MAKING SPACE FOR THE FUTURE

IMAGINING THE SMART NATION IN SINGAPORE



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ABSTRACT

People imagine futures through sensory and affective engagements with materials like the smart city's smart urban infrastructures. Through an ethnography of two "Smart Nation" smart home projects in Singapore, I detail how state planners project and replicate future imaginaries through the smart city by repeatedly materialising them in smart urban infrastructure. These historically-rooted planning practices project some residents as representing and productive of national futures while excluding others. Residents repeatedly and materially engage with these imaginaries, sometimes replicating and sometimes reimagining them, through everyday embodied engagement with smart urban infrastructures.

Drawing upon the rich literature on imagining futures through sociotechnical projects of city and nation building in Singapore, I deepen the science and technology studies (STS)-informed theory of co-production using the feminist posthumanist concept of differentiated repetition to detail the specific, differentiated forms of "technical agency" afforded by the Smart Nation (Neff et al. 2012). I engage scholarship on refusal and resistance in quotidian practice with critical data studies of racialising surveillance to detail how residents disrupt and create un-accounted for data flows in their daily lives. Differences in ease of refusal make a difference for racial minorities, queer residents, and non-citizens for whom data flows mean continued exclusion from national futures. Overemphasis on visible protest in public space neglects the impacts of these quotidian acts of political resistance, particularly in highly surveilled contexts. I complicate existing smart citizenship research in which a sovereign republican subject engages in either wholesale acceptance of or resistance to the smart city. Analysing instead how differentiated residents navigate their "technological everyday" (Amin 2007) by spatialising "geographic counter-stories" (Kobayashi 2005), I argue, shows how state power is expressed and experienced through smart urban infrastructure. It also illuminates residents' agency in co-producing smart city futures, constructing their senses of self and nation, and practicing (smart) citizenship.

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They plan. They build. All spaces are gridded,
filled with permutations of possibilities.
The buildings are in alignment with the roads
which meet at desired points
linked by bridges all hang
in the grace of mathematics.
They build and will not stop.
Even the sea draws back
and the skies surrender.

They erase the flaws,
the blemishes of the past,
knock off useless blocks with dental dexterity.
All gaps are plugged with gleaming gold.
The country wears perfect rows of shining teeth.
Anaesthesia, amnesia, hypnosis.
They have the means.
They have it all so it will not hurt,
so history is new again. The piling will not stop.
The drilling goes right through the fossils of last century.

But my heart would not bleed
poetry. Not a single drop
to stain the blueprint
of our past's tomorrow.

The Planners, Boey Kim Cheng

CHAPTER 1: INTRODUCTION

1 MAKING SPACE FOR THE FUTURE

Imagining the future is a material practice. We imagine the future *through* and *with* the built environment and the materials it provides us to think with. The way we build our cities, then, fundamentally shapes the futures those living in them can imagine and bring into being. This is the central claim of this thesis. Imagining the future, like thinking itself, is *of* the material world, practiced by emplaced bodies through their sensory and affective engagements. This thesis focuses on the materiality of the smart city's urban infrastructures, as well as the other urban forms and technologies that permeate digitally mediated cities. The central question of this thesis is *how* futures are projected, replicated, and reimagined through the smart city, and by whom. I ask: what material-symbolic resources do smart city planners, developers, and residents have to imagine futures with? How do they differentially use these resources to project future imaginaries in their everyday practice?

In this dissertation, I answer demand for analysis of how "the smart city is constituted discursively, techno-materially, and spatially", specifically how "political rationalities" are historically and materially embedded in the smart city (Luque-Ayala and Marvin 2020:26, 2015:2110; Mertia 2017). Luque-Ayala and Marvin (2015:2109) identify three "critical deficits" in current analyses: how "smart" is *theorised,* how and by whom smart urbanism (SU) is *implemented,* and the possibilities for *alternative* agendas to the *normative* futures expressed by and through the more powerful actors and infrastructures of SU. Ameliorating these deficits requires in-depth analyses in specific cities of how SU is imagined and sustained in varying urban contexts, which actors co-produce different variations of the smart city, and who they exclude. Luque-Ayala and Marvin (2015:2108)

> highlight the need for a more in-depth examination of the manner in which the transformational potential of SU is created. Such claims and potential, fundamentally *produced with and through digital technologies operating under specific political rationalities and governmental techniques* (Klauser et al., 2014) currently remains beyond the reach of social science (Hudson, 2011).

Answering this need, I conducted an ethnography in the specific urban context of Singapore's Smart Nation project to contribute to a comparative analysis of SU. I analyse how and whose future imaginaries are "produced with and through digital technologies" in the Smart Nation, through which "specific political rationalities and governmental techniques" (ibid). Building on anthropology and geography's critical examination of the interface between urban space and digital technology (Anand, Gupta, and Appel 2018; Ash, Kitchin, and Leszczynski 2018; Boyer 1992; Crang and Graham 2007; Easterling 2014; Graham 2002; Graham and Marvin 2002; Thrift and French 2002; Larkin 2008; Knox 2017), I detail the relations of power expressed through smart urban infrastructures and the differentiated forms of "technical agency" they afford, asking "who can act, when, how, and why" to achieve specific futures (Neff et al. 2012:312). From this Smart Nation ethnography, in this thesis I develop a conceptual approach to how cities "variously complicate, enable, disrupt, resist, and translate SU" (Luque-Ayala and Marvin 2015:2108). I create a model for comparative work which conceptualises practices of enacting future imaginaries through smart urban infrastructure as both contextually specific and globally interconnected.

Smart city projects are not just technological or infrastructural projects: they are also world-building projects that aim to project normative imagined futures. Through my ethnographic work, I analyse the dynamic relationship between state and resident future imaginaries as they are repeatedly projected, replicated, and reimagined through the smart city, specifically the smart home which I use as my case study. Through an ethnography of two smart home projects in Singapore conducted between 2015-2019, I demonstrate how Singapore state actors attempt to project particular futures at the exclusion of others through smart urban infrastructure. I trace how residents sometimes replicate and sometimes reimagine those futures through everyday embodied engagement with the same infrastructures.

My empirical research yields three key contributions to anthropological and critical smart cities scholarship. First, we obfuscate power dynamics and misplace our critiques of smart urbanism when we create a false binary between abstract imagination and lived experience, especially when we assign the former to "elites" or states and the latter to "ordinary" people. Imagining the future is a material practice performed by both state and non-state actors in their everyday lives. It is the difference between their lived experiences, and particularly between the materials they are given to imagine and enact futures with, that produces different and unequal socio-material effects and frictions.

Second, anthropological analyses too often end by framing the messiness of small-scale, local, micro human experience as resistance against large-scale, global, macro entities like the state or corporations, ultimately replicating such scalar imaginaries and leaving the effects of this resistance unspecified. Instead, we must denaturalise and unpack scalar imaginaries by asking how they *came to matter*. That the smart city often reproduces rather than alleviating inequality should be the starting point of our analyses, not the end point: the important question is *how*. By detailing the recursive loops through which state and non-state actors project, replicate and reimagine scalar imaginaries like the smart city, we can better theorise how people (re)invent and change them.

Third, residents co-produce the smart city through their differentiated daily practices as smart city infrastructures simultaneously differentiate residents. We therefore need to replace existing republican models of active/passive smart citizenship with analyses of these diverse and distributed modes of resident participation in smart city creation. Rather than asking residents to *become* "active citizens", we need smart citizenship theories which recognise the many political expressions of citizenship in residents' material, affective engagements with the smart city in quotidian spaces. This retheorisation also helps us better locate specific groups' obstacles to accessing smart citizenship:

specifying *how* people are materially and symbolically excluded from the smart city's future, who and what excludes them, and how they often make space for their own futures nonetheless.

My analysis uncovers dynamics of state power projected through the smart city and the possibilities present for reimagining state smart city futures, accounting both for resident difference and the restrictions residents face when trying to change the smart city or spatialise smart citizenship. It provides an empirical method for rigorously analysing how imaginaries become collectively held and reshaped by individuals; how residents co-produce sociotechnical and citizenship imaginaries through everyday embodied practice; and how states enact power to shape the future by limiting the material-symbolic resources that residents have to imagine with—but also how state future imaginaries, because state actors must repeatedly project them through space, make space to imagine other futures.

In this chapter, I introduce my research questions, contextualise my smart city field site, detail my study's contributions, and outline my chapters.

2 Research Questions

The central question of this thesis is how people project, replicate and reimagine futures through repeated everyday engagements with the digitally mediated city, specifically the smart city. According to Jasanoff and Kim (2015), actors project normative future visions through the development of material technologies, which Jasanoff and Kim term "sociotechnical imaginaries." Social studies of technology have also widely adopted Jasanoff's (2006) concept of co-production to assert that a variety of expert and non-expert actors produce sociotechnical imaginaries. I use the sociotechnical imaginary concept to describe the smart city, as it usefully foregrounds the intertwined material-symbolic elements of smart city development. But this literature often lacks detailed accounts of *how* sociotechnical imaginaries like the smart city are actually co-produced at the level of daily life. How exactly do people project futures through them, and how do they replicate or reimagine those futures?

I argue that imagining the future is a repeated, everyday material practice performed with and through objects. Repeated material engagements with sociotechnical infrastructures replicate and rework the future imaginaries projected in them. Since future imaginaries are enacted in smart urban infrastructure, and since people use objects to imagine futures, it is important to ask what materials both state planners and residents have to imagine futures with, what imagined futures are actively being projected in those materials, and what space there is to imagine the future otherwise. I ask:

> *RQ1: How does the state project its future imaginaries through the digital and urban space of the smart city?*
>
> *RQ2: How do smart city residents replicate and reimagine state future imaginaries through these same digital and urban forms?*

I offer a theoretical and empirical map to systematically analyse *how* residents' everyday embodied practices recursively co-produce the digitally mediated smart city, providing a textured and non-vertical account of state and resident power and agency.

This model for analysing smart city projects is generalisable to other contexts, since governments repeatedly seek to materialise different sociotechnical relations and imagined futures by packaging material-symbolic resources into smart city projects, which residents also replicate or reimagine through their everyday practice as they engage with those resources in the same or novel ways. I argue that we can understand this continuously re-enacted relationship between state and resident future imaginaries as they are materialised through and mediated by many kinds of smart urban infrastructures. I offer a model for unpacking and dissecting those smart city storytelling components and theorising how a range of actors aspirationally assemble them into future-making projects. This model also explains why the "smart city" can cohere as an imaginary across national and urban contexts despite possessing different component infrastructures and sociotechnical goals.

I now briefly contextualise my smart city field site and its foundational imaginaries.

3 CONTEXT: IMAGINING SINGAPORE

> *Our vision is for Singapore to be a Smart Nation—A nation where people live meaningful and fulfilled lives, enabled seamlessly by technology, offering exciting opportunities for all. We should see it in our daily living where networks of sensors and smart devices enable us to live sustainably and comfortably. We should see it in our communities where technology will enable more people to connect to one another more easily and intensely. We should see it in our future where we can create possibilities for ourselves beyond what we imagined possible...A tiny nation that not many will have credited with a shimmering future when it became an independent nation on August 9, 1965."*
>
> - Lee Hsien Loong, Prime Minister of Singapore. Smart Nation Launch, 24th November 2014.

The term "smart city" has been deployed in diffuse spheres of development in existing cities, but few have defined "smart" as a central civic priority to the extent that Singapore has. Since 2014, state agencies have articulated plans to mould Singapore into a "Smart Nation" with digital technologies "transforming the way people live, work, and play, so that Singapore remains an outstanding global city" (GovTech Singapore 2017). These initiatives focus on placing data-gathering technologies into the urban fabric and residents' homes: artificial trees and lampposts measuring air quality, global positioning system (GPS) trackers transmitting traffic congestion information, radio-frequency identification (RFID) cards identifying mobility-impaired people on crosswalks, and sensors tracking motion in elderly residents' homes, to name a few. Singapore is thus enmeshed in a dense web of "smart" technologies. But "smartness" indexes particular value-orientations, bolstered by situated social practices and ideologies, that require analysis (Ho 2009).

Since Singapore has been a strategically planned city from before its independence and the same party (the People's Action Party, or PAP) has been in power since, there is longevity and continuity to urban planning practices and the sociotechnical imaginaries expressed through them not as present in other cities and nations. Singapore's imaginary has shifted in name over the years. But as Da Cunha (2010:160) ruminates: "The most curious thing about these aspirational objectives is that every time Singapore has remade itself it has assumed a new identity without actually discarding its previous

identities." It is this continuity of replicated imaginaries that has contributed to Singapore's regulatory power and continuity of state planning practices.

Singapore state agencies explicitly position the Smart Nation project as **futuristic** in relation to the rest of the world. Other nations' future is Singapore, a model to be exported and adopted, an exemplary (postcolonial) success story (Chua 2011). But this national storytelling of Singapore as a space for the future has roots stretching back into its history. Since independence in 1965, Singapore state planners have laboured to imagine, project, and export Singapore as an imagined future, as city-state Singapore had little natural resources and land.

Singapore has a rapidly ageing population and declining birth rate (Fischer 2015). Since independence, state agencies have mandated that "Asian Values" inform policy, using them to project "national family" values of heterosexual reproductivity, labour productivity, and filial piety through residential models restricting housing access: like marriage requirements, racial quotas and inter-generational living (Teo 1994, 1997; Teo et al. 2006). State agencies use this "family" as a metonym for the nation, the "cradle of Singapore's future" (Balakrishnan 2015). State planners have long imagined these racialised, aged, and heteronormative practices as productive of Singapore's bright future (Khong 1995; Hiramoto and Teo 2015; Wong and Yeoh 2003).

The state and private sector have also long operated together in highly regulated ways to project Singapore as a **connected** and connective global science and technology hub, a "digital port" on the "digital Silk Road" (Lee 2014; Ong 2015; Balakrishnan 2018). Smartphone penetration is among the highest in the world at 152% (Digital Influence Lab 2020). The projection of this smart urban image to other global cities to connect with foreign partners began with sharing Singapore's public housing model in the 1960s and persists today as a state practice termed "technopreneurship" (Wong and Yeh 1985; Phua 2018).

Housing is therefore both key to Singapore's Smart Nation plan and its sociocultural management, making it a useful site to locate a study of smart city development. Almost 90 percent of citizens live in public housing blocks ("HDBs") highly regulated by the state (Chua 2000). To promote "racial harmony", the state imposes racial quotas, based on continuous population data collection since before its independence, requiring blocks to reflect the population makeup: 80 percent Chinese-Singaporean, 15 percent Malay-Singaporean, and 5 percent Indian-Singaporean (Haila 2015). It proliferates multigenerational housing plans, building "3Gen flats" and dual-key apartments" which materialise the official "Asian" position of the family unit as building block of society (Lee 1988). HDB towns are designed as standardised "total housing environments", with uniform populations and amenities meeting all resident needs. Due to these projects of social and technical design, the state explicitly imagines each HDB estate as a standardised metonym of Singapore as a whole, regulating expressible difference and who can "stand in" for the nation. Based upon this imaginary of standardisation, it invites researchers from all over the world to use the flats as neutral "test beds" for smart technologies in Singapore's "living lab"(Shatkin 2014).

State agencies make these metonymic scaling processes explicit, as they make smart home technologies to be tested in a small group of homes, then entire housing blocks, then all Singapore public housing, then exported to other aspirational smart cities. State agencies make these models of smart living "exportable" to other connected cities to follow Singapore's cutting-edge, futuristic technological development (Woods and Kong 2017). They present Singapore's multiracial population as a standardised sample of the global population (Ong 2016), gathering racialised biometric data to continuously create the foundation for these smart city sociotechnical imaginaries. Tracing these scalar imaginative infrastructural movements is crucial to understanding how specific futures are projected and replicated or reimagined through smart urban infrastructure. I analyse how projects become imagined as such: how parts of a body's sensor-detected motion in one home come to both represent

and make up a part of an urban and national sociotechnical imaginary (the Smart Nation), and how daily resident material interactions with such smart urban technologies also lead to the replication and reimagining of the smart city sociotechnical imaginary itself.

These imaginaries of standardisation, connectivity, and futurity pervade the planning of the Smart Nation and encounter friction when disrupted by residents living life in non-standardised ways, imagining other forms of connectivity, and materialising other futures. To approach the question of how futures are continually projected, replicated, and reimagined through the smart city, I conducted an ethnography of two smart home projects in four public housing estates in Singapore. I traced the design, development, and use of smart urban infrastructures that smart home residents interacted with in their daily lives, including smart home sensors and the data they produced.

In the next section, I briefly detail three key original contributions emerging from this research: imagining the future through material practice, following recursive loops to theorise change, and redefining smart citizenship.

4 Key Contributions

4.1 Imagining the Future through Material Practice

First, I replace a persistent binary I discovered in both critical smart city and wider anthropological literature which separates the "abstract imaginaries" of monolithically described entities like the state from the "everyday lived experience" of "ordinary" citizens. Many critics point to a bifurcated smart city, one of imagination and one of actual practice, often assigning abstract imagination to experts and entities like planners, developers, corporations, and states. This scholarship on the smart city diagnoses state and corporate imagination as abstract fantasy unmoored from the everyday lived experience of ordinary residents, blaming the smart city's failings on this gap (Luque-Ayala and Marvin 2020; Beverungen and Sprenger 2017). It largely focuses on the corporate smart city, arguing as a result that

the smart city is inherently depoliticising (Greenfield 2013; Luque-Ayala and Marvin 2016; Kitchin 2015; Cardullo and Kitchin 2017).

Instead, I found that imagination and lived experience are not dichotomous, with imagination being an abstract process and lived experience a material practice. Imagination is an intersubjective material practice, mediated by repeated everyday embodied experience, through which people continually perform and rearticulate imaginaries. Everyone, including experts like state planners, replicates and reimagines the smart city through repeated engagements with its material-technological infrastructures. Both entities like "the state" and groups like "ordinary" residents, therefore, are made up of people with lived experience through which they materially project, replicate, and reimagine futures. I argue that it is the difference between those lived experiences, particularly between the materials they have to imagine and enact futures with, which produces unequal socio-material effects.

Providing a new approach, I analyse how the always-already digitally mediated resident recursively co-produces smart city futures with state actors and smart urban infrastructures through everyday practice. Conceptualising smart cities as enacted through stories, made in social and material practice, I collapse theoretical distinction between discursive, affective, metaphorical practice and material, embodied, enacted practice. Stories are not just stories of, they are stories for (Fischer 2015). And they are told *through* places and material things (like smart cities and technologies).

States telling stories through material-technological infrastructures to bring shared national future imaginaries into being at the exclusion of others predates the smart city. And since the smart city is a particular story told by the state through its sociotechnical infrastructures, like all stories it must be continuously retold to continue having effects. These practices are historically traceable: state actors draw smart city stories from older narratives about the role of technology in national imaginaries, continuously replicated through sociotechnical infrastructures built to shape resident behaviour and

imaginable futures (what Singaporean poet Boey Kim Cheng calls "the blueprint of our past's tomorrow" in his poem "The Planners", cited in the epigraph). This requires ethnographic attention to the minutiae of diverse and differentiated everyday practices of planners, developers, and residents, as a range of actors project futures into the smart city and experience futures as they are projected through the smart city. Those futures are also contested and reimagined through the same infrastructures used to express them. Through this analytical lens, I show that rather than being depoliticising, the smart city is a key site for the enactment of politics.

In this thesis, I foreground "geographic counter-stories" of the smart city by narrating residents' digitally mediated "technological everydays" and affective engagements with the Smart Nation (Kobayashi 2005; Amin 2007). Attention to these geographic counter-stories, I argue, explains how smart city stories are told through materials and have everyday material effects on residents, making some futures easier to imagine and replicate than others. As residents go about their everyday lives, they interiorise and exteriorise senses of place, self, and nation using the material-symbolic resources they encounter in their domestic and urban spaces (Tay 2012). Making space for other futures is therefore a material-imaginative process, repeatedly enacted through engagement with the smart city.

4.2 Following Recursive Loops to Theorise Change

Second, much smart city scholarship focuses on corporate smart city imaginaries or overgeneralises the role of "the state" in producing the smart city. Focus has largely been on "elites" like developers, planners, and corporations (e.g. Luque-Ayala and Marvin 2020; Söderström, Paasche, and Klauser 2014; Vanolo 2014) or on the ways that "ordinary" residents resist the already fully-formed smart city ideal (Greenfield 2013; Wiig 2016): less often do studies carefully trace how the smart city evolves and changes through the interfaces and overlaps in the everyday practices of these actors. Anthropological work on technology and the data it produces also generally takes one of two forms: a study of the "elites"

responsible for developing the technology (e.g. Kelty 2008; Dourish and Bell 2011; Forsythe 2001) or how existing community relations and cultural norms reshape pre-given technologies (e.g. Miller 2011; Burrell 2012). As Larkin (2013:328, 339) argues, anthropology has found it difficult to study digitally networked infrastructures, largely lacking a systemic ethnographic approach conducted with people in different locations across sociotechnical systems like the smart city.

Responding to this need, I ethnographically analyse the daily practices of state planners, developers, and other smart city residents to carefully explain how they together recursively co-produce smart city futures, offering a different anthropological analysis than those generated by studying only one group. I detail how a specific set of smart urban infrastructures were projected, replicated, and reimagined through resident daily practice, also analysing the future imaginaries projected, replicated, and reimagined through these smart urban infrastructures. This method of studying how *both* state and other resident actors co-produce the smart city at the level of daily practice in interweaving ways, and what resources they have to do so, shows the possibilities for and restrictions on imagining alternative urban futures.

I continue my anthropological analysis farther along a recursive loop than many existing studies, showing how state actors project futures through the smart city and how residents materially alter those projected futures (and the smart city itself) through daily practice, changing the practices of state actors too. This continuation is frequently missing in anthropological writing, which captures the "messiness" of human experience and its refusal to neatly conform to state models, but often ends there analytically (Bear et al. 2016; Tsing 2005, 2015). I seek to explain in detail how that messiness literally produces new kinds of smart city futures and citizenship, and how it sometimes changes "the state" itself.

This approach demonstrates how to theorise state power and resident agency by neither universalising the former through totalising "macro" frames like neoliberalism and corporatisation nor

reducing the latter to an active "resistance" to the state's smart city in the "micro" world of daily life, affected by but not affecting those macro frames. Geographical literature on urbanism frequently conceptualises the "jumping" of scales like the micro and macro, the local and global (Brenner 2001; Swyngedouw 2004; Smith 1992; Marston, Jones, and Woodward 2005). I instead detail how these scalar forms are materially and imaginatively created rather than existing a priori. In my analysis, I intentionally do *not* argue that I connect "macro" processes of sociotechnical smart city projection performed by the state to "micro" processes of resident resistance. Everyday embodied practices *create* what we have been repeatedly convinced to imagine as macro or global sociotechnical and geopolitical forms.

Aspiring to become a "global" smart city, for example, requires various actors to define the global and the smart and make their city imaginaries speak to an imagined wider community. As I found in Singapore, creating collective imaginaries like the Smart Nation, then exporting that smart city model to other global cities, requires both material and symbolic work to *project* the scales of "city", "nation" and "global" and to make those scales seem natural. Boey's poem illustrates this material-symbolic work: how state planners "knock off useless blocks with dental dexterity" and "plug the gaps with gleaming gold" to give the nation "perfect rows of shining teeth" so "history is new again." Tracing these aspirational scalar projects is crucial to understanding how actors project and repeatedly re-enact "global" imaginaries like the smart city, and how they become collectively held or encounter friction (Tsing 2005) as actors attempt to project them further. It also shows us whose historical ground and exclusion these imaginaries are built upon (Valentine and Hassoun 2019).

4.3 Redefining Smart Citizenship

Finally, my finding of state power and resident agency as distributed and diverse, enacted through affective and material interaction with smart urban infrastructure, also necessitates retheorising the smart citizen. My analysis complicates the relationship between the state and the smart citizen detailed

in existing smart citizen literature, which largely deploys top-down/bottom-up frames of state smart city planning and passive/active modalities of smart citizenship. Rather than observing how self-contained, sovereign "smart citizens" accept or resist the corporate or state-designed smart city wholesale, I replace these value-laden bottom-up/top-down and active/passive frameworks of citizen participation with a more diverse and differentiated theory of resident participation in smart city creation.

Citizenship is both an imaginal affective identification with the nation and materially spatialised through being "in place" with the "right" documents and data: it is both about an affective sense of belonging and being able to materially access one's right to belong, to be in the place of one's choosing. By extension, smart citizenship is a relationship between the state and residents, a negotiation of who can signify themselves as part of a smart nation and (re)produce its future. Rather than asking residents to *become* "active citizens" by adopting a republican citizenship model like much smart citizenship scholarship does (Cardullo and Kitchin 2017; Townsend 2013), I show how residents already actively participate in the political life of the smart city, in quotidian spaces like homes, schools, and community centres and through material, affective engagements that are themselves political expressions of citizenship.

As Amin (2015:250) argues, geographical work on political mobilisation in the city has understudied body/space dynamics, focusing instead on "conscious acts of organization". This focus leads critical smart cities scholarship to deem the smart city depoliticising, citing a lack of active citizen participation. I show instead how a focus on body/space dynamics uncovers political engagements with the smart city made invisible by a narrow definition of politics as conscious voice and visibility in "public" space. I foreground the affective dimensions of politics enacted through space (Berlant 1997; Laclau and Mouffe 2001:137; Simone 2016; Manning and Massumi 2014): how the smart city co-constructs

subjects and social relationships, and how materially changing the smart city also makes space for other socio-political configurations. Following Simone (2016:34):

> varying distributions of capacities—to affect and be affected, to bring things into relationship, to navigate actual or potential relations—are political matters. These are matters about who gets to acquire particular emotional patterns, thresholds, and triggers, and they are connected to a complex virtual field of differential practice, what John Protevi (2009) calls "bodies politic".

My analysis of politics as affective, material engagement illuminates "what's stuck and what's possible" in the smart city, taking "bodies politic" literally to show resident embodied enactments of politics (Berlant 2011:9; Protevi 2009). Rather than being restricted to the conscious forming of consensus and mobilisation in a democratic public sphere, politics in my analysis concerns what changes differently embodied residents can enact in the smart city, consciously or unconsciously. It highlights "the affect required to inhabit and rework temporalities of imposition and erasure, such as colonial wounds" (Venkatesan et al. 2018:20).

Attending to what residents do and feel in the smart city, not just what they speak in response, surfaces smart citizenship practices enacted by those often left out of academic smart city discourses. This retheorisation also illuminates how the smart city evolves through everyday resident material engagement and shifting affective identifications with it. Importantly, it still attends to the limitations residents face when trying to spatialise smart citizenship. This is because I carefully attend to the *specificity* of resident difference in my analysis, refusing to overgeneralise state power or resident agency. Some components of (smart) citizenship and smart city futures are more easily reimagined through daily practices of spatialising belonging than others, by some residents more than others.

5 Chapter Outlines

In Chapter 2 I review a set of existing literatures to explain my contributions to anthropological and critical smart cities scholarship. In Chapter 3 I detail my research methods. In each empirical chapter (Chapters 4–7) I analyse the sociotechnical imaginaries of *standardisation*, *connectivity*, and *futurity* and

the material-symbolic resources used to project, replicate, and reimagine them (outlined in Table 1). I explain how state planners have historically *projected* imagined futures through the smart city (Chapter 4), how actors (state planners, smart home developers, and other residents) in the present *replicate* (Chapter 5) or *reimagine* (Chapter 6) those futures, and how all these residents as a result *practice* smart citizenship in their daily lives (Chapter 7).

		SOCIOTECHNICAL IMAGINARIES		
		Standardisation	**Connectivity**	**Futurity**
RESOURCES	**Material**	HDB + Smart Home + Smart City Planning Technologies		
	Symbolic – Social	Racial Harmony/Quotas	International partnerships and "exporting the Singapore model"	"Asian Values" (productivity and reproductivity via filial piety and national family)
	Symbolic – Technical	"Total Environment" and "living lab"	Connected ICT Infrastructure	"Ahead of the pack" due to rapid technological advancement

Table 1: Smart Nation Sociotechnical Imaginaries.

In Chapter 2 (Literature Review), I draw upon the rich literature on sociotechnical projects of city and nation building in Singapore (e.g. Ban, Pakir, and Tong 2004; Bahng 2017; Fischer 2015; Kong and Yeoh 2003; Clancey 2012; Bunnell and Goh 2018; Ho 2017; Klein 2018; Koh 2005) to propose that the smart city is a sociotechnical imaginary (Jasanoff 2015) as normative visions of the future are repeatedly enacted through its smart urban infrastructure. I argue that *how* co-production of sociotechnical imaginaries occurs in practice is undertheorised in existing literature and explicate it with posthumanist theorisations of both the body and of differentiated repetition. Attending to the specific affective and material practices of differentiated urban residents also illuminates how they unequally

spatialise citizenship and (re)imagine smart city futures, problematising the republican smart citizenship ideal frequently put forth in existing literature.

In Chapter 3 (Methodology), I detail my methodology, field methods, and field site, as well as my positionality, storytelling practice, study limitations, ethics procedures, and data analysis practices. I used critical feminist ethnography to study embodied everyday spatial practices of smart citizenship, performing participant-observation combined with semi-structured interviews and city walkalongs. This methodological approach shows how people rework dominant political formations and imagine other futures through situated material engagement with technologies and technoscientific practices. I used a sociomaterial approach from science and technology studies (STS) to analyse smart home sensors and smart city planning technologies like GIS maps, following the sensors and their data across state planners' offices, developers' smart home laboratories in their sponsoring state agencies, and residents' smart homes in HDBs.

In Chapter 4 (Projecting Smart Nation Histories), I show how the Singapore state has repeatedly projected normative visions of the future through the urban sociotechnical infrastructure of public housing, using it to shape resident behaviour and imaginable futures. I detail how state planners historically materialised foundational imaginaries of standardisation, connectivity, and futurity in and through public housing and explain how they materially and symbolically underpin smart city planning. I argue that nations have long materialised imagined futures by expressing national identity, belonging and exclusion through the built environment. The smart city is not simply a 21st century corporate fantasy of digitally mediated control: it is a technology of nationhood (Abu-Lughod 2005) and citizenship firmly rooted in pre-digital infrastructures.

In Chapter 5 (Replicating Smart Nation Futures), I show how state planners learn how to replicate these historically rooted normative futures through smart city planning technologies. I describe how

planners are trained how to imagine futures like the state (riffing on Scott 1999) by more senior planners who train them to use smart city mapping technologies built from older Master, Concept, and National IT Plans. Using these mapping technologies in their daily planning practice, state planners replicate imaginaries detailed in Chapter 4 in and through the smart urban infrastructures they design.

In Chapter 6 (Reimagining Smart Nation Futures), I show how smart home developers often try to replicate these imaginaries of standardisation, connectivity, and futurity but have to reimagine them instead. Residents inhabit smart homes in non-standardisable modes of "smart" living, differentially engaging with data-gathering smart technologies. By breaking sensors or altering the kinds of data they gather, residents enact a different imaginary of connectivity than repeatedly imagined by state planners, disrupting or creating un-countable data flows and seeking other connectivity. By creating new domestic and affective networks mediated by digital technologies including and beyond the smart home sensors, residents and developers also reimagine the productive and reproductive futurity projected by state planners through smart home projects.

In Chapter 7 (Practicing Smart Citizenship), I explain how residents (including state planners and smart home developers) slowly change the smart city through this everyday reimagining work, rather than accepting or resisting it wholesale as "passive" or "active" smart citizens. I describe how residents spatialise differentiated forms of smart citizenship through material and affective engagements with the smart city. I show how young planners learn to reimagine rather than replicate the Smart Nation when they map elderly residents' diverse daily practices, changing the planning practices detailed in Chapter 5 and the imaginaries detailed in Chapter 4.

In Chapter 8 (Conclusion), I explain how to apply my research to future study of participation in smart city co-creation initiatives; privacy and data security; different forms of governance's impacts on smart city development; the perceived sterility of smart cities and its effect on resident affective

experience; and the role of aesthetics and design in the co-production of smart city futures. I argue that the way we build our (smart) cities fundamentally shapes the kinds of futures those living in them can imagine and bring into being.

6 Conclusion

My goal is to explicate how and whose future imaginaries become materialised through smart city design, a design which I argue is technical and social. I analyse how entities like states are composed of people who use existing urban infrastructures, technologies, and cultural histories to materially and imaginatively project "Smart Nations" into the future. By investigating power as expressed through smart urban infrastructures and planning practices, this research illuminates how smart technologies are made to have social effects that regulate imaginable futures. However, it guides critical smart cities scholarship away from totalising frames that homogenise analysis of those effects. It shows how residents imagine and enact smart citizenship outside of state future imaginaries, changing them in often small but significant ways through their daily practice, and articulates difference in their agency to do so. It also explores the trajectories and implications of increased domestic smart technologies in daily life across the world, as technologies and urban planning strategies developed in Singapore are actively exported to other cities.

This analysis furnishes an understanding of how state planners, developers, and residents replicate or reimagine the smart city sociotechnical imaginary through conscious and unconscious engagement with the material infrastructures of the smart city, spatialising smart citizenship through their daily practice. Because they imagine in and through material infrastructures, attention to those infrastructures and practices tells us how the smart city can be imagined otherwise and how possible it is to imagine outside of the future imaginaries enacted through smart urban infrastructures. It therefore gives us a nuanced picture of both state and resident power and agency in the digitally mediated smart

city: what capacity state planners, international and local developers, and residents have to reimagine futures. It provides a model for smart city research in other contexts, asking: what symbolic stories are smart city actors trying to tell, through what materials, to bring into being which imaginaries of the future? And how do residents materialise other futures by spatialising different stories?

In the next chapter (Chapter 2), I further detail my theoretical orientations and argument through a literature review.

CHAPTER 2: LITERATURE REVIEW

1 INTRODUCTION

In this thesis, I respond to Luque-Ayala and Marvin's (2015:2110) call to investigate how "the smart city is constituted discursively, techno-materially, and spatially" as well as affectively, paying particular attention to how "political rationalities are embedded" in the smart city. I argue that analysing how smart city residents navigate the "technological everyday" illuminates how state power is expressed and experienced through smart urban infrastructure, as well as residents' agency in co-producing smart city futures through their "geographic counter-stories" (Amin 2007; Kobayashi 2005). This analysis refigures the smart citizen, because it theorises citizenship as made through practice: through performative, affective engagements with the nation's material-symbolic resources projected through the smart city's smart urban infrastructure.

I define power as the ability to enact particular futures at the exclusion of others, examining the processes by which states materialise future imaginaries in and through the smart city. I focus on the relationship between state power and resident agency in the smart city. I largely set aside corporate power, which has been well-researched (e.g. Hollands 2015; Söderström et al. 2014; Wiig 2015; Shelton et al. 2015; Luque-Ayala and Marvin 2016; Batty 2013). I take up Barns' (2020) call to theorise ontologies of power in the smart city beyond those of control, data capture and surveillance, widening analytical attention to more malleable, quotidian modes of resident engagement with state smart city imaginaries. I detail the relations of power expressed through smart urban infrastructure and the differentiated forms of "technical agency" they afford: asking "who can act, when, how, and why" to achieve specific urban futures (Neff et al. 2012:312).

In this literature review, I explicate the STS-informed theory of co-production (Jasanoff 2006) through the posthumanist concept of differentiated repetition (Rose 2017), arguing that everyday

embodied practices of replication and reimagination in the digitally mediated city repeatedly and recursively create the sociotechnical imaginary of the smart city. I use the STS frame of sociotechnical imaginaries to give a socioculturally grounded analysis of the material-symbolic forms that states use to project and replicate their imagined futures. In doing so, I present a framework for analysing how individual imaginaries become collectively held and how collectively held imaginaries are reinvented by individuals through practice. I focus specifically on future imaginaries as they are repeatedly projected, replicated, and reimagined by the state and residents in and through the material-symbolic space of the smart city. I argue that developing a sense of smart citizenship requires repeatedly performing and narrating understandings of self and nation: a fundamentally affective, material practice (Berlant 1997), best theorised through posthumanist frames of differentiated repetition which describe everyday embodied experience in the smart city.

First, I argue that the smart city is a sociotechnical imaginary in which normative visions of the future are enacted through material technologies (Jasanoff and Kim 2015). To create the smart city, states project their future imaginaries into smart urban infrastructure through processes of repeated enactment, packaging material-symbolic resources to do so. I argue that *how* co-production of the smart city sociotechnical imaginary occurs in practice is currently undertheorised.

Second, I specify that co-production happens at the level of everyday embodied practice, as bodies co-constitute the digitally mediated smart city which always partially exceeds state control. Residents use smart urban infrastructures and other material-symbolic resources to develop their own future imaginaries and exteriorise them back into the smart city, co-producing it. These everyday processes occur both consciously and unconsciously, as residents continuously replicate or reinvent the state's imaginaries.

Third, I argue that smart citizenship, like residents and the digital sociotechnical forms mediating their everyday urban experience, is diverse and differentiated. It is formed through myriad affective, embodied engagements with the smart city as it is felt and lived on an intimate level. Instead of observing how self-contained, republican "smart citizens" accept or resist the state-designed smart city, this requires analysis of how differentiated residents spatialise smart citizenship through everyday practice.

Moving beyond an acceptance/resistance binary towards a framework of replication and reimagination allows us to theorise the relationship between the state and the smart city resident beyond the categories of top-down/bottom-up modes of smart city planning and passive/active modes of smart citizenship. We can instead trace how the state projects its future imaginaries through the smart city by repeatedly enacting them in smart urban infrastructure. In parallel, we can trace how urban residents repeatedly and materially engage with these imaginaries, sometimes replicating and sometimes reimagining them, through everyday embodied practice. Citizenship, including smart citizenship, is affectively experienced and expressed through resident everyday embodied practice in the digitally mediated city. Residents use its material-symbolic resources to engage in practices of signification, constructing senses of self, (smart) city and (Smart) Nation.

To conclude, I argue that this account of state power and resident agency in the digitally mediated smart city explains (1) how imaginaries become collectively held, as well as how individuals reshape collectively held imaginaries; (2) how (both conscious and subconscious) everyday practices co-produce the smart city, if we take posthuman agency seriously and account for bodies as intermediated by and co-constituted with digital technologies; and (3) how states enact power, as the ability to secure particular futures at the exclusion of others, by controlling the material-symbolic resources the smart city gives residents to imagine with—but also how those future imaginaries, because the state must

repeatedly enact them, are open to resident reimagining. We can see what other spaces residents open up and what other futures they orient toward through their everyday embodied practices: to quote Berlant (2011:9), clarifying "what's stuck and what's possible."

1.1 TERMINOLOGY

Geographers and states alike have proliferated a huge range of terms to describe digitally mediated urban experience. The smart city in particular has been diversely and inconsistently defined, in large part because it is both a signifier intentionally used vaguely to denote a range of affects and meanings as well as a sociotechnical assemblage of digital technologies, urban spaces, and social practices. Instead of nailing my use of the term to one of these meanings, I take its diffusion up as an analytical question, theorising how the state[1] packages material-symbolic resources together to create a normative future imaginary called the "smart city" and projects it through the space of the digitally mediated city. I then ask how this package of material-symbolic resources called the smart city is repeatedly replicated and reimagined by urban residents. Doing so requires terminological consistency, which I partially outline below and develop throughout this chapter.

The Digitally Mediated City. To denote the total sociotechnical assemblage, the technologically-infused urban space made up of both smart urban infrastructures and other digital technologies that residents interact with through various interpenetrating digital and spatial mediums, I use the term digitally mediated city (Rose 2017), which attends to the material, embodied, temporal and spatial mediation of digital technologies and urban residents.

Smart Urban Infrastructure. Infrastructure both refers to material objects and the relationships between material objects (Larkin 2013:330). Infrastructures are material, mediate relationships, and project

[1] I break down the category of "the state" further in Chapters 4 and 5 but refer to it as such in this chapter for clarity of other concepts I develop.

symbolic meanings (Easterling 2014; Venkatesan et al. 2018; Anand, Gupta, and Appel 2018). It is the material-symbolic, relational quality of infrastructure I operationalise in this thesis, to explicitly analyse who structures infrastructure and how they use its materiality to do material-symbolic structuring work. Attending to the smart city's infrastructure forces analytical specificity in detailing what materials make it up, how and who links them together, and what practices it structures. It helps me ask: what matter is the smart city, and what matter does make it come to matter? Because infrastructure is relational, it focuses methodological attention on the systems of people, practices, and technologies it co-produces. An infrastructure "invites us to explore its constitutive relations: the materials, the finance arrangements, the politics, the dreams of progress, the design...and the force of contingent events that routinely disrupt the best laid effects" (Venkatesan et al. 2018:5). It also "invites us to explore the emergent effects, the ways in which specific material transformations shape social worlds and create new environments" (Larkin 2013:330). Building on STS's emphasis on tracing networks, I use the term "smart urban infrastructure" to refer to material smart city systems, assemblages of networked technologies and built environments, built to structure social relations and project symbolic meanings (Anand 2017; von Schnitzler 2008; Collier 2011; Harvey and Knox 2012; Knox 2017; Bear 2015). Because infrastructures are fundamentally material things, a focus on infrastructure allows me to bring analytical specificity to the study of sociotechnical imaginaries, detailing how actors assemble material infrastructures into networks to project futures.

Digital Technologies. I use the more general term "digital technologies" to refer to the wide range of other digital devices that smart city residents interact with. As many state-driven smart city projects are enacted through personal devices like smartphones, however, slippage inevitably occurs. I point out these frictions as explicitly as possible, as they illuminate productive tensions and interpermeations between the smart city and the digitally mediated city.

The Smart City. I use the "smart city" to denote the material-symbolic package which makes up the sociotechnical imaginary that my interlocutors refer to as the "smart city" and is deployed by actors like states to do future-making work. The smart city is a smart city because it has been named as one by particular people toward particular ends. Unpacking why the term is used in different spheres allows for comparison of the vastly different smart urban infrastructures configured into other sociotechnical imaginaries across different urban contexts that nonetheless make up a "smart city" in interlocutors' eyes.

2 Sociotechnical Imaginaries and Recursive Co-Production

In this section, I first argue that conceptualising the smart city as a sociotechnical imaginary focuses analytical attention on how actors project normative futures in and through material infrastructures. I then detail how states package material-symbolic resources to project their sociotechnical imaginaries. Third, I argue that the ability to project sociotechnical imaginaries is not equally available, as it is often difficult to create certain material-symbolic resources (like infrastructural projects). Fourth, I explain how sociotechnical imaginaries are continually rearticulated through practices of recursive co-production. I conclude that individual and collective future imaginaries are co-produced in practice with and through the smart city.

2.1 The Smart City as Sociotechnical Imaginary

Though widely employed in STS literature, the concept of sociotechnical imaginaries is not widely used in critical smart cities literature. My work brings the importance of the imagination to theories of smart citizenship while also expressing need for more analytical specificity in STS uses of sociotechnical imaginaries. Sociotechnical imaginaries are:

> collectively held, institutionally stabilised, and publicly performed visions of desirable futures, animated by shared understandings of social life and social order attainable through and supportive of advances in science and technology." (Jasanoff 2015:4)

The smart city is a sociotechnical imaginary because it expresses aspirational "efforts to build new sociotechnical futures" that are "grounded in positive visions of social progress" and "encoded in material technologies" (Jasanoff 2015:4, 20). Thus seemingly abstract visions of the future generated by institutions like the state are projected through the smart city. As Luque-Ayala and Marvin (2015:2105) argue, calling for an in-depth, situated analysis of the process, smart urbanism is "deeply rooted in seductive and normative visions of the future where digital technology stands as the primary driver of change." Attending to this material dimension of political imagination focuses critical smart cities analysis on the "skilled implementation" of those imaginaries as they "get built into the hard edifices of matter and praxis" (Jasanoff 2015:17, 323).

I theorise the smart city as a sociotechnical imaginary to trace how normative imaginaries are projected by the state through smart urban infrastructures that have social and material effects on residents, orienting them toward the state's specific imagined futures. I also use the concept to analyse how residents replicate or reimagine these imagined futures through engagement with these smart urban infrastructures.

2.2 Projecting National Sociotechnical Imaginaries

States in particular mobilise material-symbolic resources, representing past achievements to substantiate future plans, to project "national sociotechnical imaginaries" (Jasanoff and Kim 2009). Analysing the state's packaging of material-symbolic resources helps explain how imaginaries become widely replicated:

> In tracing how individual visions sometimes rise to the status of collectively held objectives, the imaginaries framework urges us to note not only the *material instruments* that reformers are able to accumulate but also their *uses of symbolic and cultural resources, such as images, texts, memories, metaphors, and language itself.* (Jasanoff 2015:25, emphasis mine)

The Singapore context exemplifies this use of material instruments and symbolic and cultural resources. Prime Minister Lee Kwan Yew's "vanguard" visions still resound in policy and state practice (Hilgartner

2015). The Singapore state terms its smart city programme the "Smart Nation" project, explicitly tying its aspirations for the smart city to the nation's future. It does so in part by symbolically placing the project on a historical timeline of state-driven technological innovation through adversity. Hence large infrastructural projects become national "symbols of modernity and arrival" (Vale 1999:391 in Graham and Marvin 2001:20). The continuity of power through the long-ruling People's Action Party and its integrated use of images and urban technology to foster collective future imaginaries renders this sociotechnical imaginary particularly traceable through time and space. These are affective performances of nationhood materialised in and experienced through sociotechnical forms.

Tracing the material-symbolic resources which make up sociotechnical imaginaries also helps explain why some are more "durable" than others: those rooted in pre-existing shared histories, moral orders, or cultural understandings tend to be replicated more (Jasanoff 2015). For example, the state explicitly ties the Smart Nation to the state's post-independence achievement of "survival" through rapid technological development and material transformation of postcolonial urban Singapore into a "global" city through technocratic governance. As Jasanoff (2015:22) articulates:

> By turning to sociotechnical imaginaries, we can engage directly with the ways in which people's hopes and desires for the future—their sense of self and their passion for how things ought to be—get bound up with the hard stuff of past achievements, whether material infrastructures or normative ones.

Nations have always attempted to collectively imagine and forget to forge collectively-held identities (Renan 1882). Storytelling, imagining together, has long been a state tool to cohere national identities and orient people toward collective futures. As Anderson (1991:11) states in *Imagined Communities*, nations "loom out of an immemorial past, and still more important, glide into a limitless future. It is the magic of nationalism to turn chance into destiny." Bhahba (1990:1) argues that the nation comes into being, not as a "discipline of social polity" but rather as a "system of cultural signification": the nation's ability to narrate its history and future in collectively-captivating ways is central to its ability

to cohere and persist—what Jasanoff (2015:338) terms the continual enactment of the "dreamscapes of modernity." Mbembe (2004:376) gives the example of Johannesburg locating its past elsewhere, in the myth that it was a "European city in a European country in Africa."

I elaborate upon nation-making practice as signification practice in great detail in this thesis, specifically as it affects smart city residents' narrations of smart citizenship in the Smart Nation. Storytelling is essential to both the state's performances of nationhood and individuals' performances of self as part of the nation. These performances mediate citizenship definitions. As Berlant (1997) argues, the nation is a site of affective identification: an entity experienced, felt, fantasied, and lived at an intimate level, mediated by residents' bodily movements through its material-imaginative spaces as they "bathe in an affective ether of signs" (Thrift 2009:123). Citizenship requires a sense of self, nation, and materials to signify belonging. This is a fundamentally affective, material practice performed with the material-symbolic resources one's environment provides.

Material-symbolic packages like the smart city are central to these acts of collective imagining and storytelling, as residents develop a sense of self and nation. National sociotechnical imaginaries are "collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects" (Jasanoff and Kim 2009:120). These projections can be desirable futures and/or risk-laden futures to avoid. Smart urban infrastructures enact "performative scripts" that project future imaginaries in a "masonry of political world-making", creating what Jasanoff (2015:14) terms a technologically inspired "sense of being well-ruled."

The efficacy of state-driven sociotechnical imaginaries thus relies on how well they enmesh with people's collective understandings of themselves and their futures: "projects of world-making succeed best when they are well-synchronised with ongoing projects of nation building and the reaffirmation, or reperformance, of dominant national identities" (Jasanoff 2015:335). Note the necessity of repeating

these performances, to which I return below. Because "smart and digital technologies are now the key policy and political tools of postcolonial states to embrace and imagine new urban futures", I analyse the social relations and futures that states attempt to project through smart city sociotechnical imaginaries (Datta 2018:417). I now turn to the making of smart urban infrastructure.

2.3 Infrastructure and the Uneven Distribution of Material-Symbolic Resources

The ability to project sociotechnical imaginaries is not evenly distributed, as it is often difficult to create new material-symbolic resources (like infrastructural projects). States usually have more scope to (re)package and project material-symbolic resources into sociotechnical imaginaries that shape social worlds and imaginable futures (Jasanoff 2015). Returning to my definition of state power as the ability to enact particular futures at the exclusion of others, I argue that states build smart urban infrastructures to shape social relations and bring into being particular futures. As Easterling (2014:14) asserts, "the medium of infrastructure space makes certain things possible and other things impossible." States use networked infrastructure to "extend social power" (Graham and Marvin 2001:54). Which groups are privileged in and excluded from the state's imagined futures is partly visible through the materiality of smart urban infrastructure: who is connected to resources through pipes and Internet cables, software systems and algorithms, and who is bypassed (Graham and Marvin 2001; Anand 2017; Howe et al. 2016; Larkin 2008; Dalakoglou 2012; Elyachar 2010; Mains 2012). Resident reimagining, which often takes material form (through destruction, rerouting, or alternative use), "shed[s] light both on the components of the imaginaries and the social apparatus that supports them" (Jasanoff 2015:323).

Urban planning often exemplifies sociotechnical imaginaries at work, as state planners frequently seek to realise utopian future imaginaries through the city (Harvey 2000; Jameson 2005).[2]

[2] There is a large body of critical scholarship on (the failure of) modernist architect's attempts to bring social orders into being through technical design. See for example Hall (2014), Cities of Tomorrow: An Intellectual History of Urban Planning and

(Smart) Urban infrastructures illuminate sociotechnical processes through which "sociotechnical geometries of power" are spatialised and sustained: they are "congealed social interests" and "embedded geopolitics" that are "thick with politics." (Massey 1992; Bijker 1995, 2007). Infrastructure networks are "central to the normative aspirations of planners…to define their notions of a desirable urban order" (Graham and Marvin 2001:12). These "metropolitan built forms" are "projective extensions" of state future imaginaries, a way of "writing time, of forgetting and remembering": they produce and perform affective relationships and material effects (Mbembe 2004:375). Senses of time, as well as space, are intentionally shaped through infrastructure (Yarrow 2017; Dalakoglou and Harvey 2012; Edwards 2003; Harvey and Knox 2012; Bear 2007).

Brazilian state planners, for example, attempted to project social order through Brasilia's urban design. They tried to enact equality through homogenous buildings and uniform apartment blocks (Holston 1989). But Brasilia's residents found standardisation produced anonymity and stripped the city of quotidian pleasures. They inhabited the flats in ways unintended by planners, privatising "public" spaces and publicising "private" spaces. Though planners theoretically had material and imaginative control over Brasilia's future, residents who reinvented the city through their everyday practice also reimagined the state's materialised futures. As Lynch (2020:666) argues, the "material and spatial relations of the city" are "key to enacting such alternative futures," since "urban algorithmic governance is constituted through material-discursive projects of 'future-ing'" (Leszczynski 2016:1691). In the next subsection, I argue that residents recursively co-produce state future imaginaries through such repeated interactions with state-designed smart urban infrastructure.

Design since 1880; excerpts from LeCorbusier, Ebenezer Howard and Frank Lloyd Wright in *The City Reader* by Le Gates and Stout (2020). Greenfield (2013) warns that the smart city is the latest instantiation of this modernist impulse.

2.4 *Recursive Co-Production and Continual Rearticulation*

Sociotechnical imaginaries like the smart city recursively co-produce the social worlds that they circulate in, as co-production involves the constant use of "social levers" to reconfigure the technological and technological levers to reconfigure social imaginaries (Jasanoff 2006). Projecting a sociotechnical imaginary like the smart city requires continuously cohering diverse imaginings into more collective ones (Appadurai 1996). Appadurai (1996:31) defines the imagination as:

> an organised field of social practices, a form of work (both in the sense of labour and of culturally organised practice) and a form of negotiation between sites of agency ("individuals") and globally defined fields of possibility."

Imagining, rather than being abstractly done in individuals' heads, is a fundamentally material, social, and spatial process through which ideas and affects become embedded into institutions and infrastructures and rearticulated through daily practices. It operates at an "intersubjective level, uniting members of a social community in shared perceptions of futures that should or should not be realised" (Jasanoff 2015:5).

Sociotechnical imaginaries also call analytical attention to how people repeatedly connect their own imagined futures to collectively held ones and what frictions occur: how different future imaginaries compete, how sociotechnical imaginaries persist despite these differences, and how "practices of collective imagination resolve conflict and produce consensus" (Jasanoff 2015:21). These daily individual practices of storytelling, seen in part through what Kobayashi (2005) calls "geographic counter-stories", shed light upon these signification processes, as residents use the smart city's material-symbolic resources to create collective identifications in their experienced "technological everyday" (Amin 2007).

Sociotechnical imaginaries like the smart city are not created and disseminated once but are continually rearticulated through practices of recursive co-production. A sociotechnical imaginary is a "continually rearticulated awareness of order in social life" (Jasanoff 2015:26). Those who design smart urban infrastructures attempt to repeatedly enact collective behaviours through "technosocial

engineering", redesigning users through redesigning technology (Frischmann and Selinger 2018). This need for continual rearticulation is crucial to note, recalling Butler's (1990) theory of performativity as repeated enactment, as it opens space for the imaginary to be reimagined through practice. It also leaves room for frictions and contradictions to be recursively incorporated into an evolving smart city, because "the performative dimensions of a society's self-reproduction—the enactment and re-enactment of its imaginaries—so heavily depend on…practices that are intimately linked to science and technology" (Jasanoff 2012:437; Hilgartner 2000). That sociotechnical imaginaries must be continually re-enacted is instructive analytically, inviting study of the practices of collective imagination through which these repetitions and reimaginings occur.

If practice is the level at which sociotechnical imaginaries are enacted (as STS approaches like Jasanoff's argue), we must unpack what exactly co-production *is* as a practice. Jasanoff's work tells us that urban residents repeatedly engage with sociotechnical imaginaries like the smart city to co-produce the future, nuancing structure/agency binaries. States project future imaginaries into smart urban infrastructures, which continuously shape residents' everyday urban experience, which can be reimagined through repeated, recursive material engagement. Jasanoff broadly theorises this process of co-production but calls for work explaining *how* sociotechnical imaginaries evolve. Without a more detailed account of how everyday practices co-produce sociotechnical imaginaries, which are collectively held, it is difficult to map distributed state power in the smart city or resident agency in reimagining smart city futures.

Answering this call, in the next section I explicate the STS concept of recursive co-production through the posthumanist frame of differentiated repetition to theorise how it occurs through everyday embodied practice and specify the dynamics of that practice. I argue that what Jasanoff (2015) refers to as a **sociotechnical imaginary** (collectively held normative visions of desirable futures attainable through

technology) is a package of **material-symbolic resources** through which the imaginary is projected, replicated, and reimagined (Rose 2017). By explicating the STS concept of the sociotechnical imaginary through posthumanist concepts of individuating and exteriorising with material-symbolic resources, more grounded in the minutiae of daily urban experience, I show how everyday embodied practices of replicating or reimagining using material-symbolic resources repeatedly (re)enact or reinvent the sociotechnical imaginary. Conversely, I use the STS frame of sociotechnical imaginaries to provide a more socioculturally grounded analysis of the material-symbolic resources that states use to project and replicate their sociotechnical imaginaries than generally found in posthumanist analyses. By closely examining the "technological everyday" in the digitally mediated smart city, I detail how urban residents co-produce the smart city and the future imaginaries it enacts through daily practice.

3 Everyday Embodied Practice and Differentiated Repetition

In the previous section, I argued that states repeatedly project future imaginaries through the smart city which residents recursively co-produce through material engagement. In this section, I argue that theoretical and empirical attention to everyday embodied practice, as feminist geographers understand it, elucidates (1) what material-symbolic resources the smart city provides residents to imagine futures with and (2) the practices through which residents recursively co-produce the state's imagined futures. I add to the slim feminist geography literature on digital technologies by explaining how urban residents' everyday embodied practices are co-constitutively mediated by digital technologies in diverse and differentiated ways as they co-produce the *technological* everyday in the digitally mediated city.

To further explicate this everyday embodied practice of co-production, I mobilise posthumanist theorisations of both the body and differentiated repetition. The state repeatedly packages certain material-symbolic resources into the smart city to project its future imaginaries. Urban residents are constantly mediated by these and other material-symbolic resources as they move through the

"technological everyday" of the digitally mediated city, replicating some and reinventing others (Amin 2007; Rose 2017). Residents repeatedly use these material-symbolic resources to both develop their own imaginaries and project those imaginaries outward, rematerialising them in technological and spatial forms like the digitally mediated city. Returning to Jasanoff's (2015) concept of co-production, which happens through repeated enactment, and mobilising Rose's (2017) interpretation of "difference-in-repetition", I theorise that smart city residents make space through their everyday embodied practices to orient themselves (via processes of individuation) and the digitally mediated city (via processes of externalization) toward other futures than those imagined by the state.

Interactive repetition is present in both Jasanoff's (2006; Jasanoff and Kim 2009, 2015) co-production and Rose's (2017) posthuman agency in the digitally mediated city, and both argue that it is this need for repeated enactment (of imaginaries and of individuation/exteriorisation processes, respectively) that opens space for (re)invention. Like Jasanoff, I use "repetition" in the Butlerian sense, as something that must be performatively rearticulated and that therefore makes space for possibilities other than identical replication (in my case, the state's imagined futures). Following Rose's (2017) interpretation of Stiegler, I use **differentiated repetition** to refer to repeated everyday embodied practices of materially engaging with smart urban infrastructure and either replicating (repeating) the future imaginaries projected in it or reimagining (reinventing) them. What Rose terms "repeating" and "reinventing" I refer to as **replicating** (to avoid semantically confusing the entire process of repeated enactment with the identical reproduction of symbols) and **reimagining** (to call attention to the specific dynamics of the future imaginaries I study). I use **co-production** to refer to the collective social effect that Jasanoff describes, made up of many acts of differentiated repetition.

3.1 Everyday Embodied Practice and the Technological Everyday

In this subsection, I apply feminist materialist and posthumanist theorisations of everyday embodied practice to analyse resident co-production of the "technological everyday", attending to the co-constitution of bodies and space (Amin 2007). I argue that residents co-produce the smart city through everyday embodied engagements with digital technologies and smart urban infrastructures across diverse spaces.

Attention to everyday practice in the digitally mediated city illuminates how national geopolitics occur through residents' seemingly banal daily practices, movements through space, and ways of inhabiting (Koskela 1997; Billig 1995). Feminist materialist theories of everyday practice are "anchored in the body," linking "structural transformation to embodiment and lived experience" and "the personal and the quotidian to urban cultural landscapes" (Seager 2005:2; Cravey 2005:110). Bodies and spaces are sets of "uncoordinated potentialities" that can be reshaped through daily practice (Grosz 1995:382). Driven by Black feminist scholars' attention to political practice in homes and communities (Campt 2014; Browne 2015) and Berlant's (1997) theory of the "intimate public sphere", the nation as an affectively experienced entity that enacts politics in domestic space and intimate relations, I look beyond the "public sphere" to see residents spatialising diverse forms of smart citizenship. The nation is not an abstract political entity constructed from rational discourse, but a fragile, loosely held together set of icons and symbols which produce affective identifications, felt and experienced on an intimate level (Berlant 1997). This nation as affective entity is nonetheless expressed through material, physical space which co-produces bodies.

For example, domestic space is a site of state intervention, through control over reproduction, housing access, and foreign domestic labourers (Yeoh and Huang 1999; Chang and Lin 2000). States imagine intimate relations as sites of nation-building, projecting women as symbolic reproducers of the

nation (Anthias and Yuval-Davis 1989). Domestic architectural divisions, produced by the state in public housing design, shape inhabitants' imaginings of their positioning in space and consequently their social and sexual positioning through the "lived spatiality" of the home (Grosz 1995:385). Transforming intimate space can also transform one's imagining of self and position (Ahmed 2006). Inhabiting domestic spaces in ways unimagined by the state, like by creating habitation and (non)reproductive practices outside the heterosexual nuclear family, can therefore be a powerful form of political action, reorienting national futures (Oswin 2019).

Detailing the projection, replication, and reimagining of these state futures through everyday embodied practice require attention to bodies' co-production with the (digitally mediated) city. Cities "are not only spatial or infrastructural territories transformed or impacted by technologies…they also operate as imagined territories" or "built thought", as "idealised conceptions" are projected through them (Sandercock 2002; Barns 2020:54). Grosz (1995:385) instructively theorises the relationship between body and city as an "interface" or "co-building": the city's "forms, structure, and norms" seep into the body, partially constituting its "corporeality and/as subjectivity." Instead of framing the digitally mediated city as an entity separate from the body, extracting its data, feminist posthumanists analyse how digital technologies and urban spaces always mediate embodied cognitive processes. These processes also take place beyond the body, externalised in material forms like (smart) urban infrastructures (Munster 2006; Hayles 1999a, 1999b). Bodies and the digitally mediated city dynamically interpermeate to form a "co-evolving and densely interconnected complex system" (Hayles 1999a; Beer 2009:988), disturbing self-contained models of resident corporeality (Grosz 1995; Moss and Dyck 2003).

Everyday embodied practices in the digitally mediated city are thus distributed and diverse, interpermeating scales and locations of urban experience such as residents' digital devices, homes, and daily movements through cities. Spatiality is always-already mediated by bodies and material

engagements, requiring attention to the embodied, material ways digital technologies participate in this mediation (Leszczynski 2015; Richardson 2018; Gabrys 2016). Entangled digital technologies, social relationships, and memories mediate people's experiences of self and place (Boellstorff 2008; Ginsburg 2012; Mol 2002; Horst and Miller 2012). Feminist digital geographers find that residents navigate the digitally mediated city in an intimate, embodied fashion, enabling "technology appropriation that translates into new 'spatialities', blurring the link between "corporeal and public" (Odendaal 2015:32; Elwood 2021). Odendaal's (2015:32) informants engage the smart city through a "situated urbanism", *producing* it through their mutually constitutive interactions with digital technology as they inhabit both digital and urban space simultaneously, requiring attention to "how people use space and what the constraints are."

Building on earlier geographical work on cities as "relational fields of action" (Massey 2005; Cresswell 2004; Mitchell 2000), Barns (2019:7) argues that work on smart cities must analyse the "many intimate ways we negotiate the diverse affective and social registers of urban places and the *performativity* of our entanglements of these spaces" (emphasis mine). Kitchin and Dodge (2011) term the collapse between code and the city "code/space", noting that the reproduction of code/space is continuous, constantly digitally mediating residents' urban experience and understandings. Residents exist in in a feedback loop or "relation of performativity" with technological apparatuses (Leeker, Schipper, and Beyes 2017:11). Barns (2019:7) argues that "everyday, embodied socio-spatial experience" is the locus of this continuous reproduction. Gabrys (2016:216) shows how sensing processes produce new "bodies-in-formation" and have a politics by "establishing what matters flow and what experience matters."

Thus the technological everyday of the digitally mediated city is co-produced through residents' everyday embodied practice as they "bathe in an affective ether of signs" (Thrift 2009:123). The

distributed and diverse non-human agency of space and software in producing and circulating this intense, affective urban landscape of material-symbolic resources is well-articulated by (digital) urban geographers, but as Rose (2017) argues, these literatures currently lack a corresponding distributed and diverse notion of resident agency in the digitally mediated city. Given these relations of performativity, I now turn to theorise *how* residents repeatedly replicate and reimagine the smart city through everyday embodied practice.

3.2 Differentiated Repetition in the Digitally Mediated Smart City

I have argued that states project their sociotechnical imaginaries into smart urban infrastructure, which makes up a part of the digitally mediated city, by packaging material-symbolic resources and projecting them through the smart city. In this subsection, I use Rose's (2017) theory of differentiated repetition to detail how residents replicate and reimagine the smart city using the material-symbolic resources offered by the digitally mediated city. Remaining focused on the repeatedly enacted relations of performativity (Butler 1990) residents have with the smart city, I also use Berlant's (1997:355) concept of the nation as "experienced at the level of emotion and intimacy" and citizenship as "lived within and through the body at an intimate and sexual level". In doing so, I detail how sociotechnical imaginaries like the smart city are recursively co-produced by states and residents. I conclude with a theory of state power that emerges from this distributed and diverse notion of posthuman agency in the digitally mediated city.

I use Rose's interpretation of Stiegler due to the temporality and materiality expressed in their understanding of "tertiary retentions": how memory is "externalized from human beings and inscribed into specific material forms that carry the potential for the transmission of knowledge and affect across time and space within them" (Ash 2012:10). As Rose (2017:784) notes, Stiegler invests in memory at the expense of other "interiorised forces." I instead focus analytical attention upon the temporally charged

force of the imagination, oriented toward the future. I argue that imagination, like memory, is well-articulated through a posthumanist account of agency as it is temporally oriented and spatially mediated, repeatedly materialised through processes of individuation and exteriorisation undertaken in tandem with technologies in the digitally mediated city. I explicate the relationship between individuals moving through (and co-constituting) the smart city, using its material-symbolic resources to imagine their own futures, and collective sociotechnical imaginaries projected by the state through the smart city.

Developing a sense of smart citizenship, as a sense of both self and nation, is a process of both externalisation and individuation: projecting memory (and imagination) into space, while drawing from one's environment to repeatedly produce one's own imaginings. Spatialities (and I argue, temporalities) are "symbolically materialized in tertiary retentions to be repeated, reinvented, or both, by desiring posthumans whose individuations are thus spatiated in particular ways" (Rose 2017:784). Exteriorisation makes imaginaries "extend beyond the individual both spatially and temporally to be encountered elsewhere and in the future" by materialising them in forms like the digitally mediated city. Technology helps organise the affects and symbols that Thrift (2009) mentions as urban residents orient them in place and time, replicating or reinventing the "techno-symbolic content" offered by the digitally mediated city by placing it in the "temporal rhythms" of their everyday practices. I move away from a framework of "resistance" when explaining resident engagement with state-imagined futures toward a framework of "reinvention", because residents are constantly interpermeated with technologies as well as sociocultural signs and symbols (material-symbolic resources) as they move through the "technological everyday" of the smart city. Given this constant mediation, wholesale resistance or acceptance of the smart city makes little sense theoretically.

Returning to Jasanoff's concept of co-production, which happens through repeated enactment, and specifying it through Rose's concept of "difference-in-repetition", I argue that co-production of the smart city occurs through differentiated repetition, through which there is space to orient oneself (via processes of individuation) and one's urban environment (via processes of exteriorisation) toward other futures. Residents use the material-symbolic resources offered by the digitally mediated city, which is made up in part by the material-symbolic resources packaged by the state into the smart city, to individuate. This individuation happens through what Levi-Strauss (1966) terms "bricolage"—creatively, through pastiche and repeated negotiation. Rose (2017) explains that many individuation and exteriorisation processes will largely replicate whatever narratives or symbols are most straightforwardly popular. But some will be new reinventions, even minutely, which open other forms of temporal orientation: making space for imagining other futures than the state's, for example.

In sum, urban residents use the material-symbolic resources that digitally mediated cities abundantly provide to individuate and exteriorise. These processes happen repeatedly and at the level of everyday practice, as residents either replicate the state's future imaginaries or reimagine them through constant interaction with and exteriorisation of the material-symbolic package of the smart city. Theorising co-production in this way allows us to attend to how urban residents "individuate and reinvent through differentiated repetition", and what difference that difference makes to collective smart city futures (Rose 2017:784). Like Campt (2015), I seek to "think beyond conventional notions of resistance as the primary model for understanding the relationship of marginalized subjects to power." She instead calls attention to the "quotidian practices of Black subjects" whose "micro-labours of struggle are frequently overlooked in an emphasis on collective and individual acts of resistance." She calls these daily acts a "grammar of futurity realised in the present."

As I argue in the next section, this should change smart city scholars' task from observing how self-contained, sovereign "smart citizens" accept or resist the smart city to analysing how the digitally mediated urban resident co-produces smart city futures with the state through practices of differentiated repetition. We can then trace how the state repeatedly projects its future imaginaries through the material-symbolic package of the smart city. In parallel, we can trace how residents repeatedly materially engage with these imaginaries, sometimes replicating and sometimes reimagining them, through embodied daily practice. We can see what other spaces residents' differentiated repetitions open up and what other futures they orient toward through these practices.

3.3 State and Resident Power and Agency in the Digitally Mediated Smart City

In this subsection, I return to a theory of state power as the ability to realise certain future imaginaries at the exclusion of others and theorise resident agency using Leszczynski's (2020:196) attention to "mundane" tactical manoeuvres in "counter topographical" performance through repeated engagements with "glitchy" technologies. Given that future imaginaries are repeatedly materially enacted by the state (Jasanoff 2015) and "repeated, reinvented, or both" by urban residents in everyday practice (Rose 2017), two key questions arise: (1) Where do the material-symbolic resources that residents need to reimagine the future come from? and (2) How do residents learn how to replicate or reimagine the future?

The capacity for reimagining state future imaginaries is not unrestricted. Residents' ability to reinvent, because these processes happen in tandem with their urban environments, relies on the material-symbolic resources they have to imagine other futures with (Ahmed 2006). Further, residents must *learn* how to replicate and reimagine, in part through generational transmission, which can limit what they render imaginable (Rose 2017). Taken together, these restrictions can lead to the

reproduction of existing social inequities if wider resources and ways of reimagining are not encountered.

Answering the first question requires ethnographic attention to *how the state spatially organises and packages material-symbolic resources in the smart city to offer only certain, limited capacities for reinvention, and, by extension, reimagining other futures.* The spatial organisation of a digitally-mediated practice is also a temporal organisation—orienting toward particular futures, in part by invoking particular pasts (hence Stiegler's attention to memory). As articulated in section 2, states are well-practiced at creating and generationally transmitting salient material-symbolic resources. The digitally mediated city is both the "site of the body's cultural saturation" and as a result is a "key tool" of governmental control and regulation, the "most immediately concrete locus for the production and circulation of power" (Grosz 1995:386). Though the digitally mediated city does often reproduce offline or pre-digital socio-spatial inequalities, it does not do so automatically: states must work to (re)project socio-spatial relations through the smart city.

But the digitally mediated city might offer other possibilities for reinvention than those projected by the state or transmitted generationally, since residents are hungry for other material-symbolic resources (Rose 2017). It might literally provide other resources to repeatedly imagine the future with. People use technologies to develop many kinds of self-understandings (Neff and Nafus 2016), both consciously and unconsciously, as "posthumans in cities are sociotechnically co-produced digitally with many different digital devices while doing many different things" (Rose 2017:786). Residents use these technologies, spaces, and the data they produce to generate a range of different individuations and material externalisations, through embodied practices. Different technologies enable different kinds of reimagining. As a result, we must attune to the mundane (Leszczynski 2020) and the minor (Katz 1996) which produce "major" changes to state-driven narratives: the many diverse, specific

expressions of human agency enacted through the urban technological everyday in the smart city. This should prompt us to ask *what space residents make to imagine the future of the smart city otherwise.*

This spatio-temporal organisation of future imaginaries directs my ethnographic attention to the second question of *how smart urban residents' reimaginings, through daily practices of differentiated repetition, orient toward and open up other futures.* Answering requires empirical research attending to how future imaginaries, both the state's and urban residents', are enacted and re-enacted daily through digitally mediated engagements with urban space. We must observe the forms of temporal, technological and spatial organisation by which social inequality is repeated, how those forms came to matter, and ask what space, literally and figuratively, exists to create difference: how these dynamics "play out in the lives of everyday people" in encounters of "glitchy marginality" that both shed light on existing restrictions and offer possibilities for "mundane tactical maneuver" in "counter-topographical" performance (Leszczynski 2020:196)

Since digital technologies co-configure users, we must ask what forms of "technical agency" these material-symbolic resources afford, what possibilities for agency look like from *within* technological systems (Neff et al. 2012:303-4). In doing so, we can see how these systems both "limit and drive us": particular people make them in particular ways, toward particular ends, with particular technical specifications and constraints, but in practice they "take on a life of their own" (ibid). I argue that ethnographic attention to everyday embodied practice can show us how this happens, asking "who can act, when, how, and why" (Neff et al. 2012:312). I maintain that we can better understand both what is imaginable by individuals in smart cities, and how collective future imaginaries are recursively remade, by examining the material-symbolic resources that people have to draw on and their practices of differentiated repetition in imagining futures.

I use "recursive" in the sense of Kelty's (2008:15) "recursive publics" to break down misleading analytical distinctions between abstract imaginaries and material practice, since the actors he describes both have "shared moral and technical understandings of order—and can inhabit and transform the thing that creates those understandings." In repeatedly replicating or reimagining smart urban infrastructures, a range of actors also replicate or reimagine the normative future imaginaries projected through them. Theorising co-production as recursive also avoids teleological understandings of technological progress and sidesteps wholesale acceptance/resistance binaries because smart city creation involves many interactive looping effects (Hacking 1995): sociotechnical imaginaries repeatedly call upon social understandings and technical forms that already exist, sometimes arranging them into something new. This repeated enactment of social understandings through material-technological forms opens up space for a range of actors engaging with those forms to change the smart city sociotechnical imaginary, even given limited resources.

This approach produces detailed and nuanced accounts of power and social inequality as produced and reproduced (often by the state) through the smart city, while accounting for resident creativity and capacity to reimagine and reinvent smart city sociotechnical imaginaries and futures. It also directs empirical attention to how recursive co-production happens through everyday embodied practice, illuminating more clearly the necessary conditions for change. In the next section, I argue that this focus on everyday, ordinary, ongoing practices of replication and reimagining mandates redefining smart citizenship.

4 Spatialising Diverse and Differentiated Smart Citizenship Practices

In previous sections, I theorised state and resident power and agency as distributed and diverse, enacted through everyday embodied practices of differentiated repetition. In this section, I argue that this necessitates rethinking the smart citizen, a key figure in smart cities literature. I analyse the key issues

with current theories of smart citizenship: (1) the promoting of active (vs. passive) citizen participation; (2) the lauding of bottom-up (vs. top-down) smart city planning practices; and (3) the narrow definition of political participation as voice and visibility in a democratic public sphere. I suggest reworking theories based upon a general, ideal smart citizen, instead analysing specific ways that differently embodied and emplaced citizens participate in the smart city.

Smart citizens, like the non-human technologies that digitally mediate their everyday urban experience, are diverse and differentiated, as are the practices through which they spatialise that citizenship. Pulling apart the self-contained, sovereign smart citizen who accepts or resists the state-designed smart city, I instead analyse how differentiated and diverse always-already digitally mediated urban residents recursively co-produce smart city futures. Since states mediate citizenship (as recognition of being "in place") through the intimate public sphere (like by embedding sensor technologies into domestic spaces), these spaces are also sites where smart citizenship is expressed and negotiated.

I first show how this framework complicates the relationship between the state and the smart citizen detailed in existing literature, which largely deploys top-down/bottom-up frames of state smart city planning and passive/active modalities of smart citizenship. More recent literature, building on Isin and Ruppert's (2015) notion of digital citizenship as a diverse set of *practices*, shows that numerous forms of smart citizenship are mobilised by both urban residents (Datta 2018; Zandbergen and Uitermark 2020) and by the state (Joss, Cook, and Dayot 2017). These broader understandings of smart citizenship are required to capture the richness of mundane practices and affective entanglements with material-symbolic performances of nationhood that materialise futures through the smart city (Lynch 2020; Leszczynski 2020; Berlant 1997). I argue that this understanding of smart citizenship as affective practice leads to a more accurate mapping of where and how residents can reinvent the state's future

imaginaries. Finally, attending to the specificity of differentiated and diverse urban residents illuminates how they unevenly spatialise citizenship in the smart city.

4.1 Expanding the Republican Smart Citizen

Much smart citizen literature criticises "top-down" forms of smart city planning which create "passive" citizens, offering as an antidote an "active" smart citizen who engages in "bottom-up" smart city design (e.g. Allessie 2016; Cardullo and Kitchin 2017; Townsend 2013; Ratti 2016; Vanolo 2014; Greenfield 2013). These literatures argue that smart citizens resist top-down state power through "alternative" bottom-up modes like hackathons and citizen-science (Sassen 2012; Cardullo and Kitchin 2017; Hemment and Townsend 2013; Fernandez 2013). They further assert that passive and top-down forms of participation mediated by sensor technologies actively degrade political engagement (Halpern, Mitchell, and Geoghegan 2017; Gabrys 2014). Both smart cities critics and policymakers deploying smart city solutions have embraced this "active" smart citizen as the answer to former "top-down'" attempts to introduce smart city technologies into cities: even corporations like IBM and Cisco have adopted this language (Shelton and Lodato 2019).

<table>
<tr><th colspan="2">Form and Level of Participation</th><th>Role</th><th>Citizen Involvement</th><th>Political discourse/ framing</th><th>Modality</th><th>Dublin Examples</th></tr>
<tr><td rowspan="3">Citizen Power</td><td>Citizen Control</td><td>Leader, Member</td><td rowspan="3">Ideas, Vision, Leadership, Ownership, Create</td><td rowspan="2">Rights, Social/Political Citizenship, Commons</td><td rowspan="3">Inclusive, Bottom-up, Collective, Autonomy, Experimental</td><td>Code for Ireland, Tog</td></tr>
<tr><td>Delegated Power</td><td>Decision-maker, Maker</td><td rowspan="2">Civic Hacking, Hackathons, Living Labs, Dublin Beta</td></tr>
<tr><td>Partnership</td><td>Co-creator</td><td>Negotiate, Produce</td><td rowspan="2">Participation, Co-creation</td></tr>
<tr><td rowspan="3">Tokenism</td><td>Placation</td><td>Proposer</td><td>Suggest</td><td rowspan="6">Top-down, Civic Paternalism, Stewardship, Bound-to-succeed</td><td>Fix-Your-Street, Smart Dublin Advisory Network</td></tr>
<tr><td>Consultation</td><td>Participant, Tester, Player</td><td>Feedback</td><td rowspan="2">Civic Engagement</td><td>CIVIQ, Smart Stadium</td></tr>
<tr><td>Information</td><td>Recipient</td><td rowspan="3">Browse, Consume, Act</td><td>Dublinked, Dublin Dashboard, RTPI</td></tr>
<tr><td>Consumerism</td><td>Choice</td><td>Resident, Consumer</td><td>Capitalism, Market</td><td>Smart building/ Smart district</td></tr>
<tr><td rowspan="2">Non-Participation</td><td>Therapy</td><td rowspan="2">Patient, Learner, User, Product, Data-point</td><td rowspan="2">Steered, Nudged, Controlled</td><td rowspan="2">Stewardship, Technocracy, Paternalism</td><td>Smart meters, Mobile/locative media</td></tr>
<tr><td>Manipulation</td><td>Dublin Bikes, Smart Dublin</td><td>Traffic control</td></tr>
</table>

Table 2: Cardullo and Kitchin's (2017) Scaffold of Smart Citizen Participation.

Cardullo and Kitchin's (2017) Scaffold of Smart Citizen Participation (Table 2) exemplifies this hierarchy, in which smart citizen literature values active, bottom-up modes of engagement over passive, top-down modes (Hill 2013; Allessie 2016; Sassen 2012).[3] The highest level, "citizen power", is characterised by a "bottom-up" modality in which citizens take the role of "co-creator" or "leader" and have "citizen control". This form is associated with the political discourse of "democracy" and "commons". The lowest level is "non-participation", with the citizen as "learner", "datapoint", "patient" or "user" and the political discourse "technocracy" and "stewardship" (just below "neoliberalism"). The ideal form of citizen participation is active, bottom-up, and democratic.

Examples of the highest forms demand the most time and conscious labour from citizens, while the lowest forms happen unconsciously, not requiring "active" citizen labour. The top is exemplified by

[3] These modes are usually integrated, with few examples of bottom-up, passive modes of citizen participation, or vice versa (which I give in later chapters).

hackathons and civic hacking, the lowest with traffic control. Practical improvements in citizen everyday life, like automatic waste disposal, are framed as less politically important than rights claims or deliberative debate in a commons or public sphere. Cardullo and Kitchin (2017) use sensor-enabled traffic lights and smart lighting as examples of "technocratic smart city systems", criticising the way they discipline residents due to the "passive" engagements citizens have with invisible technologies. Ranking those low, they highly rank initiatives "wholly owned and organised by citizens for citizens" (Cardullo and Kitchin 2017:17).

The scaffold exemplifies how this literature largely defines political participation as vocalising rights claims in democratic public space, equating "passive", practical engagement with smart city infrastructures with a lack of political agency (Hollis 2014; Hollands 2015). Cardullo and Kitchin (2019:17) find it problematic that in smart cities "to participate is largely practical and instrumental in nature, rather than grounded in a much more political discourse of rights, citizenship, and urban commons." Gabrys (2014:38) argues that in the sensing city "participation involves computational responsiveness" rather than "initiating a political debate" or "enabling citizens to make rights claims": it is "instrumental rather than empowering in a political sense." Vanolo (2016:35) says the smart city should instead be "a huge agora in which every citizen will have the possibility of having a voice." For Hollands (2008:2), a "real" smart city uses information technology to "enhance democratic debates" and create "virtual public culture"—defining public culture, from Zukin (1995), as where "all possible interests and priorities of a whole range of citizens are placed on the agenda and discussed and debated." The agora is repeatedly used as the ideal form of democratic participation, despite its historical exclusions.

The definition of political participation underpinning this smart citizen risks reinforcing the inequalities it seeks to circumvent. Despite critiquing the smart city for being a neoliberal project, smart

citizenship theories like the scaffold privilege forms of participation which offload civic labour onto citizens. As deWaal and Dignum (2017:269) argue:

> practices of 'bottom-up' organization fit in a broader trend of 'responsibilisation' of citizens and civic groups for the organization of public values. Using a rhetoric of 'participation, involvement and responsibility', governments outsource responsibility for public value creation to citizen groups.

Critiques of data extraction are vital but if overgeneralised risk removing political agency from citizens who *want* public works to be invisible and minimise their labour. Alleviation of domestic labour can be politically significant for those whose time and space it opens, as I argued in section 3. Many scholars point out inequalities in technology access which differentiate the capacities of smart citizens, but still seek spaces where these citizens can be given voice and visibility rather than seeing their current practices and interactions with the smart city as potentially generative of political subjectivity (Vanolo 2016; Sheldon and Lodato 2019). Foregrounding this tension, I push scholars to think more critically about the unequal demands placed by the "active citizen" ideal on different residents and more deeply about the specific kinds of participation their work encourages citizens to undertake. Rather than providing an antidote to corporatising urban planning, these theories of smart citizen participation can reinforce rather than replace exclusionary citizenship models.

In short, I argue that much smart citizen scholarship relies on a model of participation that privileges voice and visibility in public space over other modes of engagement. This model is rooted in a republican understanding of agency and citizenship, visible in descriptions of citizen-subjects vocalising rights claims in a democratic public sphere as ideal forms of political action (Vanolo 2016; Bauman 2006; Hollands 2008). It risks systematically excluding those with less access or desire to speak in public fora and missing many ways that residents politically participate in the smart city.

This humanistic conceptualisation of agency reduces options for resident engagement with the (smart) city to acceptance or resistance performed by a sovereign, unmarked, generic subject. Instead,

following feminist, postcolonial, and queer accounts of the subject, we must account for the "inventiveness and diversity of urban posthuman agency" (Rose 2017:781). Refiguring smart citizen agency as diverse and distributed, practices obfuscated by this generic smart citizen figure return to view, as I describe in this section. Moving beyond a rational discourse-based conception of the citizen toward an understanding of citizenship as an affective relationship mediated by symbols, an intertextual "definitional field", also opens up new "potential for agentive citizenship" (Berlant 1993:397) not restricted to a civic, republican model. It also illuminates the many ways that states attempt to manage citizenship through control over affective and intimate spheres, over the collective imagination and spaces like the home (Berlant 1997).

Smart citizenship should be more inclusively understood as "rooted in a composite, paradoxical form of subjectivity" based upon "specific situated interests and forms of engagement" than in a straightforwardly republican model (Zandbergen and Uitermark 2020:1743). For citizens in the environmental sensing project Zandbergen and Uitermark (2020:1745) studied, citizenship

> was not merely and only imagined through the republican tropes of public debate, objective data, and collective action. It was also rooted in local and ad hoc forms of negotiation based on individualised and affective forms of sense-making…as part of an urban environment consisting of information flows to which they could attune their senses.

Further, as Luque-Ayala and Marvin (2015:2113) argue: "In practice, community involvement in SU shows that notions of 'top-down' and 'bottom-up' do not adequately reflect the complexity of issues at play." They argue that "rather than idealising such alternative modes", scholars should critically analyse the complex relationship between state smart city design and citizens. As discussed in previous sections, state power is not just vertically expressed through rigid infrastructures which extract data from passive smart city residents, so resident engagement is not a singular act of resistance or acceptance of data-gathering smart urban infrastructures each materialised once by the state. As Barns (2019:9) argues, drawing attention to "performative ontologies" of power:

> if we fail to attend to the more quotidian, performative and participatory spaces…we may inadvertently render the space of the urban as a subsumed domain of smart, algorithmically governed infrastructures.

Shifting away from the language of top-down control and instead examining the continuous co-production of "intentional interdependencies" between "the personal and the algorithmic, the transactional and the cognitive", we can more effectively unpack smart citizens' replication and reimagining of state future imaginaries in the smart city (Mackenzie 2005:74). As Zandbergen and Uitermark (2020:1745) argue, challenging the verticality in many analyses of smart city politics: "we cannot assume that politics corresponds to a struggle between the system and the lifeworld, between top-down imposition and bottom-up cooperation or between citizens and authorities." This "vertical reading of smart city politics", in which "bottom-up democracy" is pitted against "authoritarian control" does not account for diverse and differentiated modes of smart citizen engagement, as "cybernetic experiences and practices are not inherently authoritarian and may contain seeds of alternative ways of organising urban life" (Zandbergen and Uitermark 2020:1733). I now turn to some of these everyday practices.

4.2 Smart Citizenship as a Diverse Set of Practices

Building upon theories of everyday embodied practice detailed in previous sections, I follow Isin and Ruppert (2015) in articulating (smart) citizenship as a diverse set of practices. Smart cities change political subjectivities in diverse ways, but the smart citizen is not a unified or singular political subject: "multiple subjectivities are likely to emerge from different situations and relations" in the smart city, and there are many ways to be a smart citizen (Vanolo 2016:35). Reimagining the smart city happens through repeatedly enacted spatial practices, "in ways we participate in and co-create hourly, daily" (Barns 2019:9).

Following Hartman (1997:51), "practice" is more than a naming of activities: it is "a way of thinking about the character of resistance…operating in and against the demands of the system, negotiating the disciplinary harnessing of the body, and counter-investing in the body as a site of possibility." Datta's (2018:409) postcolonial smart citizen, for example, refuses exclusion from the smart city and instead vernacularises smart citizenship "through an embodiment of situated and discursive politics." These articulations of smart citizenship happen through performative everyday embodied practices in the smart city, using the smart city's material symbolic resources in "'digital acts' of a population participating online and making claims to the future smart city" and "in the corporeal performances of a population through marathons, poster, essay and poetry competitions" (Datta 2018:409). This citizen both replicates and reimagines the smart city as they practice citizenship, drawing attention to continuously rearticulated contradictions in smart urbanism and resisting a neat distinction between top-down and bottom-up governance, active and passive strategies:

> the *chatur* citizen is both a complaint subject and an active citizen moving fluidly and unproblematically between these two positionalities. Their quotidian acts of governing themselves in everyday life suggests how it is possible to garner support for a large-scale top-down urbanisation project such as the 100 smart cities. Their transgressive speech acts and opportunist politics also underline the faultlines of this large-scale vision of smart urban futures. (Datta 2018:416)

Smart city residents therefore diversely exercise "power and subjectivity across digital and material spheres of the city" (Datta 2018:408; Sundaram 2009; Appadurai and Holston 1996).

Zandbergen and Uitermark (2020) find, for example, that citizens engaged in an environmental citizen sensing project used the multiple citizenship imaginaries offered differently: "cybernetic" citizenship, where they engaged affectively with data as their behaviour created feedback loops with sensors, and "republican" citizenship, where they used collected data to engage in political debates. Different participants were interested in different kinds of engagements with the sensors (as material-symbolic resources), and not all were interested in both forms of citizenship: some felt empowered by

the individual-level tinkering enabled through the cybernetic form (even though these forms were "standing in opposition to republican forms of power"), while others felt disenfranchised by the project's inability to facilitate republican citizenship claims (like Gabrys' (2016) citizen-science participants) (Zandbergen and Uitermark 2020:1745). As they (2020:1745) argue:

> Whereas cybernetic power is often identified with top-down control, corporate nudging, and state surveillance…cybernetic environments can translate into new appealing forms of relations imagined and experienced between individuals and the environment in which they are implicated.

Further, citizens doing citizen-science conceive of its coupling with performances of politics differently, depending on their scientific and political context. Citizen-science generates different citizenship imaginaries outside of "participatory liberal democracies", requiring a more situated understanding of how everyday embodied practices like citizen-science translate into different smart city imaginaries in different contexts (Fan and Chen 2019:182). It is therefore crucial to attend to the different modalities of affect mediating these practices and performances of smart citizenship.

The state, too, employs diverse imaginaries of smart citizenship. Joss et al. (2017) find that the state (through the British Smart City Standard) flexibly employs "individual-liberal" and "civic-republican" citizenship imaginaries, in ways that sometimes seem to contradict, viewing the smart city as a complex system yet trying to simplify it both discursively and through smart urban forms. State initiatives that seek to "empower" smart citizens to reimagine the smart city are often met with apathy (rather than resistance or acceptance) from residents who imagine their roles in co-producing the smart city differently (Cowley, Joss, and Dayot 2017). As affective spaces, smart cities (particularly as national sociotechnical imaginaries) are places of *mediation,* where "a variety of nationally inflected media come into visible and sometimes incommensurate contact" (Berlant 1993:395). It is what citizens *do* with this "affective ether of signs" (Thrift 2009:123) co-produced by the state that generates (smart) citizenship.

These diversified and differentiated models of smart citizenship lead to a different imagining of urban futures. Theorising the smart city as space where the state enacts "material-discursive projects of

future-ing" (Leszczynski 2016:691), Lynch (2020:661, 666) asks what "alternative projects of 'future-ing" we might imagine through these spaces, locating the potential for enacting alternative futures from those imagined by the state in the "material and spatial relations of the city" and pushing beyond smart citizen frames that restrict political action in the smart city to "petitioning the state for rights." He does this, following Gibson-Graham (2008:613) by bringing "marginalised, hidden, and alternative" activities into view to "make them more real and more credible as objects of policy and activism" (Lynch 2020:661). Like Lynch (2020:661), I seek to do more than critique the state, inhabiting a "position of openness towards the possibilities for alternative, counter-hegemonic modes of digital development in (re)producing urban life". Attending to less visible modes of smart citizenship both uncovers imagined digital futures that are "deeply territorialised and attuned to the needs and conditions of particular communities" while also "radically open" to other possibilities (Lynch 2020:666). I do more of this differentiating work in the next subsection.

4.3 Differentiated and Diverse Spatialisations of Smart Citizenship

Attention to differentiated urban residents who spatialise citizenship in diverse ways both explains why some forms of spatialised political engagement do not provide particular residents the material-symbolic resources to reinvent smart city futures (or access citizenship) and illuminates forms of spatialised political practice hidden by an undifferentiated understanding of smart citizenship. Residents have different abilities to use the material-symbolic resources provided by the digitally mediated city through their everyday embodied practices to reimagine state futures. Seeing the smart citizen as a generalised figure leads to poor understandings of how spatialised smart citizenship practices replicate or reimagine spatial and social inequality (Shelton and Lodato 2019).

While public spaces are often romanticised as democratic spaces where (smart) citizenship is expressed (Vanolo 2016; Hollands 2008), in reality they are "striated" spaces of repression and

containment in which citizenship practices have different transformative potentials (Duncan 1996). As Skeggs (1999:228) puts it: "Only some groups can positively and resourcefully spatialise the claim for recognition via visibility… and only some groups can legitimate and/or symbolically convert their visibility claims." For example, making oneself public as a minority does not always mean gaining access to greater citizenship rights. Sex workers who engage in public marches lose valuable anonymity (Hubbard 2005). Public visibility increases exposure to unwanted male gazes, state surveillance, fetishising gazes, and colonial gazes, among others. Browne (2015) shows that "dark sousveillance" practices, rooted in *evading* visibility, have historically been most subversive against biometric technologies seeking to make (parts of) Black bodies and their movements highly visible, countable, and governable. Applying Hubbard's (2005) argument on sexual citizenship, privileging street demonstrations as the primary means of claiming rights replicates symbolic masculinist public/private distinctions, valorising the public as the space of transformative political practice rather than reimagining new modes of citizenship not reliant on this material-symbolic package. Public visibility is not always a good for all bodies and should not have to be the primary means through which people seek citizenship.

As a result, different spatialised practices of smart citizenship carry different meanings. As Fenster (2005:249) argues:

> The power to exclude, based upon boundaries of belonging (which are symbolic, used by hegemony) becomes in many cities the power of urban planning, of monopolising space through zoning, and the relegation of weaker groups in society to less desirable and attractive spaces.

For example, women and minorities reimagining urban space through everyday embodied practices like walking is a "manifestation of power" given how fraught these spaces can be for bodies read as non-White and non-male (Koskela 1997:316). Attending to diverse spatialisations of smart citizenship illuminates the reimaginings of those often left out of smart citizen classifications: women working in domestic spaces or performing multiple labour roles that render them too busy to practice activities like citizen-science or hackathons; the elderly, for whom certain forms of technological engagement and

public space can be difficult to access; and those for whom public voice and visibility could be threatening rather than empowering, like queer residents, those without formal citizenship rights, and sex workers (Johnston and Longhurst 2009; Duncan 1996; Bell and Binnie 2000; Oswin 2010, 2019; Fan and Chen 2019).

These practices generate geographic counter-stories of the smart city, produce alternative archives of the nation in other places and technologies, and materialise different understandings of smart citizenship (Berlant 1997). In chapters 6 and 7, I detail how residents use a range of material-symbolic resources to replicate and reimagine the state's future imaginaries—in everyday embodied practices that would escape the view of many existing smart citizen literatures.

5 Conclusion

Sociocultural anthropology and human geography often strive to move between the "micro" and the "macro", the particular and the universal, the individual and the collective. Much ink has been spilled on the notion of "jumping" scales, particularly in geographical literature on urbanism (Brenner 2001; Swyngedouw 2004; Smith 1992; Marston, Jones, and Woodward 2005). This analytical framework attends to motion but leaves scalar categories like the "local" "national" and "global" intact, often while creating its own new scalar imaginary (e.g. "planetary").

In my analysis, I intentionally avoid arguing that I am connecting "macro" processes of sociotechnical imagining performed by the state to "micro" processes of individuation and exteriorisation. If we take both STS theories of co-production and posthumanist theories of distributed and differentiated agency seriously, we must describe how everyday embodied practices *create* what we imagine to be universal or national sociotechnical and geopolitical forms.

Tsing (2005) helps guide such analysis by showing how nation-building projects are aspirational: creating collective imaginaries requires both material and symbolic work to *enact* scales like the micro and the macro, the local and the national, the particular and the universal, and to cover over that work so those scales are taken-for-granted as natural. Aspiring to become a "global" city, for example, requires various actors to define the characteristics of the global and make their city imaginaries relevant to or align with those of an imagined wider community. Scales must therefore be materially brought into being by a range of people: "proposed, practiced, and evaded, as well as taken for granted" (Tsing 2005:58).Tracing these scale-making projects and the frictions they encounter is crucial to understanding how "big" concepts like the smart city are projected and repeatedly re-enacted.

As a result, I use the term **projecting** to refer to how institutions like the state imagine and materialise seemingly abstract visions of the future into smart city projects. Projection captures the material (turning something into a project, or something that physically protrudes outwards), symbolic (projecting an image onto a screen, or one's voice), imaginative (projecting one's desires or mental images onto someone or something else), spatial (like a map projection on a plane surface) and temporal (projecting something into the future, as in a forecast) dimensions of this process.

This understanding of projection as an aspirational material practice that must be carefully articulated by anthropologists and geographers is especially needed in sociotechnical analyses of the smart city. In existing work on the digitally mediated smart city, two poles of scholarly analysis lead to the same epistemological problem. On one pole, as I discussed in section 4, an overly intact and sovereign idea of the smart citizen results in an unmarked, undifferentiated human agent who either accepts or resists the smart city designed by the state to extract data. The other pole presents a dizzying array of smart city technologies and spaces, ending with a sense that everything is unboundedly fluid and complex, both the non-human and the human infinitely diverse and distributed. This leaves the

reader with a profound uncertainty about how structures of power operate, including possibilities for intervention. It casts human agents as unmarked, expansive entities, surprisingly similar to the first pole. There is no sense of the difference that difference makes for smart city residents (Rose 2017).

Instead, I hope to have offered a theoretical and empirical map (the latter which I detail further in the next chapter on methodology) to systematically analyse *how* residents' everyday embodied practices recursively co-produce the digitally mediated smart city, providing a textured and non-vertical account of state power and resident agency. This review forms the basis of my research questions:

> *RQ1: How does the state project its future imaginaries through the digital and urban space of the smart city?*
>
> *RQ2: How do smart city residents replicate and reimagine state future imaginaries through these same digital and urban forms?*

With the theories explained and terms defined through this literature review, I can restate my research questions as follows:

> RQ1: *How does the state spatially and symbolically project the smart city to offer a limited range of resources for reinvention, and, by extension, for reimagining the imagined futures projected through it?*
>
> *RQ2: How do smart city residents' reimaginings, through everyday practices of differentiated repetition, orient toward and make space for other futures?*

I argued that the smart city is a sociotechnical imaginary recursively co-produced by the state and urban residents. Theorising state power as the ability to enact particular futures at the exclusion of others, I argued that the state packages material-symbolic resources into what it calls the smart city and continually (re)projects its future imaginaries through smart urban infrastructure, which residents recursively co-produce through repeated material engagement. I detailed how this recursive co-production occurs through everyday embodied practices of differentiated repetition, by which residents repeatedly replicate and reinvent state future imaginaries through the digitally mediated city using its

material-symbolic resources. Projecting and reimagining futures through the smart city requires repetition on the part of both the state and residents, as states must continually re-enact future imaginaries through diverse digital and material spaces of the city, leaving them open to reimagining by residents. These reimaginings, however, are limited by the material-symbolic resources that urban residents can access to imagine with in their everyday practices, as well as the sources of their learned capacities to reimagine. Attention to everyday embodied practices of differentiated repetition, I argue, furnishes a more detailed understanding of who co-produces the smart city, when, with what technical agency, how, and why. It also provides more diverse and differentiated understandings of how residents unevenly and affectively spatialise smart citizenship.

My analysis unearths dynamics of state power projected through the smart city and the possibilities present for reimagining state smart city futures, accounting both for resident difference and the restrictions residents face when trying to change the smart city or spatialise smart citizenship. My approach allows us to rigorously analyse (1) how imaginaries become collectively held and reshaped by individuals; (2) how residents co-produce sociotechnical imaginaries through everyday embodied practice and (3) how states enact power to shape the future by limiting the material-symbolic resources that residents can imagine with—but also how state future imaginaries, because the state must repeatedly project them, make space to imagine other futures.

Empirical chapters 4, 5, 6, and 7 map on to this literature review framework: 4 analyses state projection of sociotechnical imaginaries, 5 & 6 detail co-production through differentiated repetition (focusing respectively on practices of replication and reimagination), and 7 analyses smart citizenship as practice. Chapter 4 describes how the Smart Nation sociotechnical imaginary has roots in more longstanding national sociotechnical imaginaries and urban infrastructures, historicising the component imaginaries of standardisation, connectivity, and futurity and the material-symbolic resources used by

the state to project them. Chapter 5 details how those imaginaries are co-produced through everyday practices of state planners as they consciously and unconsciously replicate these imaginaries through and with the smart city planning technologies they use and smart urban infrastructures they create. Chapter 6 details how state planning agencies give local and international smart home developers these material-symbolic resources to replicate state future imaginaries with, but as residents live in smart homes in differentiated ways which disrupt imaginaries of standardisation, connectivity, and futurity, they reimagine those futures as well. Chapter 7 explains the implications of these findings for smart citizenship, showing how my interlocutors' affective and material engagements with smart urban infrastructure are forms of political practice which shape their understandings of self and nation.

Before moving to these empirical chapters, I detail my methodology in Chapter 3.

CHAPTER 3: METHODOLOGY

1 INTRODUCTION

My research answers academic appeals to study the "actually existing" smart city and citizen by analysing the sociomaterial effects of smart city planning (Shelton and Lodato 2019). It responds to calls for more long-term, detailed, nuanced ethnographic research on the smart city as it is actually implemented (Kitchin 2015; Luque-Ayala and Marvin 2015, 2020). People experience locally specific instantiations of smart city plans in actual cities: smart cities are not "placeless" (Cowley et al. 2017). I therefore examine "the ground on which smart city experiments take place", the interfaces where residents materially-imaginatively co-produce the smart city (Mattern 2016).

At the beginning of my ethnographic research, I found planner interlocutors' assertions that the smart city is "all heat and no fire" compelling, as they neatly aligned with critical smart cities discourses. But as I continued, I saw affective and material engagements with, and effects of, smart city sociotechnical imaginaries everywhere. For example, residents often extensively engaged with "mundane" smart city technologies in their everyday domestic or working spaces but took them for granted as they easily assimilated them into their daily practices. As a result, interlocutors did not immediately register these technologies as "smart" in interviews. It was only through observing residents' repeated, everyday material interaction with technologies that their uses became clear, leading me towards "geographic counter-stories" of smart citizenship that would have remained invisible using interview or archival methods alone (Kobayashi 2005).

In this chapter, I detail my methodological approach to the theoretical questions I explored in my literature review. As explained in Chapters 1 and 2, in this thesis I ask:

> *RQ1: How does the state project its future imaginaries through the digital and urban space of the smart city?*

RQ2: How do smart city residents replicate and reimagine state future imaginaries through these same digital and urban forms?

I first explain my choice of field methods: constructing the field site as network, employing critical feminist ethnography, and observing interfacial encounters. Second, I discuss the methodological choices these field methods emerge from, drawing upon anthropologies of the future, STS sociomaterial approaches, and material culture studies. Third, I explain how I applied these methods in my field sites: HDB estates, smart home labs, and planning agencies. Finally, I detail my positionality and storytelling practice, project limitations, ethical frameworks, and data analysis practices.

2 Field Methods

Tracing smart city sociotechnical imaginaries as residents replicated and reimagined them in practice, through digital and material forms, required an understanding of field site as network rather than clearly bounded spatial entity. In this section, I first describe how I used Burrell's (2009) concept of field site as network to trace the sociomaterial effects of smart urban infrastructures, focusing on smart home sensors and the smart city planning technologies, like GIS maps, that co-produced the smart home. By conceptualising my field site as a network and tracing infrastructures' motions, I could map how these technologies both materialised future imaginaries and were materialisations of them, continuously evolving through daily acts of differentiated repetition.

Second, I explain how I used critical feminist ethnographic methods to attend to everyday enactments of future imaginaries. I performed participant-observation and interviewing with attention to bodily difference and the body's co-constitutive relationship with space. I explored both conscious and unconscious everyday practices of replicating and reimagining smart city sociotechnical imaginaries: how residents repeatedly engaged with the digitally mediated city to produce understandings of self and nation, practices that repeatedly create the city (recall Grosz' (1998) notion of city as two way

interface or "co-building"). Ethnographically attending to smart city co-production on these bodily levels manifested how smart citizenship is co-created "hourly, daily" (Barns 2019:9) through repeatedly enacted spatial practices.

Finally, I explain how ethnographic attention to interfaces shows how these technologies must be worked *through* in material practice. It surfaces "what's stuck and what's possible" in the smart city: what material-symbolic resources residents are given to replicate and reimagine (state) futures with, and how they do so in their everyday practice (Mattern 2014; Leszczynski 2020; Berlant 2011:9).

These intertwined approaches illuminated how practices of political engagement happen in quotidian spaces, foregrounding smart citizenship spatialised in "private" domestic space as well as "public" state agency space. Taking citizenship as a diverse set of practices that must be continuously performed (Isin and Ruppert 2015), attention to my interlocutors' spatialisations of citizenship foregrounded how intersections and performances of gender, sexuality, age, and race contributed to their differing experiences, and how differential access and exclusion were projected through smart urban infrastructures. Observing how my interlocutors used the smart city's "affective ether of signs" to narrate self and nation, I learned how thoroughly political their affective, material engagements are (Berlant 1997; Thrift 2009:132).

2.1 Field Site as Network

I work towards an anthropological fieldwork tradition that would "decenter and defetishize the concept of 'the field'" while developing methodological and epistemological strategies that "foreground questions of location, intervention, and the construction of situated knowledges" (Gupta and Ferguson 1997:5). In locating my research in Singapore, I did not aim to study the "Singaporean people" or write an ethnography of a national culture. I traced a phenomenon (imagining smart futures) in a particular time and place, through the deeply human-focused lenses of anthropology and feminist geography. I

asked: "what does this look like from over here?" (Povinelli 2011). And to other scholars and interlocutors I ask: “what does it look like over there?” Given that the local and the global are not a priori categories, ethnography helps trace how interlocutors imagine and create these categories through their daily practices, particularly when used comparatively (Tsing 2005, 2015).

While many 1930s anthropologists imagined studying societies as cultural “wholes”, it is widely accepted that people live in overlapping, heterogeneous, sometimes geographically disparate, non-bounded social worlds (Tsing 1993; Appadurai 1996; Hannerz 1992; Hine 2000). Thus the practice of locating an ethnographic field requires continuous work (Abu-Lughod 2000). Focusing on locating as an ethnographic practice (rather than on doing an ethnography of the “local” by imagining a bounded field site) is also necessary for “tracking systems of power and structures of inequality” (Abu-Lughod 2000; Gupta and Ferguson 1997). Studying interlocutor engagements with smart city imaginaries was a fundamentally spatial endeavour, requiring fieldwork methods attuned to humans’ co-constitutive interactions with the built environment.

Burrell’s concept of field site as network was particularly instructive in this urban tracing work. Burrell (2009:189) conceived of her urban field site, where she studied Internet users engaging extensively with online spaces, as a network “composed of fixed and moving points including spaces, people, and objects.” Like her, I define my field site by tracing interlocutors’ movements through the heterogenous space of the city rather than relying on pre-imagined boundaries (while also noting that the term “network” can conjure an image of flat relationships, erasing hierarchy—which I explicitly avoid doing). The field site as network method follows connections, bringing:

> the social phenomenon into view by foregrounding it against the social complexity of its urban setting. To foreground is to draw the contours of the phenomenon, distinguishing it from the competing and intersecting activities also taking place between the spatial field that is also defined more traditionally by the territorial boundaries of the city. The term contour best describes the outcome of this act of foregrounding by indicating that greater precision is achieved than would be obtained relying on the boundaries of the city, the country, and so forth.

> At the same time, this term preserves the quality of irregularity and the notion that the social phenomenon is outlined rather than detached from its context. (Burrell 2009:190)

Rather than formal sites, the ethnographer seeks "entry points", subsequently following connections interlocutors point to as meaningful. My fieldwork had two entry points: a contact in the Urban Redevelopment Authority (URA) and a neighbourhood in which smart home tests were occurring. From those two points, I traced interlocutors and smart home technologies through smart home labs, different state agencies, and specific residents' homes.

Foregrounding networks of people and technologies led me to housing policies that constrained and facilitated certain kinds of dwelling and movement. My field sites became defined by interlocutors who articulated in interviews and materially indicated through city walkthroughs what they found meaningful. Burrell stresses attention to imagined spaces as well as physical ones, which became especially important in my fieldwork on imagined city futures. The Singapore smart city-as-future was one such imaginary. Singapore as a standardised model of living that should be exported to other countries was another. A third was Singapore as a connected global port, both literally and figuratively, historically and technologically. This led me to the trio of standardisation, connectivity, and futurity as the most prominent imaginaries I saw repeatedly replicated.

Interlocutors also expressed these collective national imaginaries in ways that foregrounded their reinforcement through literary, pop culture, and media images (Anderson 1983; Appadurai 1996; Abu-Lughod 2005). I therefore also analysed poetry, stories, and other artistic works produced about the urban landscape and neighbourhoods in Singapore. I focused in particular on Boey Kim Cheng's poetry and the short stories in Verena Tay's (2012) *Balik Kampung: People and Places* series, written by long-time (10+ years) residents of specific Singapore neighbourhoods. Led by material culture studies and Berlant's (1997) study of citizenship through "silly objects", I also drew from popular Straits Times-published coffee table book that I found in many cafés and homes, *50 Things to Love about Singapore*.

Finally, my field site boundaries were not physical, as fieldwork did not stop when I exited Singapore's territorial boundaries. I remained in continuous remote contact with interlocutors, archival materials, digital materials, government documents, discourses about Singapore in other countries, and other data forms. In keeping with the emic tradition of anthropological research:

> the field site transitions from a bounded space that the researcher dwells within to something that more closely tracks the social phenomenon under study. The site is constructed in terms of how such a phenomenon is perceived and acted on by participants…defined by the physical movements, places indexed in speech and text, and social imaginings produced by research participants…through an openness to following participants through space as well as in language, there is potential for empirical surprises and novel insights. (Burrell 2009:195)

Using the field site as network method focused my ethnography on a limited set of technologies and housing estates yet allowed me to follow aspirational smart city futures, the exporting of Singapore technologies and practices to other global cities, and how residents' daily lives were affected by technologies made to capture their data and mould them into model urban citizens. Imagining my field site as location-tracing process, attending to how interlocutors located themselves, fit well with critical feminist ethnography's focus on spaces of everyday practice, to which I now turn.

2.2 Critical Feminist Ethnography

I built my critical feminist approach to ethnography from a feminist geography attention to the body's co-constitutive relationship with space. The critical feminist ethnographer attends to social processes that are inscribed in and leave traces on the body, focusing on the material conditions of everyday life (Nast and Pile 1998; Moss 2002). Bodies inhabit spaces and spaces inhabit bodies: they drip "with the minutiae of the immediate environment, the mediation of power through multi-scale processes, and the culmination of historical moments" (Moss 2005:44). Analysing how bodies produce context, how specific bodies relate to each other "through recursive constitutive processes—socially and spatially", generates awareness of socio-political practices otherwise rendered invisible (Moss and Dyck 2003:56).

Using a critical feminist approach to ethnography meant paying as much attention to interlocutors' embodied interactions with spaces as their speech acts (and how each informed the other). A methodology attending to material engagement in "private" spheres, engagement performed by real, differentiated residents with bodies co-produced by distributed digital and urban technologies (and not just abstract or generic "citizens"), led me to theorise smart citizenship beyond voice in a democratic public sphere. It alerted me to smart city imaginaries and futures projected into the city's infrastructures and engaged, replicated, and reimagined materially. Without attending to those material instantiations of smart city discourse or the material ways in which people engaged with them, much of my analysis would have been inaccessible.

Real bodies, according to critical feminist epistemologies, are bodies that "eat, sleep, menstruate, experience pleasure, are in pain—that are both biological and social", always socially and spatially regulated (Moss 2008; Williams and Bendelow 1998). Processes of embodiment themselves require attention: how bodies "become, intersect, and affirm their existence" (Bray and Colebrook 1998:36). Leslie and Butz (1998) show how contextual bodily readings provide insight into processes restructuring an entire region, through injuries people sustained in auto plants which take on different meanings depending on the context (the assembly line, ski resorts, union meetings). Moss and Dyck (2003) describe a woman with lupus moving through healthcare and urban contexts. She encounters frictions and experiences spaces differently than someone else would, as she both is read in and reads the space in ways informed by her embodied experience. Her experience illuminates the wider spatial and social processes that structure what people can do in specific places, depending on who they are and what they look like. These possibilities are both self- and externally regulated.

Women often, for example, have heightened body awareness in public spaces, shaping what they consider expressible: from making less expansive body motions (Young 1980) to avoiding certain

city locations (Day 2001). These relations are built into the city's material environment, facilitating certain people's movement while excluding others: migrant workers in Singapore must travel less visible, physically bounded roads to access their living spaces, segregated from citizen-residents, even if they live in the same neighbourhood. Critical feminist ethnography researches places where "power and difference constitute specific bodies (like universities, hospitals, bureaucracies, homes, and workplaces)" (Nelson and Seager 2008). This ethnographic commitment led me to interface points with smart city technologies (what Mattern (2014) terms "the city's operating system", as I discuss in the next subsection) which make certain interactions with the city more possible than others, for certain people more than others. The technologies themselves also co-constitute those who use them.

Finally, a critical feminist ethnography recognises that the personal is political: that political actions take place in a range of spaces, private and semi-private included, and are affected by differentiating embodied experience. I therefore did research in domestic spaces and places like playgrounds, parks, and museums, as well as government offices and spaces more explicitly coded as places of civic engagement. My interlocutors outside of state and laboratory spaces were almost entirely elderly, queer, and/or women, and had different smart city experiences based on their racial and citizenship identities. Following work on queer placemaking, I attended to the "productive possibilities of paradoxical space" in my ethnographic engagement (Valentine 1993:395), leading me to "geographic counter-stories" of smart city participation that otherwise would have remained invisible (Kobayashi 2005). I attended to the objects and media interlocutors engaged with in their everyday practices, the material-symbolic resources they used to perform diverse and differentiated forms of smart citizenship, as they produced an alternative archive of the Smart Nation through a range of digital and analogue media (Mattern 2019).

I found through this method that residents do engage with the state-imagined future of the smart city, but rarely through standard civic participation channels. Smart citizenship needs to be theorised more expansively to understand its full expression in practice, like many other concepts feminist theory has drawn attention to and expanded (e.g. women's labour). In the next subsection, I turn to the interface.

2.3 Working Through the Interface: Following Sensors and Maps

My methodological design involved following smart home technologies from the planning offices where they are imagined as part of the Smart Nation plan, to the workspaces of the developers (both international and local) who design and test the smart home sensor system, to the homes in which residents dwell with the sensors and give them data about their daily activities (e.g. their movements, use of energy, sleeping patterns, eating habits). While I originally set out to trace the motion of the sensors through a sociotechnical system, I realised during the research that I had imagined a linearity to this work: from design, to creation, to dissemination, to use. I instead found the processes are recursive, as each group constantly interacts with and provides feedback to the other, through talk and through material engagement with planning technologies, the sensors themselves, and the HDB space in which the technologies are emplaced. In my initial proposal, I had planned to neatly split my time between the groups I studied but found instead that their worlds overlap significantly and frequently.

This led me to a more opportunistic method: say yes to everything. I began to find the interface points between groups and technologies the most interesting. I took every opportunity to go with the developers and planners when they went outside of their office and labs into the city, and to sit in on any meetings or events that involved them interfacing with other agencies, businesses, or residents. Mattern's (2014) concept of the interface (expanding on Hookway 2014 and Galloway 2012), as zones or spaces through which people engage with and work through technology, was instructive in

illuminating what was possible and imaginable for planners, developers, and residents spatialising smart citizenship in the smart city. My sociomaterial approach led me to focus on these interface points, which showed both frictions in and possibilities for resident co-production.

Methodological attention to interfacial encounters foregrounds embodied resident engagement, as well as the power expressed through smart urban infrastructures, as distributed across networks of bodies and bits (Grosz 1998). Residents' embodied interactions with smart city interfaces illuminate what and whose futures are most easily expressible. The interface is a threshold that must be "worked through" (Hookway 2014). That interaction requires mobilisation of the interactor's past, capabilities, identities, and contexts that structure their inputs and the outputs they receive. Examining urban interfaces helps illuminate what possibilities exist for reimagining state futures: using Mattern's (2014) rubric, we can ask what information they allow residents to access, the visual (or non-visual) form information takes, their dimensionality (is it a 2D screen?), their mode of access (e.g. touch, sight), their location and size, the metaphors they use to convey information (e.g. file folder, lightbulb), to whom they speak (and leave out); the choices they offer. The interface's interactive nature becomes increasingly palpable when broken, as residents are faced with further choices and experience affective responses (Leszczynski 2020).

Interfaces can be used in unintended ways that offer insight into their intended uses and limitations, what Galloway (2012) terms a "counter-cartography" that uncovers the "informatic imagination" underlying systems. Residents can "test the 'prohibitions' of platforms' forms and materialities and affordances" (Galloway 2012:97). The test occurs, not just at the level of the message (the content that the interface presents) but the medium, too (what residents can access and how they can access it) (McLuhan 1994). These affordances structure and (intentionally) limit resident

participation in the smart city, and residents' material engagements with them shed light into possibilities for reimagining the smart city itself.

It is important to note that much of the smart technologies and infrastructures that residents interact with do not take the form of interface-as-screen, so (as Mattern (2014) articulates), an expansive notion of interface is required, as well as a more distributed notion of embodiment. As a result, I paid close attention to the interfaces created and used by my interlocutors, observing how they worked through these technologies in their daily practice. In my ethnographic vignettes, I mention each interface my interlocutor consciously and unconsciously works through as they move through the smart city, illustrating their distributed and differentiating relationships with smart urban infrastructure.

In doing so, I was led to the often hidden sensors embedded in smart homes and urban infrastructures. The "urban sensor" is "the body that translates and mediates between the digital and material domains of the city; in doing this, it creates new bodies and urban forms" (Luque-Ayala and Marvin 2020:6). I studied *how* interfaces like sensors form "new corpo-realities" (Luque-Ayala and Marvin 2020:217) in co-constitutive embodied engagement with developers, planners, and residents.

This method also led me to another, less expected, sociomaterial technology: smart city digital planning maps. I discovered the GIS maps (and their analogue map ancestors) were a crucial interface engaged with by planners, developers, and residents in myriad ways. These maps both produced other material realities, like the physical spaces of HDB estates, and were produced by data from a range of residents (including planners and developers) and pre-existing material-symbolic resources materialised in prior Master Plan maps and state planning agency practices. They expressed and replicated the material-symbolic resources of standardisation, connectivity, and futurity that emerged throughout the fieldwork, but were also a key site through which these resources were reimagined. These maps drew my analytical attention to other kinds of resident mapping practices that interfaced with the GIS maps

in sociotechnically meaningful ways, leading to my focus on resident geographic counter-stories and the counter-cartographies they produced, spatialising different kinds of smart citizenship.

I now turn to the research methodologies that these field methods emerge from.

3 Research Methodologies

In this section, I first explain why my methodological choice of ethnographic research is suited to analysing futures as they are imagined and materialised through everyday practice, exploring the "technological everyday" of the Smart Nation. I propose that imagining the future is an affective, material process enacted through "mundane" (Leszczynski 2020) spaces and objects, requiring ethnographic attention to the minutiae of resident everyday life as they engage with the myriad smart urban infrastructures through which the state attempts to project its future imaginaries.

Second, I explain my decision to follow feminist STS scholars in situating digital technologies as material, active participants that shape human bodies and mediate affective and imaginative processes. Because I frame the smart city as a sociotechnical imaginary, repeatedly enacted through material-technological forms, an STS sociomaterial methodology underpins my ethnographic methods. Finally, since I study how people replicate and reimagine smart city sociotechnical imaginaries through quotidian engagements with spaces and objects, I draw from material culture studies methodologies to explore how these digital technologies co-produce social life in spaces of daily practice, specifically in domestic space. I link this approach with Berlant's (1997) methodological attention to mundane, everyday media objects as central to the construction of citizenship (Sturken 2012).

3.1 Anthropologies of the Future

In this section, I explain that ethnography facilitates exploration of how people imagine and enact futures in their everyday lives through material engagements with sociotechnical systems. I have

explored the future as an object of anthropological analysis in other writings[4] (Valentine and Hassoun 2019; Hassoun 2016). Furthering anthropology's methodological attention to the future, I propose that imagining the future is a practice enacted through material engagement with spaces and objects. Imagining the future as a material practice is especially pertinent to the study of digital technologies, as technologies are key vehicles through which actors try to build and sustain visions of the future. As anthropologists studying the future have argued, visions of the future "find their ground on things", and in technological design "*things* are bound to a broader process where visions of the future are also produced, and which is inseparable from the design context and the specific market that this 'thing' is designed to participate in" (Lanzeni and Ardèvol 2017:118).

Such anthropological methodologies highlight that the relationship between digital technologies and the future is "based not only on what technologies make possible, but reflects a situation where in order for these technologies to participate in the future, *the future needs to be projected into (and by) them"* (Lanzeni and Ardèvol 2017:118, emphasis mine). My ethnographic practice analyses this emphatic phrase: how people project futures into the smart city, and how the smart city projects those futures. This future anthropology requires ethnographic attention to the diverse and differentiated "technological everyday" of planners, developers, and other residents, as a range of actors project futures into the smart city and in turn experience futures as they are projected through it (Amin 2007).

To study "how the future emerges ethnographically", I therefore situate it "in the mundane terrain of the developers' activity," as well as the mundane terrain of smart city residents as they engage with the myriad smart urban infrastructures through which the state projects its future imaginaries (Lanzeni and Ardèvol 2017:119; Fortun 2008). As Watts (2015:151) describes in her ethnographic study of "situated futures" (adapted from Haraway's (1988) concept of "situated knowledges"):

[4] See David Valentine and my 2019 review "Uncommon Futures" in the *Annual Review of Anthropology* for an extended analysis of existing anthropological work on the future.

> futures are made and fixed in mundane social and material practice: in timetables, in corporate roadmaps, in designers' drawings, in standards, in advertising, in conversations, in hope and despair, in imaginaries made flesh.

The same futures are contested and reimagined through those same digital-material forms. As this dissertation fundamentally asserts, making space for other futures is a literal process. It is repeatedly enacted through engagement with the digital-material forms of the smart city, through which futures are repeatedly projected. Residents repeatedly replicate and reimagine state smart city futures—spatialising smart citizenship by making space for their own futures—through many conscious and unconscious interactions with the digitally mediated city.

Studying how the future emerges ethnographically allowed me to see that making space for the future is a recursive and continuously rearticulated affective process rather than a single event of material instantiation, as "futures that matter inhabit the very processes of making technologies possible" (Lanzeni and Ardèvol 2017:119). Future-making happens through the stories people collectively tell with smart city technologies and the understandings of self and nation people develop through their use. These stories, as I argued in Chapter 2, are rooted in pre-existing narratives about the role of technology in national imaginaries, continuously replicated through storytelling practices materialised in sociotechnical forms. I now turn to those sociotechnical imaginaries and methodological reasons for studying them.

3.2 Sociotechnical Imaginaries and Sociomaterial Approaches

Feminist STS focuses methodological attention on *processes* of subject formation, showing the repeated everyday work actors perform with technologies to generate collective affective identifications. Drawing on feminist STS, I situate smart technologies as material, social participants that shape human bodies, senses of self and nation, and collective future imaginaries as part of heterogenous networks. I traced

these networks to study how technologies co-produce smart city sociotechnical imaginaries with a range of "elite" and non-elite actors, rather than just "studying up" with elites like state planners or developers.

Integrating interpretive anthropological studies of the imagination with a feminist STS sociomaterial approach accounts for the "hardness" of technological systems and policies while leaving room for the "subjectivity" of human agency, resisting technological determinism but detailing the material constraints imposed by states through infrastructure projects (Jasanoff 2015:24; Adam and Groves 2007; Rosenberg and Harding 2005). Ethnographic practice attends "to the means by which imaginaries frame and represent alternative futures, link past and future times, enable or restrict actions in space, and naturalise ways of thinking about possible worlds" (Jasanoff 2015:24). I used a feminist STS-informed ethnographic practice to trace how sociotechnical imaginaries "become collectively held reference points and anchors for future projects" (Jasanoff 2015:28).

STS' sociomaterial perspective emphasises technoscientific knowledge's constructed and situated nature (Haraway 1988). Technoscience and society are always locked in processes of co-construction, and technologies are non-human actors that shape their creators and users (Latour 1986; 1987). They shape the reality they measure, including bodies and imaginaries (Knorr Cetina 2009; Downey and Dumit 1997; Hess 1997; Rapp 1997). Following those technologies provides insight into the many different actors that co-produce them throughout a sociotechnical system (Beer and Burrows 2013; Tsing 2015). This tracing is important as institutions exert "particularly brutal forms of power" through the stories they tell with technologies (Martin 1998:30). Studying these effects by following specific smart technologies, like data-gathering smart home sensors and digital smart city planning tools like GIS maps, helps illuminate how the Smart Nation is repeatedly projected, replicated, and reimagined across diverse city-spaces.

"Studying up" can project "elites" like state planners and developers alone as creators of sociotechnical imaginaries, missing the diverse and distributed processes that shape technology design (Nader 1972; Forsythe 2001; Ho 2009). For this reason, my methodological approach does not focus solely on elite knowledge production. Those who produce technoscientific discourses and infrastructures require allies, interfacing with not-exactly-scientific actors like state agencies, journalists, and the public (Latour 1987). Ethnographic thick descriptions place technoscientific practice in larger cultural and historical contexts (e.g. Traweek 1988; Forsythe 2001; Hess 1997; Montoya 2011), showing how non-expert groups co-create technoscientific knowledge. As Martin (1998:28) puts it:

> What if many other kinds of processes proceeding from fundamentally different assumptions about the world profoundly affect experts and scientists even as they accumulate resources and build networks? What if important, forceful processes flow into science as well as out of it? What if instead people who call themselves scientists are continuously interacting with, and being profoundly affected by, people who do not call themselves scientists?

I followed these "important, forceful processes" that flow through technoscientific practice and shape the worlds of both technoscientists and non-technoscientists dwelling in the smart city as they invest things with meaning in specific sociocultural contexts.

As a result, I studied the technologies and ways of seeing through which people project the smart city, their history, how people learn them, and how they evolve in practice through recursive material engagement. My desire therefore was not to study "the interior lives of experts as an elite as such, but rather to understand their frame, which we assimilate by collaboration" (Holmes and Marcus 2005:248). I centred my fieldwork in specific Singapore neighbourhoods, as well as the labs and offices of developers and planners, to ground my research questions in interlocutors' lived experience. Rather than assuming state planners and developers imagine a visual or discursive regime that residents must then accept or resist wholesale, I traced the repeated and recursive material processes through which all actors make the smart city. I explicitly attended to the processes by which power was expressed through the smart city, not taking for granted that planners and developers held all the power. Instead

of drawing a neat distinction between "elites" and residents, I observed how planners and developers experienced the smart city as residents, too.

3.3 The Social Life of Things: Material Culture and the Home

While analyses of the "household" have been wide-ranging in anthropology, studies often lack explicit attention to the materiality of home space in mediating and manifesting social relations (Miller 2001). Drawing upon material culture studies, I focused on the materiality of smart technologies and sociotechnical imaginaries projected through domestic space. Ethnographic attention to material practices of dwelling in domestic space shows how smart technologies become part of the material culture of everyday life, co-producing imaginable futures. I asked: what happens when sensor technologies find a home amongst religious icons and family photos? What material-symbolic resources does the smart home give its residents to build, dwell, and think with (Heidegger 1971)?

Attending to the mediation of home space and quotidian objects is particularly necessary to theorise smart citizenship. "Mundane" everyday objects, including digital technologies and "silly" media, are intertextual, affective artifacts which signify the quality and intensity of our identifications with national culture and are mediums through which alternative identifications are performed (Berlant 1997). They help us understand the politics of citizenship as expressed in and through quotidian space and objects.

Material objects in the home generate contexts, as they are material-symbolic resources used to shape the use of space in socioculturally mediated ways (Appadurai 1986; Bourdieu 1970; Buchli 1997; Daniels 2010; Douglas 1991; Haddon 2011). Residents engage in mutually constitutive relationships with home objects: objects do not just reflect social practices but actively make them, as they configure cultural identities and subjectivities, as well as storing and altering (collective) memory (Gell 1986; Tilley

1999). The home shapes its inhabitants from a young age, and home objects like heterosexual family photos bound the kinds of futures children can imagine (Ahmed 2006).

It is important to study the way residents use home space in practice, rather than just studying housing plans. For example, Dayak housing plans (Figure 1) show divided, self-contained living spaces with little interaction space between them. However, Helliwell (1996) found through ethnography that holes pepper the walls and sound travels easily. People constantly chat through walls with neighbours as they perform daily tasks, creating a very different socio-spatial experience than inferable from plans alone.

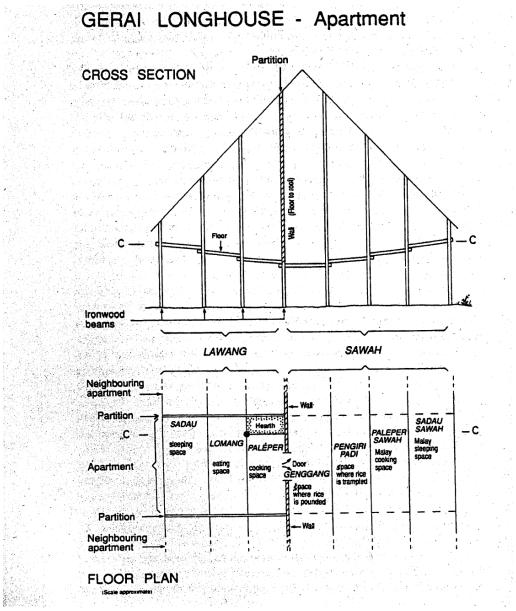


Figure 1: Gerai Longhouse (Helliwell 1996).

The home is a space where social relations are processually negotiated, rather than a straightforwardly private space. It requires people to spatialise their belongings to tell stories about who they are in relation to others. Assembling items in the home (and throwing items away) becomes "the active management of one's externalised memory", since objects form relationships with pasts (Miller 2001:8). Organising those objects manifests particular futures, excluding some pasts from memory and therefore from continued presence in the world of the dweller. The home becomes a space through

which the relationship between one's imagined self and one's social place is constantly mediated (Clarke 2001). The interior space of the house is therefore often imagined as public even if no one visits it, troubling a public-private dichotomy.

Ethnographic studies stress the agency of the house, and the difficulty occupants have in negotiating its material influences, whether due to traces of previous inhabitants or the physical infrastructure of the home. Inhabitants

> develop a negotiated compromise between that which is expressed by the house and that which we seek to express through the medium of the house. As such, the house comes to occupy us as we come to occupy it…and what we may not be able to fully possess comes to some degree to possess us. (Miller 2001:11)

Due to these insights, I foreground the materiality of the (smart) home throughout this thesis: particularly because in Singapore the home is an explicit site of state sociocultural management and future-making.

As a result, I used home visits as a key ethnographic method for understanding how residents dwelled with smart technologies. I went on home visits with smart home developers to see how they interacted with residents and technologies. I also conducted participant-observation and interviews with residents in their homes. To maintain resident anonymity and due to an NDA with one of the smart home projects, I took limited photos. To supplement, I use Alecia Neo's (2009) photographic series, *Home Visits*, to illustrate life in the HDB. She photographs Queenstown, an HDB estate with very similar demographics to the ones I worked in:

> Queenstown is one of Singapore's oldest housing estates developed by the government's public housing authority and has a reputation as the first satellite town in Singapore. It has one of the highest proportions of the elderly, aged 65 and above. Many of the residents live in small two-room and three-room flats, like the ones you see in the images. Some have lived in this area all their lives, building a tight-knit social group within the estate, while others are foreigners in the country, such as domestic helpers and students renting rooms in the area, making this place home temporarily. Presently, eight years down the road [2018], the area is undergoing massive redevelopment.



Figure 2: Tenants. Home Visits, Alecia Neo. 2010.

Like mine, Neo's (2009) work emerges from "interactions with each person in their homes", interested in the "relationships each person forms with their spaces and possessions, which they chose to reveal or conceal in my presence." Residents told stories about their lives through the objects in their homes. Neo (2009) concludes that while "the nation is often conveniently dismissed as monotonous and operating with clinical dentistry", recalling Boey's poem *The Planners* cited in my epigraph, "the presence of these tenderly ordinary individuals appear enchanting." She foregrounds residents and their uniqueness-in-ordinariness.



Figure 3: Sidewalk Easement, Ang Song Nian. 2010.

I also draw from Ang Song Nian's (2010) "Sidewalk Easement", a "photographic record of the improvised living spaces of Singaporeans in HDB flats," to show how dwelling transforms state-planned urban space. Ang (2010) focuses on how residents' clutter is "gradually integrated into the urban environment" over years. He captures the continued negotiation between unique, individual "quotidian messiness" and both state-planned and resident "controlled organisation" of flats and objects (Wong 2013). Ang uses a sense of residents' just-being-absent to let eclectic material belongings tell stories of collective and individual HDB life, as public and private spaces spill into each other. Both photographers, through an intimate focus on the daily lives and material practices of residents in tandem with their domestic built environment, disrupt state imaginaries of HDB standardisation (as I discuss further in Chapter 6). All other photographs are my own, unless cited otherwise. I turn now to a description of my field sites, selected based upon these methodological considerations.

4 Field Site Locations

Due to the methodological choices detailed above, I conducted participant-observation, semi-structured interviews, and city walkalongs in the spaces of three overlapping groups in Singapore: four HDB (public

housing) estates fitted with smart home technologies; the labs of two smart home projects, one international and one local, where developers worked; and the workspaces of urban planners in state planning agencies. These spaces were linked in a networked field site, as I went on smart home visits in the HDB estates with developers and did city walks with state planners into HDB estates, as well as spending time in their workspaces. I also attended many Smart Nation events and exhibitions, as well as analysing media, policy documents, plans, and other grey literature on the Smart Nation.

I lived in three flats in different neighbourhoods on three fieldwork trips, each spanning three to six months. Living in a rental HDB with roommates gave me additional insight into dwelling in the Smart Nation. I joined a National League football team and a futsal team, living a "normal" life: making friends, going to coffeeshops, eating dinner in hawker centres, and staying up to watch European football matches with teammates. I deeply owe my teammates for their ample explanations of their interactions with the smart city (and their laughter as I tried to keep up with Singlish phrases). Specific insights are included only with their permission, but they inform much of my analysis of everyday life in the Smart Nation. I am grateful for their support through a demanding three years.

4.1 HDB ESTATES

I conducted research in four HDB estates where state-university partnerships deployed smart home technologies, repeatedly visiting 95 resident flats across 20 out of the approximately 40 blocks of flats in each estate (of around 3,000 flats)[5]. I chose test sites for Smart Nation initiatives, including the deployment of smart home technologies, that were also neighbourhoods where Singaporean residents have lived for years. Like all HDB towns, the ones I studied had high-rise housing, a community and/or Senior Activity centre (SAC), a hawker centre (food court), and "3Gen" courtyards where children play and adults (both working and retired) exercise and socialise. The state's goal is to expand the

[5] These numbers are approximations to prevent site identification.

technologies tested in these HDBs to the whole city. To protect my interlocutors' anonymity, I do not disclose which estates, but I share representative photos to illustrate daily life in HDB estates.[6] I detail the layout and design of HDB estates in Chapter 4 but share some illustrative maps and photos below.



Figure 4: Map of HDB Estates around Queenstown. https://services2.hdb.gov.sg/web/fi10/emap.html.

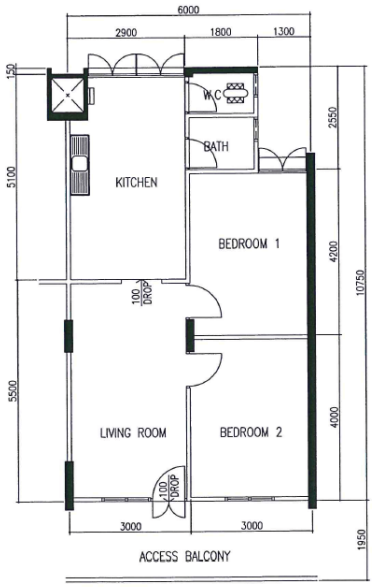


Figure 5: HDB 3-Room 60 sqm Floor Plan Found in all 1960s and 1970s HDB Estates, Teoalida. https://www.teoalida.com/singapore/hdbmap/

[6] For maps of HDB estates coloured by year built, see https://www.teoalida.com/singapore/hdbmap/



Figure 6: "3Gen" Courtyard, HDB Estate.



Figure 7: HDB Estate. HDB 2018.



Figure 8: Outside an HDB Estate.

Though HDBs are supposed to be homogenous due to state restrictions like racial quotas, HDBs vary by resident age and socio-economic status. As these HDBs were inhabited by older residents, they tended to be on the lower-income side of Singapore's population.[7] I interviewed most of the residents of smart home enabled flats. Some interviews lasted fifteen minutes, some over an hour, depending on resident preference.

Following material culture studies (Daniels 2010; Miller 2009, 2008), I conducted interviews in residents' flats to see how residents dwelled with and interacted with smart technologies. This usually involved hanging out with the resident in their flat and doing various domestic activities with them: especially elderly residents, who wanted help with household and administrative tasks. I visited some residents more than once. I asked residents to show me the sensors in the flat and discuss their feelings on the technologies and the project, observing and asking about how they covered some sensors in sensitive places like the toilet while leaving others alone, for example.

[7] In short, because Singapore developed its technology and financial sectors rapidly over a short time period of about 50 years, becoming one of the highest GDP nations in the world, older residents are less likely to have spent their labouring years in a high-income position than younger residents.

Each smart home had contact sensors on the door frame to detect entry and exit, motion sensors in each room, a gateway (either a raspberry pi connected to resident Wi-Fi or a Wi-Fi stick), an emergency button on a lanyard, and sometimes a medication box with sensors attached to detect medication schedule compliance. I include photos below to show the layout of the smart home sensors in the flats, both planned and actual, and detail the projects further in Chapter 6 and 7.

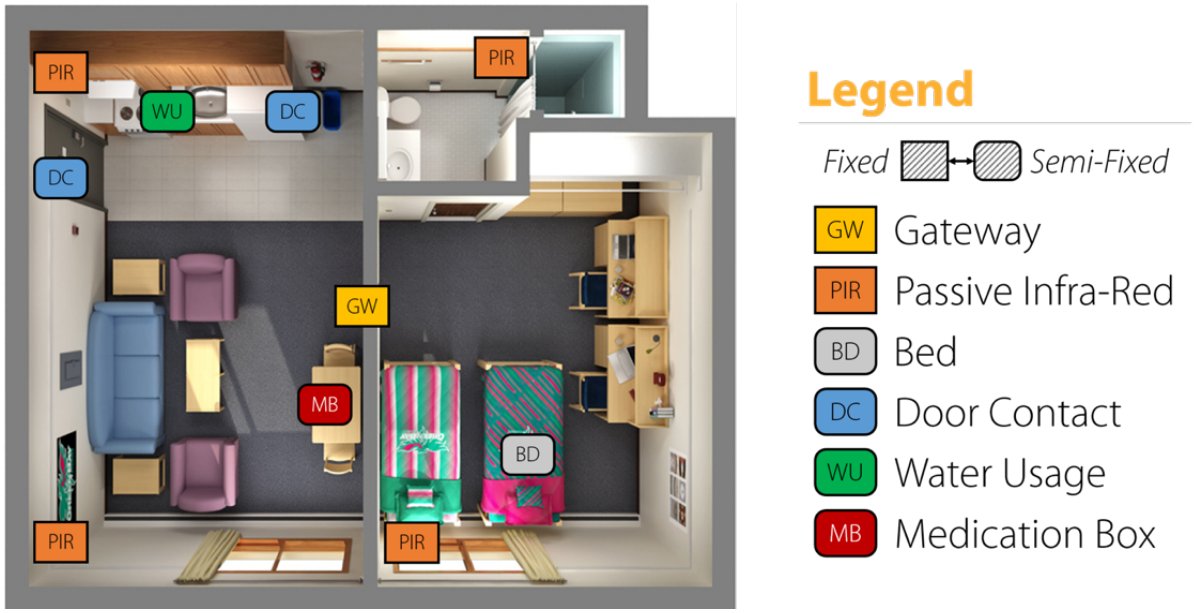


Figure 9: Bird's Eye View of Sensor Layout in HDB Flats, iHome Lab.

In interviews, I asked about the place of these smart technologies in the home but also experiences with Smart Nation initiatives and general experiences of place and change in Singapore. I conducted semi-structured interviews that allowed my research directions to be guided by resident experience, rather than assuming smart technologies held an elevated place in their lives. They showed me other digital technologies and non-technological objects of meaning in the home as well. I observed how the sensors found a place among other domestic objects and digital technologies. This method helped me understand how residents interpreted and contextualised the Smart Nation as part of their ever-evolving technological everyday, since rapid technological and infrastructural change had been so

central to their experience growing up in Singapore even before the current Smart Nation project was launched.



Figure 10: Motion Sensor above the Couch.

I also conducted participant-observation in flats and engaged in "deep hanging out" in the SAC and hawker centre, going to resident activities and meetings (Rosaldo 1993). Developers took me with them on home visits, where I watched them interact with residents, fix smart home technologies, and perform other everyday caretaking tasks in the home that might be less expected of a developer (filling pillboxes, scheduling GP appointments, calling children, fixing televisions).



Figure 11: Emergency Button Leaning on Coffee Pot next to Family Photos.



Figure 12: Looking at Photos of the Past with Smart Home Resident.



Figure 13: Gateway with Wi-Fi Stick, in HDB Flat.

I also spent time in the HDB community centres, talking to residents, playing card games, helping prepare food, and singing karaoke (admittedly not well). I went to monthly 'makan days', where the developers cook a huge meal for elderly residents in the SAC. I also attended consultation sessions with residents, where developers presented on the next phase of sensor implementation and answered resident questions. I also visited the hospital site with developers, where another smart home transitioned patients back to home life.



Figure 14: Resident Walking in HDB Common Corridor.

4.2 Smart Home Labs: ICON and iHome

During the day, I also worked in the smart home labs. I participated in design sessions, team meetings, investor pitches, and other events. I ate lunch with the team, talking about their work and joking about smart toilets. I presented on participatory design and qualitative research methods to help them better understand how to design for residents. I interviewed them about their experiences and interactions with both state planning agencies and residents.

ICON: European University—Singapore State Agency

The first smart home lab I worked in was hosted at A*STAR, in Singapore's research megacentre OneNorth. The developers were mostly European, as the project was a partnership between a French university and the Singapore state. I include pictures of the smart home model they use to design and test the sensors and sensor networks they deploy in HDB flats (Figure 15—Figure 21).



Figure 15: Cables at the Dining Table.



Figure 16: Raspberry Pi for Sensor Data Transmission.



Figure 17: Kitchen equipped with Sensors (Contact on Refrigerator and in Drawers, and Motion to Detect Falls).



Figure 18: Living Room with Camera-Based Health Monitoring Programmes.



Figure 19: Motion-Activated Lighting System.

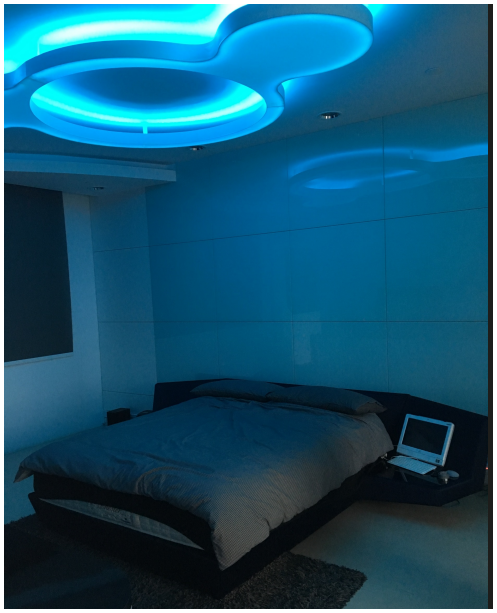

Figure 20: Bedroom with Smart Lighting and Mattress Sensors (sleep quality detection).



Figure 21: Sensors in Toilet.

iHome: Singapore University—Multinational Corporate Funder—Singapore State Agency

The second smart home project connected local developers working in a university context to a multinational corporation. Developers were expected to monetise and export the smart home model to other contexts. The sensor technologies were almost identical to those in ICON and the app design was also similar. The developers at iHome were mostly Singaporean and worked in their lab and with the smart home residents in their homes, not using a model smart home.



Figure 22: 'Elderly Monitoring System.' HDB 2018.



Figure 23: Smart Home Sensors, iHome Lab.

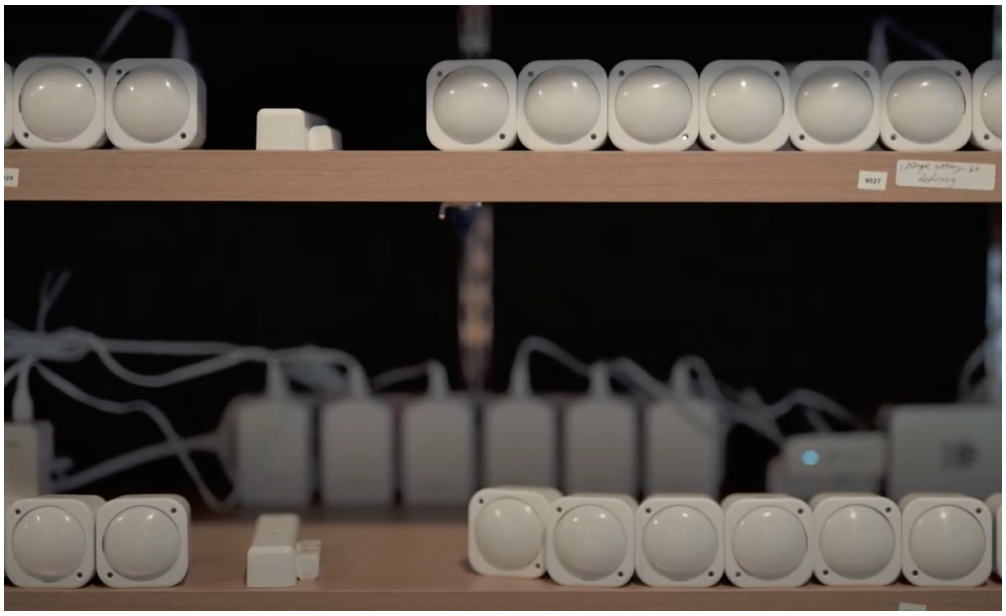


Figure 24: Door Contact and Motion Sensors (Passive Infra-Red Sensors), iHome Lab.

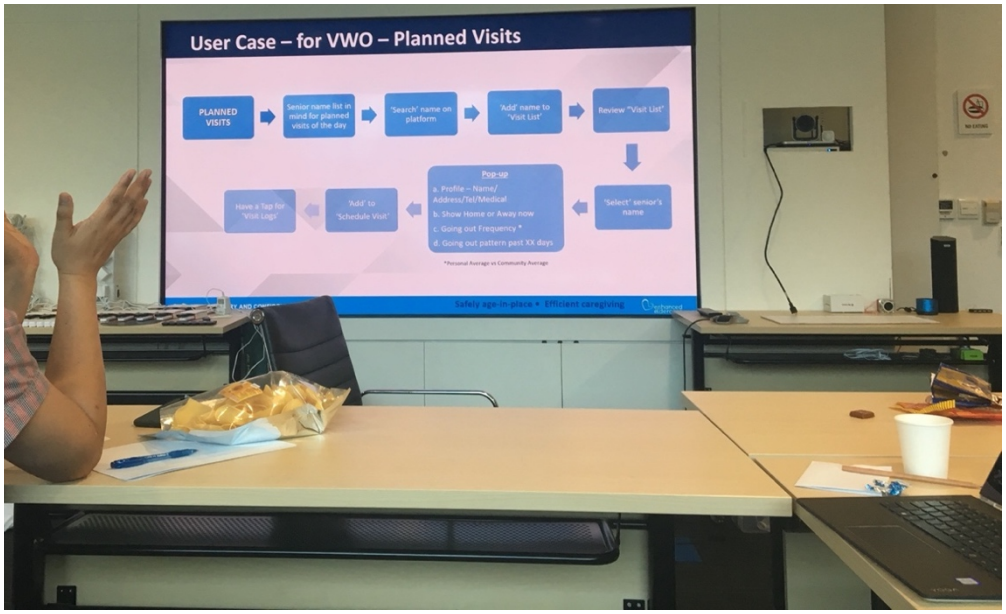


Figure 25: User Design Meeting, iHome Lab.

The formal project description states:

> We are developing and deploying an integrated sensing and sense-making platform for the elderly [Figure 27]. It is composed of a sensor-enabled home (1) with fixed and mobile sensors which monitor the environment (air quality, noise levels, temperature, humidity, etc.) and the older person (nonmovement, fall detection, physical activities, medication adherence, mobility patterns, etc.) in a non-intrusive manner. This enables a connected smart home that senses and communicates real-time data to a home care platform (2) that allows remote and continuous monitoring of the elderly's medical condition and behaviour patterns, and also performs 'sense-

making' to detect anomalies (e.g. falls) or unusual patterns (e.g. waking up every hour to go to the toilet). Based on the living patterns of the older person, a personalised care plan and an escalation protocol (3) are developed so that appropriate intervention can be done at different thresholds. We are leveraging on the strengths of the Internet- of-Things (IoT) (4) and applying them in the home environment to support older people as they age actively in place.

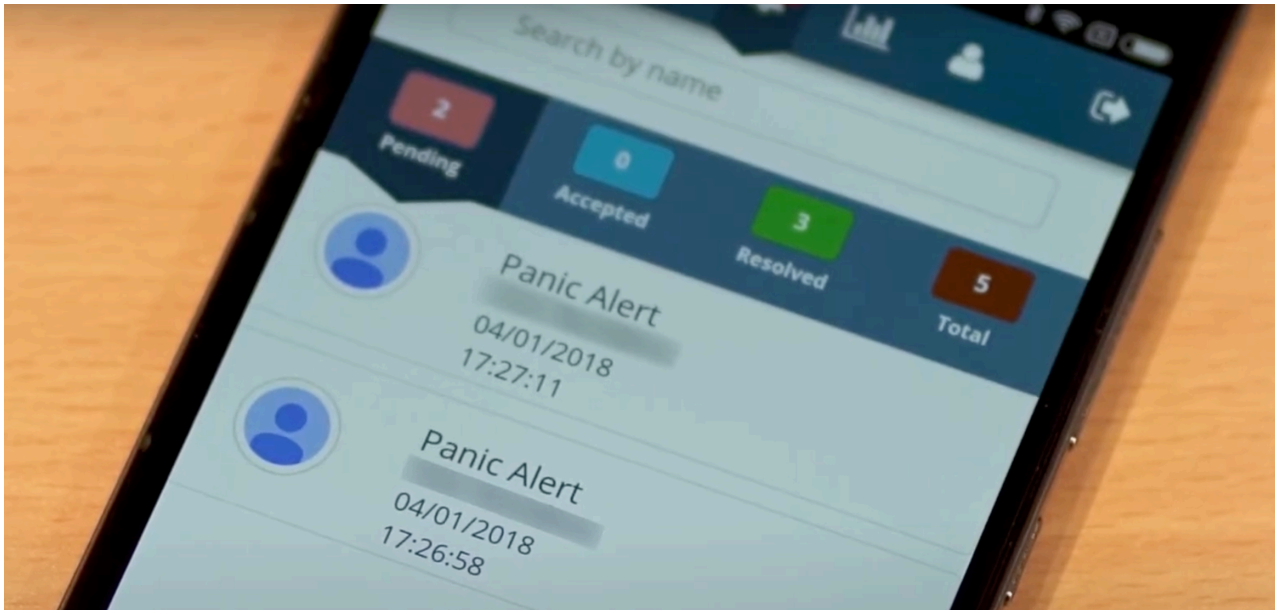


Figure 26: Alert System on Smartphone.

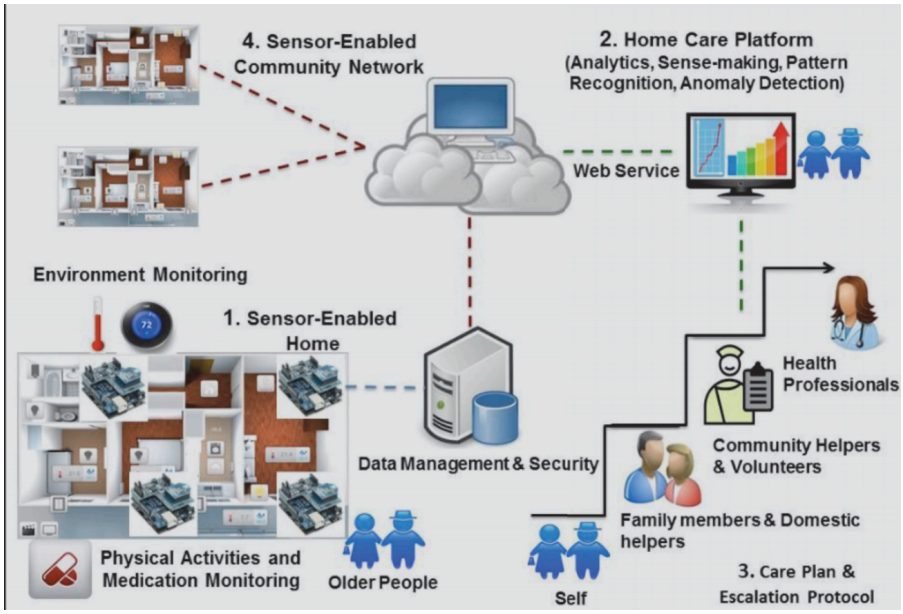


Figure 27: Design for Sensor-Enabled Care, iHome Lab.

I was also given access to sensor and survey data. Four surveys were conducted with each resident over the course of two years, on resident health and well-being, feelings toward the smart home technology, and family connections.

To illustrate the sensors and their placement in the average home, I took photos of the hospital site: a liminal space between a long hospitalisation and a return to the HDB, equipped with identical sensor technologies to the smart homes (Figure 28—Figure 35).



Figure 28: Rehab and Telehealth System (including camera).

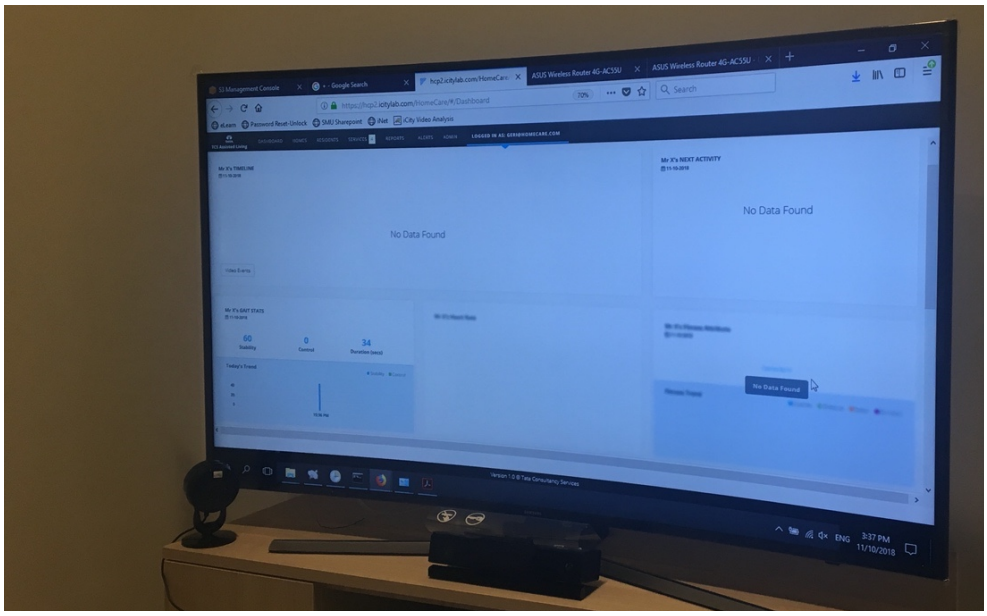


Figure 29: Sensor Data Dashboard (unpopulated).


Figure 30: Contact Sensor on Front Door (for tracking when resident leaves the house).

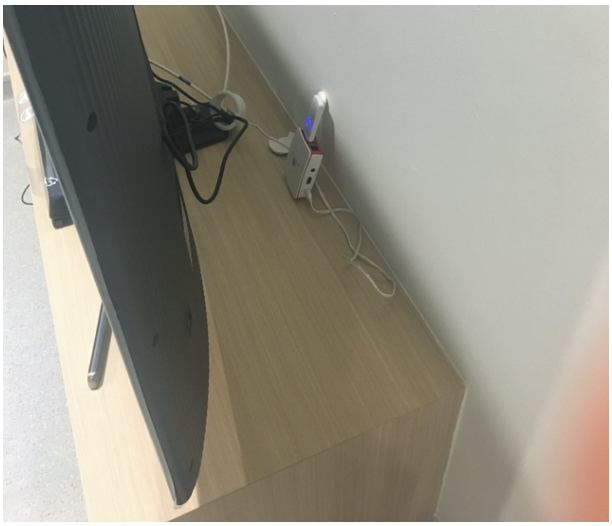


Figure 31: Wi-Fi USB Stick attached to Raspberry Pi (for transmitting sensor data back to lab).



Figure 32: Safety Necklace with Emergency Button (meant to be worn around neck). Can you spot the Motion sensor?



Figure 33: Motion Sensors above Bed.



Figure 34: Contact Sensor on Bathroom Door.



Figure 35: Motion Sensor in Bathroom.

4.3 State Planning Agency Offices and Walkalongs

I also conducted research with state planners to understand how they projected the Smart Nation and where smart home projects fit in the Smart Nation narrative. I conducted interviews with planners at the Urban Redevelopment Authority (URA), the Land Transportation Authority (LTA), Gov Tech, and the Housing Development Board (HDB), both in planning offices and other city spaces (hawker centres, cafes, malls, and even passport agencies). I detail Singapore state agency structure (Figure 36) in Chapter 5. I also interviewed urban planners working in state-university partnerships and visited their workspaces (e.g. ETH Zurich's Future Cities Lab, SMART MIT; Centre for Innovative Cities).

I asked planners to take me on city walks, particularly in areas they designed. I went to their roadshows, consultation sessions, participatory design events with residents, and open days in their planning offices. I describe the planners' offices in Chapter 5 and these participatory design events in Chapter 7.

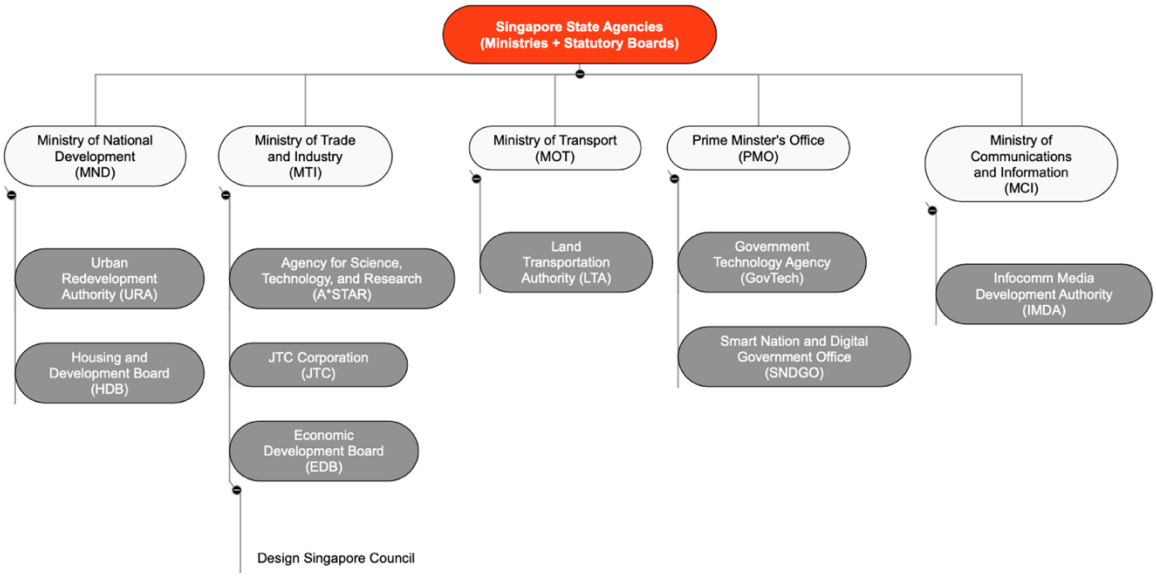


Figure 36: Relevant Singapore State Agencies.

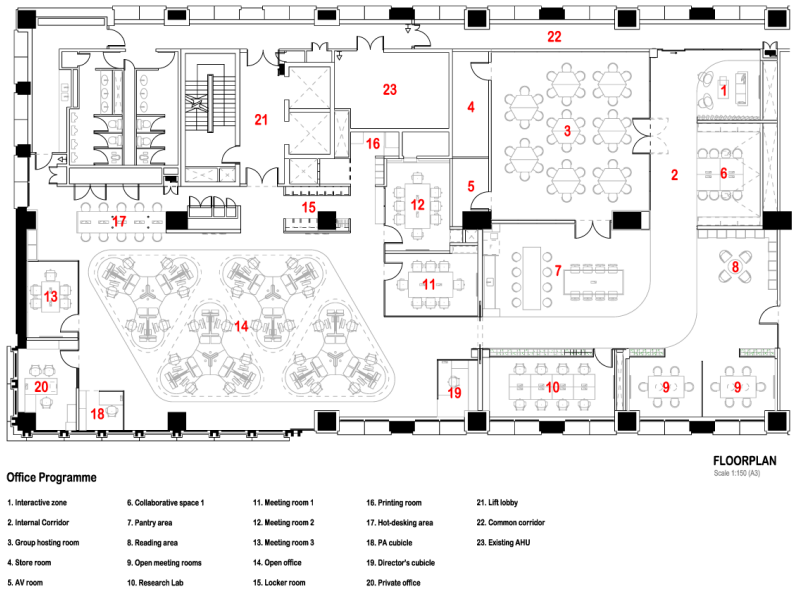


Figure 37: Office Layout, URA Digital Planning Lab Offices. https://talearchitects.com.sg/portfolio/ura-digital-planning-lab.



Figure 38: Meeting Room, Digital Planning Lab, URA. https://talearchitects.com.sg/portfolio/ura-digital-planning-lab.



Figure 39: Open Plan Workspace, Digital Planning Lab, URA. https://talearchitects.com.sg/portfolio/ura-digital-planning-lab.

I interviewed planners in their offices and also had them walk me around the public-facing exhibition spaces on the lower floors of each agency. I spent time observing the international visitors and local school groups that toured the agency exhibitions, specifically in the URA's Singapore City Gallery and HDB Hub, where residents also waited to apply for public housing. HDB Hub narrates the history of the HDB in a series of exhibitions and giant film screens, telling the stories of "representative"

families' journey to get an HDB flat. The URA's Singapore City Gallery tells the history and future of state urban planning in Singapore. One of my state planner interlocutors termed these spaces "museums for the future."



Figure 40: Building Model of Singapore at the Urban Redevelopment Authority (URA), 2018.



Figure 41: Models of HDB Estates, HDB Hub, 2018.



Figure 42: Families Narrating HDB Application Process, HDB Hub, 2018.



Figure 43: "Witness the transformation of dreams to reality in our HDB Towns," HDB Hub Video display, 2018.



Figure 44: "Futurescape" Interactive Exhibition, HDB Hub, 2018.

4.4 SMART NATION EVENTS

I conducted participant-observation at as many public-facing Smart Nation events as possible. For example, I went to Fusionopolis, home of Agency for Science and Technology (A*STAR)'s research, which contains a public-facing smart home model and displays the latest smart technologies under development by the state. I compare this public-facing model with the model ICON used to design the HDB smart home system in Chapter 6. I attended Archifest, a week-long design festival where planners shared their practices with the public. I attended National University of Singapore (NUS) urban planning students' showcases, particularly those involving design for the "Silver Generation" (Singapore's elderly residents). I visited every public exhibition on the Smart Nation I could find, which were ample, given that almost every state agency and public building (like libraries, and of course museums, but even employment agencies) in Singapore has an exhibition space showcasing what the state imagines for Singapore's future. I attended classes and lectures on the smart city at NUS, Singapore Management University (SMU), Yale-NUS, and Singapore University of Technology and Design (SUTD).

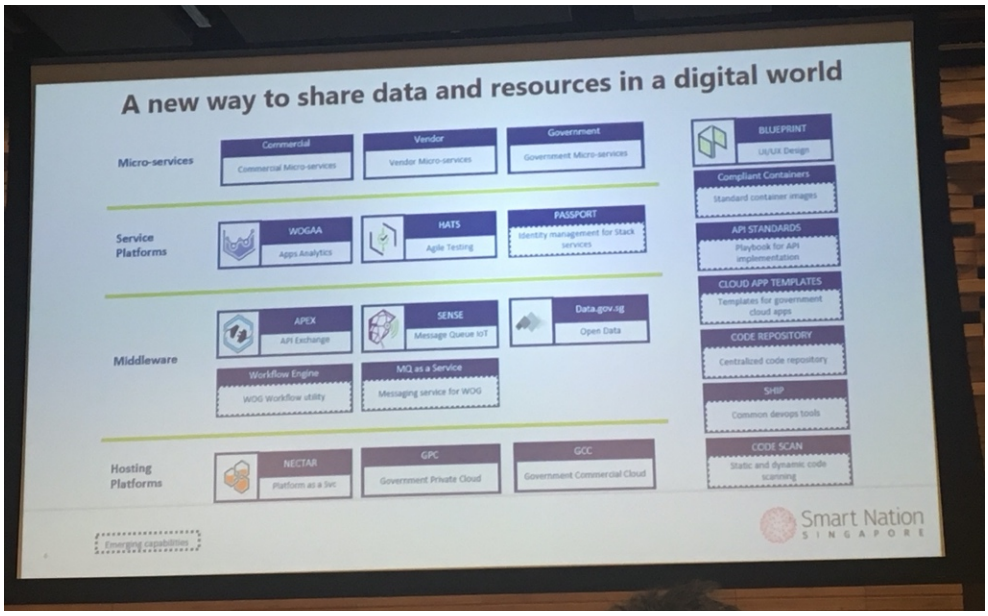


Figure 45: Smart Nation and Digital Government Office (SNDGO) Presentation on Sharing Data, 2018.

4.5 Grey Literature and Digital Materials

Policy documents, speeches, planning materials and maps, and other state-produced grey literature show the "inscription and reproduction of dominant sociotechnical imaginaries" in practice (Jasanoff 2015:26). These documents "frame desirable futures" and "monsters that policy seeks to keep at bay," using "specific verbal tropes and analogies that help identify elements of the imaginary" (ibid). In Chapter 4, I analyse housing policy and planning documents to identify these key elements, which I refer to as material-symbolic resources.

A focus on these materials alone, however, risks reifying the smart city visions that corporations and states want to promote, leading to an overly general critique that misses the smart city's emergent material effects (Shelton, Zook, and Wiig 2015). For this reason, I performed research online and offline, in archives and in person, to understand how plans and policies were continuously replicated and reimagined in smart urban infrastructure and through smart city planning technologies like GIS maps.

4.6 Other Media

Popular media showcases states' use of symbolic resources and global projection of national sociotechnical imaginaries, making it an important methodological lens. Crazy Rich Asians, a movie about the glamorous lives of Chinese-Singaporeans, came out during my fieldwork. While many Asian-Americans saw the film's all-Asian cast as progressive, in Singapore it had different semiotic meaning. As Nadia, who is Malay-Singaporean, put it:

> Right now everyone is talking about Crazy Rich Asians. Because it shows the gap between Chinese-Singaporeans and everyone else. In that movie the only Malay and Indian people are servants. Also the interesting thing about that movie is that the Singapore government put millions and millions of dollars into making it. So it's a marketing movie as well.

An Indian friend visiting from the University of Oxford could not find an HDB to rent due to this discrimination. Racial quotas in HDBs themselves work to keep Malay- and Indian-Singaporean communities apart as minorities distributed across HDB space. In the HDBs I worked in, residents were skilled at circumventing the racial quotas mandated by the state, particularly through exclusionary rent practices, making it even harder for Malay and Indian residents to access housing. This is just one example of the importance of attending to "silly objects" like romantic comedies when trying to theorise citizenship and its exclusions (Berlant 1997).

5 Positionality and Storytelling Practice

As Kobayashi (2005:36) argues in *Anti-Racist Feminism in Geography*, positionality is "more than simply the space that one occupies: it implies a recognition that such occupation is active, engaged, and contested." Since the researcher is also the research instrument in ethnographic research methods, ethnography is restricted and informed by researcher positionality (Harding 1992; Kondo 2002; Rosaldo 1993). It is therefore vital to explain how the ethnographer's position mediated access to spaces and willingness of interlocutors to speak to her, as well as the kinds of information interlocutors chose to

disclose (Luttrell 2000; Behar and Gordon 1995; Behar 1997). Researcher positionality also shapes research questions and choices in research design (Tuhiwai Smith 2012). Following Narayan (2012:671):

> instead of the paradigm emphasizing a dichotomy between outsider/insider or observer/observed…we might more profitably view each anthropologist in terms of shifting identifications amid a field of interpenetrating communities and power relations.

Ongoing reflexivity about intersectional researcher positionality is therefore necessary throughout the research process (Kobayashi 1994). Perfect reflexivity is unachievable since researcher positionings are not static or transparent, even (and perhaps especially) to the researcher (Rose 1993).

While ethnographers often write from a position of authority, a critical feminist approach foregrounds the researcher's uncertain interpretive authority (Rose 1993). Though perfect transparency is unattainable, we must strive to "uncover the mechanisms of truth claims we produce", not positioning our work as objective or value-free (Dyck 1993:244). This work, like all ethnographic works, is a partial truth told by a particular embodied subject from a situated position which produces situated knowledge (Rosaldo 1993; Haraway 1988; Clifford and Marcus 1986). I now articulate my personal and professional positionality, the ethical positions I took while conducting fieldwork, and my storytelling choices. I attempt to answer Said's (1989:212) questions: "Who speaks? For what and to whom?"

As a queer Palestinian scholar, I came to this project inspired by the Palestinian concept of *sumud* (existence as resistance), attuned to quotidian practices of resistance and refusal (Simpson 2007). I was guided by Black and Arab feminist political theory criticising excessive focus on grand moments of rupture (Campt 2017; Tawil-Souri and Aouragh 2014), particularly in highly surveilled contexts (Browne 2015). I followed the Singapore queer community's concept of "pragmatic resistance" in which they "often do not deploy strategies and tactics familiar to activists in liberal democracies, especially street demonstrations" (Chua 2014:5; Yue and Zubillaga-Pow 2012).

Singapore's socio-economic realities made it continuously challenging to trace relations of power between myself and my interlocutors. Its per capita GDP is higher than the United States (my birthplace and accent), and its social safety nets more extensive. I was still, however, white-passing and visibly non-Singaporean in a largely non-white, postcolonial country. I am a citizen of Singapore's former colonial occupier, the United Kingdom. Being a UK citizen in a Commonwealth country provided privileges like ease of visa access. As a Yale graduate and current Oxford University student, I was given access to professional spaces like state agencies due to Yale and Oxford's material-symbolic resources.

Singapore has a high Gini coefficient, indicating a large gulf between highest- and lowest-income citizens. My planner interlocutors were white-collar workers of relatively high socioeconomic status. Developers spanned a range. Some were university students (from Singapore and abroad, about 50:50) and some were working professionals (of a higher socioeconomic status). I felt most like the PhD students in economic status. My colleagues at the smart home labs termed me a "visiting researcher", somewhere between a PhD student and a salaried researcher. I suspect that my access was streamlined because having a visiting researcher from Oxford boosted project status: at a conference, the director announced that our smart home project had researchers "from all over the world, including the University of Oxford" to the 100+ person room of local and international academic, government, and private sector attendees. As aforementioned, my residential interlocutors, because they were mostly elderly, had less economic resources than younger Singaporeans I hung out with. My mostly Malay and Indian football teammates were less well-off than the mostly white and Chinese-Singaporean friends I had through university contacts.

Singapore's heterogenous ethnic makeup and high percentage of non-citizen residents (37%) makes articulating my ethnic positionality complex and foregrounded the importance of analysing diversity and migration's sociocultural specificity. As a diasporic, mixed-race person who grew up in

cities, I was drawn to anthropological questions prompted by the state advertising racial harmony as an urban technology central to its status as a standardised living lab (Lee 2014; Chua 2011; Ong 2016) and the "best" smart city (Wiig, personal correspondence from IBM Smart Cities Director interview). Despite these claims, racial hierarchies prominently existed. Chinese-Singaporeans (those educated in English, not Mandarin, schools) had better access to high-paying jobs and government positions. Malay-Singaporeans had less access and experienced Islamophobic discrimination. Rampant "NO INDIAN" signs on advertisements for flats exemplified the discrimination Indian-Singaporeans faced accessing housing.

As a Muslim, I tended to make more Malay friends, though my state contacts were mostly Chinese-Singaporean. Non-Singaporean white-collar tech workers, who constitute much of the immigrant/"expat" population, often spoke openly with me and aired grievances indicating perceived solidarity. Singaporean interlocutors in my residential field sites assumed my foreignness, which was often helpful as they explained things in more detail. They may, however, have shared different information if I shared their ethnic background.

Because I often did home visits with Singaporean developers, residents would tell us information and ask the developer to give me context. This was a helpful way of gauging how much they thought I could understand but was mediated by the background of the developer vis-a-vis the resident (for example, an Indian-Singaporean colleague had trouble entering some Chinese-Singaporean homes). Gender also created effects. Female developers felt uncomfortable with some male residents when doing home visits alone, and I experienced similar discomfort. I discuss this in Chapter 6.

Conducting fieldwork in Singapore also troubled my notion of preparedness for anthropological research, as the linguistic landscape was similarly complex and mediated. Singapore has four official languages: English, Mandarin, Malay, and Tamil. Mandarin is an uncommon mother tongue, but the state attempted to create a Chinese lingua franca by making it an official language. Most Chinese-

Singaporeans natively speak a non-Mandarin, non-mutually intelligible Chinese dialect, like Hokkien or Teochew. As a result, every developer needed a translator to communicate sometimes, since developers and residents each spoke one of Malay, Tamil, and a Chinese dialect.

I occupied a similar linguistic position, since most Singaporeans speak English plus one "mother tongue," but felt uncomfortable since using a translator is discouraged in anthropological training. I used this feeling to drive methodological questions on anthropology's imagining of the Other in a bounded field site (as homogenous, and as a group that can be adequately understood with enough language training and immersion) and theoretical questions on linguistic difference's influence on experiences of smart citizenship and imaginaries of nationhood. Practically speaking, most elderly residents spoke English, as did 90% of the population. I also learned Singlish, a combination of English and Singaporean slang drawn from other mother tongues, which helped me capture nuances.

My queerness also mediated my access and affected the questions that drive this thesis. As Berlant (1997) argues, the nation is normatively heterosexual, which permeates what she terms the "intimate public sphere" and regulates fantasies of citizenship and nationhood. This normativity is arguably more prominent in Singapore than the United States, where Berlant researched, as I detail in Chapter 4 (Oswin 2018). I had many deep, personal conversations with queer friends in Singapore which heavily influenced and nuanced my ideas about housing access, imagining the future, and citizenship in the Smart Nation, as well as infrastructurally-embedded exclusion. Most of these stories I cannot share, but they inflect my analysis.

Even as I write this section in as much detail as I can, I join colleagues in challenging the idea that we can situate ourselves appropriately if we just spill enough ink, or be a legitimate anthropological researcher if we just learn enough information, or pass enough time in the field (Todd 2018; Valentine and Hassoun 2019). The space between "my culture" and "another culture" is never clear, whether at

"home" or abroad (Narayan 2012). So I also repeatedly asked myself, following Tuhiwai Smith (1999:10), who finds these often unasked questions more important than other situating practices: Is my spirit clear? Do I have a good heart? Can I actually do anything?

My position as an academic previously employed in the technology sector made my relationship to interlocutors blurry at times. I wanted to make my research useful but resisted recruitment to interlocutors' projects. Working in technology and policy gave me perspective on challenges people outside of academia face, including the difficulties of making technology and policy that actually works to improve people's lives. This perspective informs my commitment to make this research useful as well as contribute theoretically to my field, and to not offer critique without also imagining other possibilities.

During previous projects, I learned how to code to understand the processes through which qualitative human experience becomes data and create technology based upon ethnographic research. I therefore had the technical skills to understand much of the developers' work, though I consider myself an anthropologist by training and a technologist by improvisation. This work gave me first-hand experience of how algorithms, interfaces and infrastructures manage and inform what users can express, prepared me for this tracing work, and spurred an ongoing interest in participatory design. It informed my research questions on how smart city design materialises imagined futures at the expense of others. It also informed my theorisation that digital technologies have sociomaterial effects on everyday practices of imagining futures, motivating my choice of ethnographic research methods.

Throughout both fieldwork and writing, I acknowledged when I felt like an imposter or out of my depth, thinking critically about why. Sometimes I felt I should not be conducting fieldwork in Singapore because I could not speak Teochew, or like I did not have enough technical expertise to write on sensor technologies. These insecurities were instructive as discomfort usually signals that methodological and theoretical questions need asking (e.g. on what I was missing because I didn't

understand a resident, or on why technical cultures of expertise have such a strong hold on the imagination): I endeavoured to not ignore them. Situating oneself is never finished, nor is attending to questions of power and privilege. I therefore continued to reflect throughout my fieldwork and writing.

To tell the ethnographic stories I narrate throughout this thesis, I use composite accounts of actual fieldwork events and interviews to preserve my interlocutors' anonymity, difficult in a small island nation. I interweave these with Singapore artists' photography, poetry, and prose on urban planning and the material-symbolic significance of neighbourhoods and home. In doing so, I try to describe the technological everyday of a diverse and differentiated range of Smart Nation residents, telling their geographic counter-stories in their own words and framings.

The thoughts, words and actions expressed and performed by composite interlocutors throughout the thesis are quoted and described directly from interviews and participant-observation with them. I did not invent any utterances, reflections or actions attributed to individuals cited or described, only combined and separated them into different composites to make re-identifying my participants almost impossible. Since national sociotechnical imaginaries are based upon continuously re-enacted stories told by the state, I hope these stories offer a sense of counter-cartography, of future imaginaries co-produced by residents in their own spaces and through their daily practices of materialising smart citizenship.

6 LIMITATIONS

Ethnography as a method privileges depth over breadth. It can produce deep, nuanced understandings and allow categories of analysis to emerge from interlocutors' ontologies. A lone ethnographer, however, cannot engage with large numbers of people or give "representative" sample sizes. As discussed, she filters the research through her embodied experience, providing a subjective analysis.

I chose my methods for reasons discussed in this chapter, despite ethnography's limitations. Scholars have used other methods to study similar topics. Oswin (2019) analyses global city futures in Singapore through archival research, challenging heteronormative city planning policies by connecting current policy to a state-created notion of "family" originating in colonial Singapore. I draw extensively on such researchers' deep analyses of Singapore's urban planning and other policy documents, as well as Singaporean scholars' critical insights into HDB life and the effects of discriminatory housing and family planning policies. These expand my analysis beyond my ethnographic engagement.

One of anthropology's biggest methodological questions is how to move from the particular to the universal. I have tried, in this thesis, to show how the unique experiences of my interlocutors in my unique field site can tell us something about imagining smart city futures as a whole and generate a theory of smart citizenship that can inform research in other smart city contexts. My and others' ethnographic studies illuminate contradictions, frictions, and nuances in big-picture social theories that can lead to totalising, homogenising frames of analysis (Bear et al. 2016; Leszczynski 2020; Barns 2020).

7 Ethics

7.1 Disclosure of Positionality

Since I conducted research with people possessing different affiliations and goals living and working in the same neighbourhood, I had to explicitly articulate independence from any party. I clearly expressed to developers and planners that mine was independent academic research, not in service of their aims. I did, however, selectively give advice on designing better technology for residents and share observations. This led to meaningful discussions that informed my analysis and, I hope, produced better outcomes for residents. I detail our interactions further in Chapter 6.

While I spent time in planner and developer workspaces and attended activities with them in the community, my role was not translating their instructions to residents (following Forsythe's (2001)

caution that social scientists are often pushed to serve technology projects as translators or ethical tick-boxes). I made my independent researcher status clear to people with whom I lived and interviewed. I carefully articulated the purpose of my research and disseminated project description and ethics forms. I also verbally described the research and its aims, emphasising that I was not evaluating compliance with the smart home project. I continually articulated these commitments to interlocutors rather than just stating them at the beginning, particularly if it seemed they had forgotten. This could have limited the information shared with me.

This led to an interesting dynamic whereby residents often complained to me about the project when the developers were not around. I carefully discussed their concerns with them while reminding them of my position. With their permission, I incorporated their thoughts into recommendations for the developers. As I detail in Chapter 6, developers were largely aware of the project's limitations, as they were part of residents' daily lives and knowledgeable about resident technology uses. I nonetheless carefully crafted my feedback to not advance projects of surveillance or discipline.

I want my work to improve my interlocutors' lives and, following anthropological and critical feminist theory, do not believe there was a neutral, removed, or objective place from which I could have observed. I therefore used my judgment and training in ethical research methods to go beyond "doing no harm" and actively apply my research for positive effect. This approach, though fraught, addresses the often-extractive nature of anthropological fieldwork: where a researcher goes into "the field", obtains local knowledge, and returns to further their academic career without giving anything in return.

7.2 Recruitment

My recruitment techniques involved asking people in-person whether they would speak with me further in an interview. I also emailed "experts" in Singapore's civic technology sector (identified via Internet research) to ask for interviews. To interview residents, I first confirmed with the HDB's community

support worker and the smart home team, who had their own ethical consent procedure which I was also responsible for upholding, that the person was not classified as vulnerable. I then set up interviews with residents in-person.

I asked people if they wanted to participate only once, without verbal pressure. I made it clear that participation was completely voluntary, there were many other potential participants, and it was perfectly fine not to. Most of the residents, who were part of the smart home project because they lived alone, were keen to speak with me – usually to tell stories spanning far more subjects than the smart city.

I gave participants no time limit to reply to interview requests and asked them to take at least 24 hours to consider whether to take part. I gave additional time before the interview to ensure they were fully aware of what participation entailed and had time to decide against participating. I explained that they could withdraw at any time and remove any contributions from the study. I ensured that a community support worker was on-site and informed if I was conducting an interview in a resident's flat.

7.3 Informed Consent

I obtained informed consent and anonymised research participants through pseudonyms, removing identifying information, and using composite accounts. Any identifying contribution from participants was included only with explicit permission by the participant. All necessary measures specified by University's CUREC regulations and association guidance[8] were taken to avoid risks occurring.

I gave interviewees information sheets and consent forms, containing written explanation of the study, my supervisor's and my contact information, to read at minimum 24 hours before interviews. I informed them that they could decline to answer and/or remove their answers to any question. I gave

[8] Association of Social Anthropologists of the UK and Commonwealth; Association of American Geographers Statement on Professional Ethics; Royal Geographical Society: Research Ethics and Code of Practice.

them the information sheet again in person. I verbally explained the study, their role, and how they could leave the study at any time or remove specific answers with no negative repercussions. I waived written consent in favour of oral consent because since I assigned all participants pseudonyms, the written consent form would be the only document linking them with participation in the study. Oral consent therefore lowered the risk of participant exposure. I ensured that participants understood any potential risks, how to withdraw before, during, or after the interview, and that they would not receive financial compensation. I did not probe for personal or sensitive information during interviews.

Prior to fieldwork, I completed CITI training (03/2016). I passed Oxford's online course in Research Integrity: Social and Behavioural Sciences (13/01/2018). I am trained in human subjects research ethics at undergraduate, Masters, and DPhil level.

7.4 Anonymisation and Data Storage

I handled participant information confidentially, immediately assigning participants a pseudonym. Real names were not written in field notes nor used in this thesis. These pseudonymns were the only personal identifier attached to their data. Upholding anthropological standards, I changed descriptive information to the extent that the participant should not be able to identify themselves. I did so while maintaining their intended contributions by creating composites of participants and disaggregating them into multiple people. This is a key reason for my methodological choice to tell composite stories in the form of "technological everydays," to preserve anonymity in a small country.

I deleted audio recordings once I transcribed them (always within 1-7 days of the interview) and stripped identifiable information from the transcription. I emailed from a secure university email and deleted emails after receipt, keeping participant email addresses in an encrypted, password-protected folder. I encrypted and password-protected interview data, audio and field note files. I did not transfer research data over the Internet. They remained in encrypted and password-protected files on a local

machine locked away when not in use. I stored written field notes in a locked cabinet accessible to only me. I will keep non-identifiable data stored for 5-10 years.

8 Data Analysis

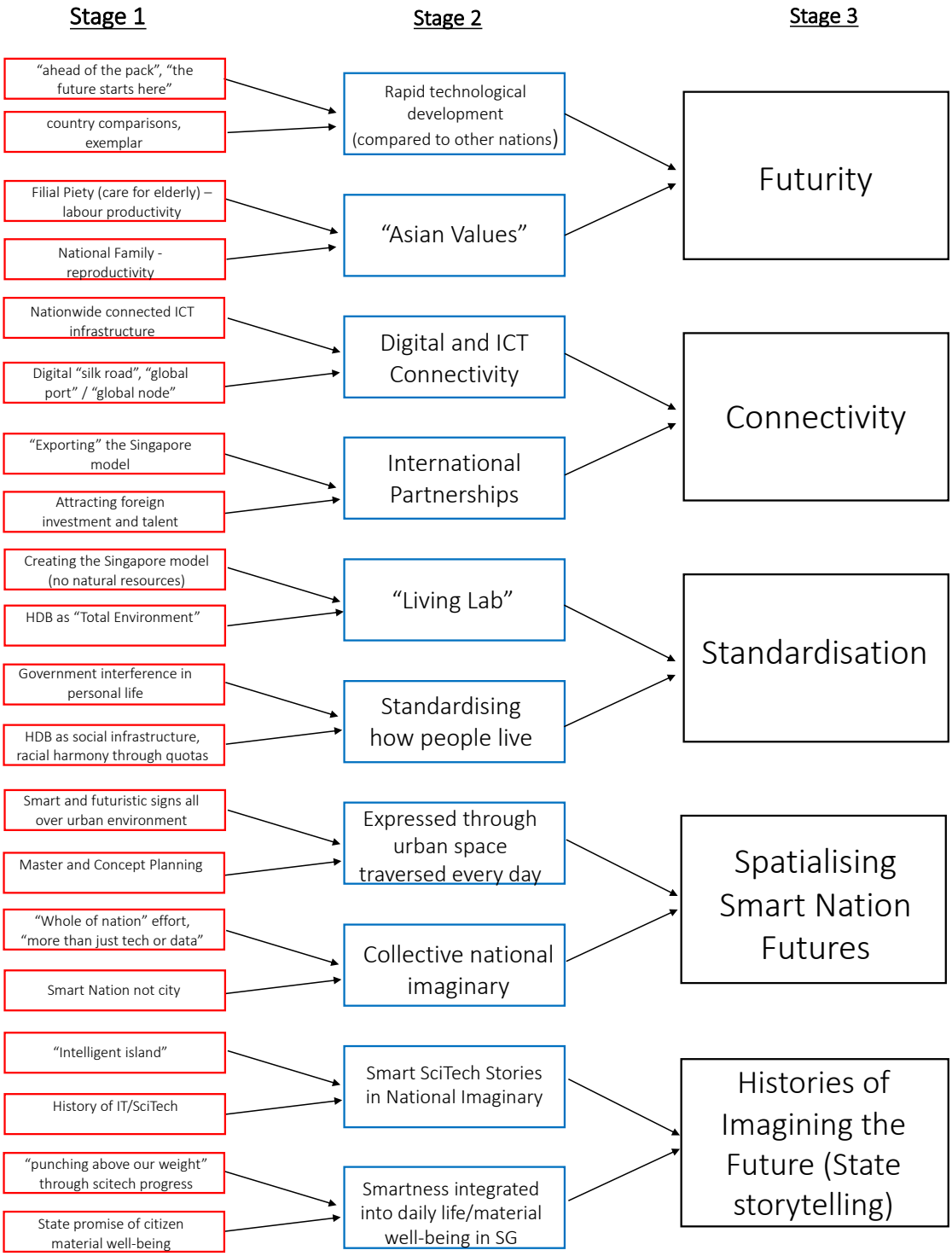
To analyse my data, I coded my interviews and field notes and performed content analysis of state planning archival material, grey literature and digital Smart Nation materials like the YouTube channel and state agency websites. I researched the history of policies and state agencies, read related scholarship, and used these to draw connections between the different data I gathered during fieldwork and build theoretical insights. I used an inductive coding method, beginning with observation and building to theory (Saldaña 2016; Emerson, Fretz, and Shaw 2011).

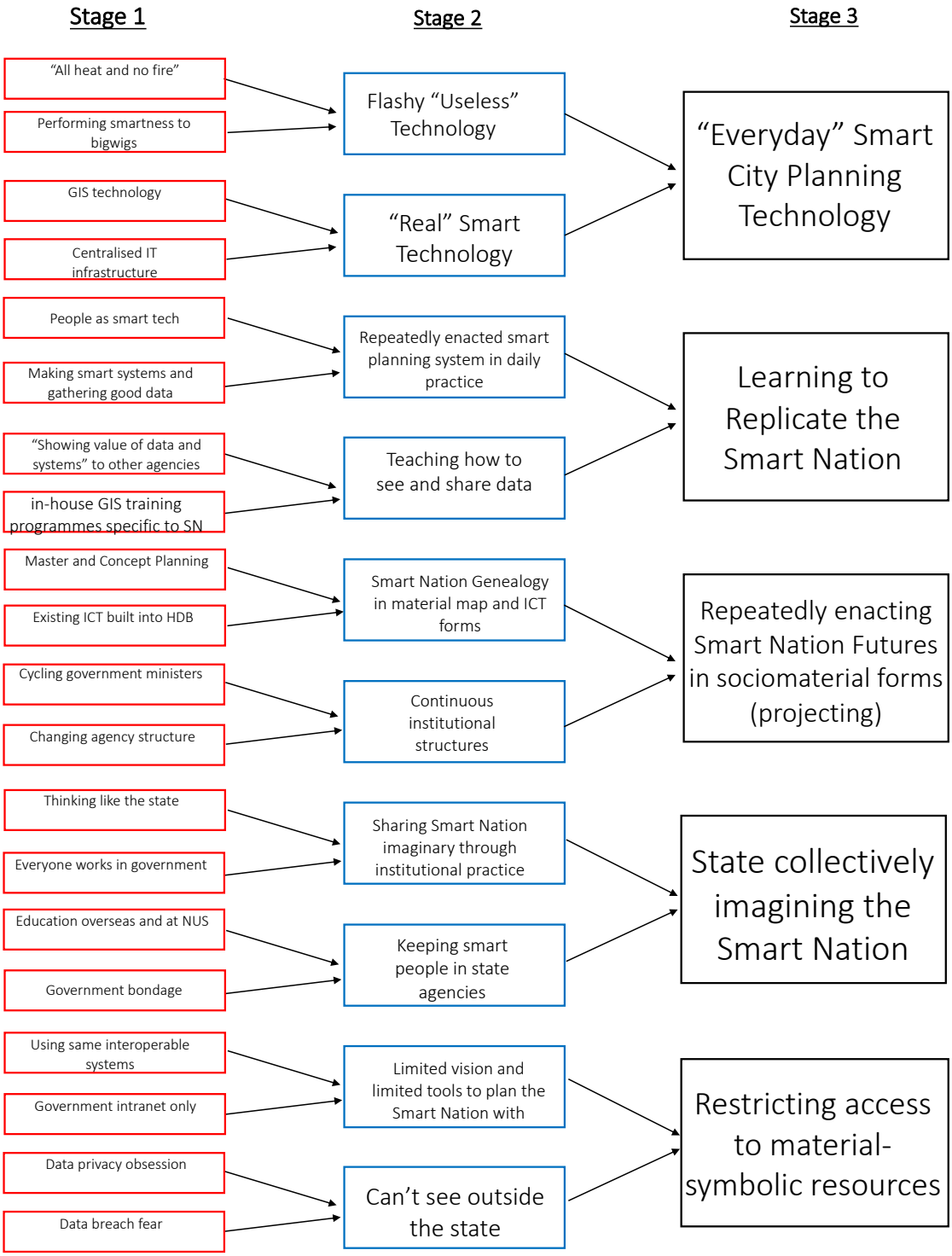
I performed multiple coding passes on interview transcriptions and field notes. I assigned descriptive, process, and pattern codes, using invivo and non-invivo codes. I used a GDPR-compliant, open source qualitative data analysis software, Open Ethnographer (that I co-designed). I first used open coding (Stage 1), heuristically assigning codes to key phrases based upon initial observations. I then performed several selective coding passes, categorising and improving Stage 1 codes and recoding some material with new codes (Stage 2).

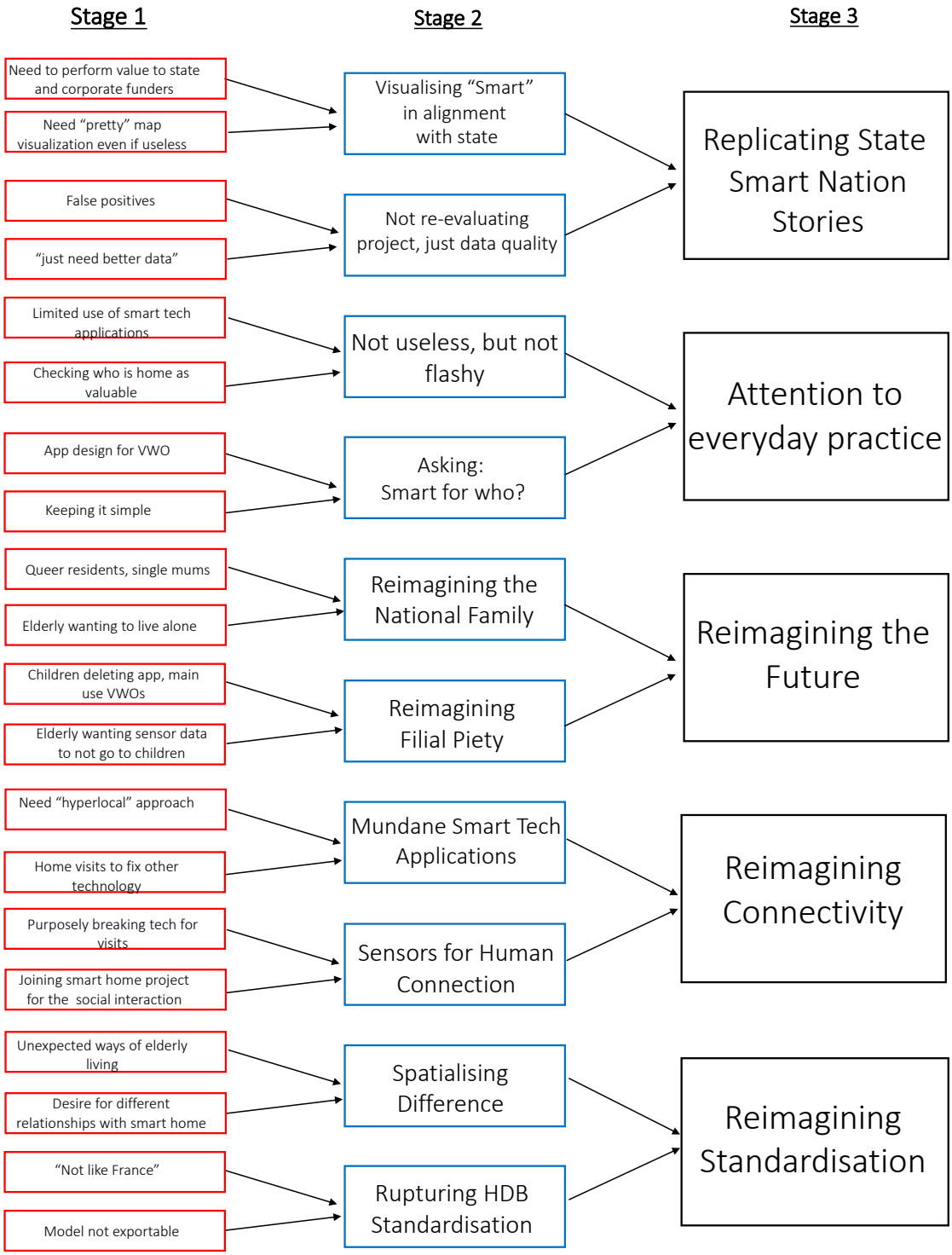
I then performed several theoretical coding passes (Stage 3), identifying themes across interviews and in-person interactions and relating them to archival work. To do so, I used the codes and my coding memos to reread interviews and field notes and understand what themes persisted across time and space. I asked: What concepts and topics emerge over my entire dataset? Are conceptual similarities mostly within groups or are there commonalities between them? Which discoveries are expected, and which surprise me? Which repeated words and concepts seem to carry shared semiotic meaning, and how? Coding helped refine this process, as did re-reading my dataset over time, frequent notetaking, and analytical writing.

I attach a simplified version of my coding schema below. For clarity, I display the codes by selectively separating ethnographic materials and sites. In my actual practice I let Stage 1 codes freely overlap across the interlinked sites and interlocutors, as they overlapped in reality, to generate Stage 2 and Stage 3 codes. The sociotechnical imaginaries of standardisation, connectivity, and futurity, and the everyday practices of projection, replication, and reimagining, emerged from analysing Stage 1 and 2 codes together in a recursive, rather than linear, approach.

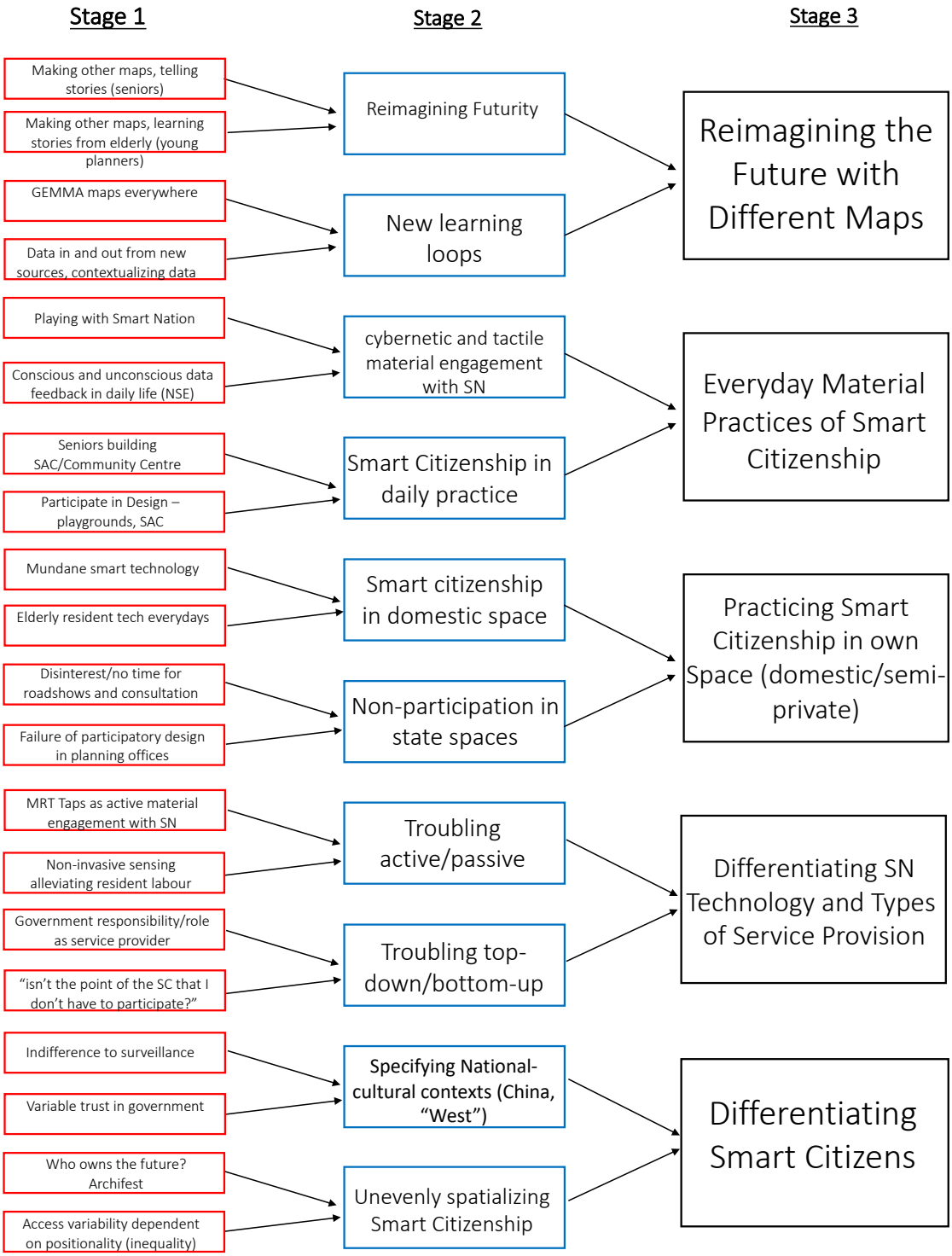
The structure of my empirical chapters emerges from this analysis, also separated by ethnographic materials and sites for the sake of clarity and readability. I first chart the history of Smart Nation future imaginaries in Chapter 4, drawing largely from archival, grey literature, and digital Smart Nation materials produced by state planning agencies. Chapter 4 analyses the longer history of the Smart Nation's constitutive sociotechnical imaginaries, detailing how state agencies have historically projected those imaginaries in and through smart urban infrastructure. Chapter 5 explores current state agency planning practices, explaining how planners learn to replicate the sociotechnical imaginaries of standardisation, connectivity, and futurity detailed in Chapter 4. Chapter 6 shows how the imaginaries planners replicate in Chapter 5 are reimagined by smart home developers and residents. Chapter 7 then details the implications of this projection (Chapter 4), replication (Chapter 5), and reimagining (Chapter 6) for existing theories of smart citizenship, explaining how people change the smart city over time through everyday embodied practice. My conclusion (Chapter 8) uses the findings from empirical chapters 4-7 to redefine citizenship and participation in the smart city, ameliorating key flaws in critical smart cities literature and suggesting avenues for future research.


Stage 1
Stage 2
Stage 3
"ahead of the pack", "the future starts here"
country comparisons, exemplar
Rapid technological development (compared to other nations)
Futurity
Filial Piety (care for elderly) – labour productivity
National Family - reproductivity
"Asian Values"
Nationwide connected ICT infrastructure
Digital "silk road", "global port" / "global node"
Digital and ICT Connectivity
Connectivity
"Exporting" the Singapore model
Attracting foreign investment and talent
International Partnerships
Creating the Singapore model (no natural resources)
HDB as "Total Environment"
"Living Lab"
Standardisation
Government interference in personal life
HDB as social infrastructure, racial harmony through quotas
Standardising how people live
Smart and futuristic signs all over urban environment
Master and Concept Planning
Expressed through urban space traversed every day
Spatialising Smart Nation Futures
"Whole of nation" effort, "more than just tech or data"
Smart Nation not city
Collective national imaginary
"Intelligent island"
History of IT/SciTech
Smart SciTech Stories in National Imaginary
Histories of Imagining the Future (State storytelling)
"punching above our weight" through scitech progress
State promise of citizen material well-being
Smartness integrated into daily life/material well-being in SG


Stage 1
Stage 2
Stage 3
"All heat and no fire"
Performing smartness to bigwigs
GIS technology
Centralised IT infrastructure
People as smart tech
Making smart systems and gathering good data
"Showing value of data and systems" to other agencies
in-house GIS training programmes specific to SN
Master and Concept Planning
Existing ICT built into HDB
Cycling government ministers
Changing agency structure
Thinking like the state
Everyone works in government
Education overseas and at NUS
Government bondage
Using same interoperable systems
Government intranet only
Data privacy obsession
Data breach fear
Flashy "Useless" Technology
"Real" Smart Technology
Repeatedly enacted smart planning system in daily practice
Teaching how to see and share data
Smart Nation Genealogy in material map and ICT forms
Continuous institutional structures
Sharing Smart Nation imaginary through institutional practice
Keeping smart people in state agencies
Limited vision and limited tools to plan the Smart Nation with
Can't see outside the state
"Everyday" Smart City Planning Technology
Learning to Replicate the Smart Nation
Repeatedly enacting Smart Nation Futures in sociomaterial forms (projecting)
State collectively imagining the Smart Nation
Restricting access to material-symbolic resources


Stage 1
Stage 2
Stage 3
Need to perform value to state and corporate funders
Need "pretty" map visualization even if useless
Visualising "Smart" in alignment with state
False positives
"just need better data"
Not re-evaluating project, just data quality
Replicating State Smart Nation Stories
Limited use of smart tech applications
Checking who is home as valuable
Not useless, but not flashy
App design for VWO
Keeping it simple
Asking: Smart for who?
Attention to everyday practice
Queer residents, single mums
Elderly wanting to live alone
Reimagining the National Family
Children deleting app, main use VWOs
Elderly wanting sensor data to not go to children
Reimagining Filial Piety
Reimagining the Future
Need "hyperlocal" approach
Home visits to fix other technology
Mundane Smart Tech Applications
Purposely breaking tech for visits
Joining smart home project for the social interaction
Sensors for Human Connection
Reimagining Connectivity
Unexpected ways of elderly living
Desire for different relationships with smart home
Spatialising Difference
"Not like France"
Model not exportable
Rupturing HDB Standardisation
Reimagining Standardisation

Resident and Other Interface Spaces (e.g. Participate in Design) Field Notes and Interviews



9 Conclusion

In this chapter, I detailed my field methods, research methodologies, and field sites, explaining how I conducted my ethnography and why I chose to do so. I used Burrell's (2009) method of field site as network to trace daily interactions between state planners, smart home developers, and smart home residents in tandem with smart technologies. I studied how these technologies both materialised future imaginaries and were materialisations of them, continuously evolving through daily embodied engagements. I also employed critical feminist ethnography to study how people differentially practiced smart citizenship in quotidian smart city spaces. I theorised the body-city relationship as a two-way "interface" or "co-building" and focused on bodies' co-constitutive relationships with space (Grosz 1998). These shape resident understandings of self and nation through repeatedly enacted conscious and unconscious engagements with the digitally mediated city. I also ethnographically attended to how planners, developers and residents work through interfaces to materialise Smart Nation futures.

Turning to the methodologies underpinning these research methods, I argued that ethnography is suited to an exploration of how people imagine and enact futures in their everyday lives through material engagements with sociotechnical systems. I used a sociomaterial approach drawn from feminist STS to study the smart city as a sociotechnical imaginary, tracing how people project normative future visions through technological infrastructures. Material culture studies methodologies situating ethnographic research in domestic space informed my approach to studying smart technologies as co-productive of residents' technological everyday.

I then described how I applied these methodologies to select my field sites, my positionality, my study limitations, and my ethical frameworks. I explained my data analysis practice, detailing how these methods focused me on a narrower set of concepts which I elaborate in the rest of this thesis.

I turn to the first set of these concepts, pictured in the first panel of my coding ontology, in the next chapter (Chapter 4). I present a brief history of Smart Nation futures and the state storytelling practices generating them. I explain how the material-symbolic resources of standardisation, connectivity, and futurity underpinning the Smart Nation sociotechnical imaginary came to be repeatedly spatialised in the HDB and subsequently the smart home.

CHAPTER 4: PROJECTING SMART NATION HISTORIES

1 INTRODUCTION

In this chapter, I address my first research question:

> *RQ1: How does the state project its future imaginaries through the digital and urban space of the smart city?*

In this chapter, I argue that the smart city cannot solely be explained as a novel concept generated by profit-driven corporate imagination. It has historical roots in national storytelling practices which replicate social and technical future imaginaries through the material-symbolic forms of the city. I analyse *smart* nation and narration (Bhabha 1990): how state planning agencies package material-symbolic resources to make national sociotechnical imaginaries collectively held, instantiating stories about shared national futures through infrastructure. I give a history of Singapore's public housing (the "HDB") to show how state planners repeatedly project normative visions of the future through sociotechnical infrastructures like public housing, making some futures for some residents more accessible than others and mediating citizenship to the (smart) nation. I detail the history both of the specific material infrastructures that become the basis of the smart home (the HDB and the technologies embedded in it) and the specific normative imaginaries enacted through them, both social and technical. In doing so, I explain how the state projects the Smart Nation through both smart urban infrastructure and the symbolic narration of social and technological progress to produce affective and material identification with its imagined futures.

I argue that the intimate sphere, particularly in Singapore, is a site of nation-building (Berlant 1997), where the state expresses citizenship as the right to be "in place" and reproduce the nation as part of its future. The state materialises its citizenship imaginary, its idea of who "belongs" in Singapore, by literally making space for the populations and behaviours it sees as the "building block" and "future"

of the nation. Conversely, it excludes people from its citizenship imaginary literally and figuratively by *not* making space for them to enact their futures. Thus the state tries to dictate who gets to represent and reproduce the nation through housing access and citizenship rights, projecting its citizenship imaginary through the material spaces of the domestic sphere and the practices that take place in it.

I argue that the Singapore state enacts a metonymic process by projecting its stories, materialising a certain heterosexual nuclear family *as* the nation, and the smart home *as* the Smart Nation, which includes and excludes people from its imaginaries of smart citizenship through material-discursive planning practices. State planners use both stories about nationhood and data-gathering smart technologies to project these metonymic processes. They do so in part through "digital epidermalization" (Nakamura 2008; Browne 2010): extracting data from parts of bodies and their motilities (e.g. race, age, and marital status; sensor-detected movements; fingerprints; digital activities) and rendering them in information technologies to stand in for some larger "whole" self or population, tell a story about its future, and define citizenship to the Smart Nation. In this chapter, I show the historical continuity of these metonymic storytelling processes, tracing histories of the state's foundational Smart Nation sociotechnical imaginaries as they have been repeatedly projected through domestic space and the technologies embedded in it. Conceptualising smart urbanism as enacted through stories, made in social and material practice, I collapse theoretical distinction between discursive, affective, metaphorical practice and material, embodied, enacted practice.

I argue that the national story of the smart city (in Singapore, the Smart Nation), is inextricable from historically continuous national storytelling practices aimed at creating a shared imagined community (Bhabha 1990; Anderson 1983; Renan 1882). The state's Smart Nation project builds on pre-existing national sociotechnical imaginaries to project its futures more effectively. Kong and Yeoh (2003) refer to this practice as the Singapore state (as governance entity) constructing the Singapore nation (as

collective imaginary). I employ their distinction, as it maps onto the state's symbolic use of national sociotechnical imaginaries (Jasanoff and Kim 2009) to do the material work of bringing residents into a shared imagined future through technological infrastructural projects.

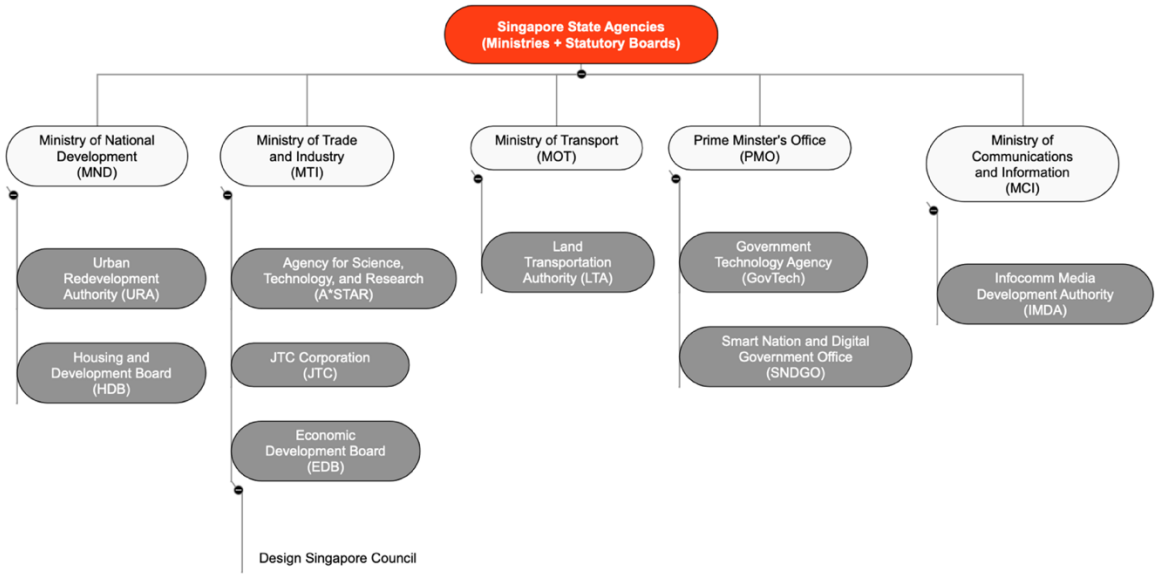


Figure 46: Singapore State Agency Structure.

Focusing on the Housing and Development Board (HDB), the Urban Redevelopment Authority (URA) and the Agency for Science, Technology and Research (A*STAR), I argue that state planners have replicated three key sociotechnical imaginaries throughout Singapore's history: Singapore as standardised, through racial harmony and uniform smart domestic urban infrastructure; futuristic, because of socioeconomically productive "Asian Values" and rapid technological progress; and a connected global node, in terms of international partnerships and ICT infrastructure. I break these imaginaries into social and technical components to illustrate how they are repeatedly projected and replicated through the material resource of the HDB, the basis of the material resource of the smart home, and through Smart Nation planning technologies like digital and analogue maps. These imaginaries and resources are in reality not perfectly divisible into social and technical, material and symbolic categories, but I categorise them to more clearly explain their effects: to show that the smart

city, rather than being a novel concept generated by a profit-driven corporate imagination, has roots in longer practices of national storytelling, replicating social and technical imaginaries, re-enacted through the material-technological forms of the smart home.

I first detail the relationship between home- and nation-building, articulating the socio-political specificities of Singapore's domestic infrastructure development. Second, I describe how the imaginary of HDB socio-spatial **standardisation** prefigures the imaginary of Singapore as standardised "living lab" where international developers can test smart home technologies. Third, I show how the state projects its imaginary of **futurity**, using the nuclear family as a metonym for the nation's future, through HDB infrastructure, materially and symbolically excluding many residents from Singapore's future. I explain how state agencies have narrativised Singapore's rapid technological infrastructural development to shape a collective identity around "survival" through "staying ahead", repeatedly projecting this "futuristic" national imaginary since independence. Finally, I argue that state planning agencies have expressed and replicated the imaginary of **connectivity**, through international partnerships with other nations and connective technological infrastructures like smart home projects. In short, projecting the "Singapore model" of smart living has long required state planning agencies to continuously narrate Singapore as a standardised, futuristic, and connected "smart city".

In this chapter, I intentionally draw from a wide range of data sources to show how the smart city is projected: my ethnographic work, official and public-facing state agency communications; archival state agency materials like photos, reports, and interviews; national museum exhibits; and housing blueprints (past, present, and future). In doing so I show how imagining smart city futures is a repeated, interlinked material-discursive practice, projected through plans and infrastructures over time. I also trace and argue for the longer history of biometric data—as data that measures people's bodily features and motilities, through digital or non-digital means (Browne 2015). In tracing this longer history and

explicitly focusing on the pre-digital state sociotechnical imaginaries that form the material-symbolic "building block" of the Smart Nation, I trouble existing literature that situates the smart city as an abstract, 21st century form of corporatisation built on entirely new methods of datafication. Instead, I show that national stories, projected in and through domestic infrastructure, have continuous material effects which bring certain futures into being while excluding others. These material-symbolic practices continually manifest specific instantiations of the smart city and must be analysed *in situ* to critically theorise it. I use two smart home partnership projects, historicised in this chapter, as ethnographic examples in subsequent chapters.

2 The HDB as Material Resource: Making Space for a Smart Nation

> *The last stronghold of the kampungs was in these HDB flats: Grandmother and Mother were custodians, keeping alive rural kindness and simplicity, two of many thousands strewn across our tiny, rapidly modernising country. The kampung did not die in soil; it dissipated, withered away into the sunlessness of modernity, the sharp grids of order mapped into the sky…*
>
> *Nee Soon was coming under the cranes of progress, and the Government had made intricate plans to rehouse everyone living in the kampungs there. Considering the area, I imagined the lives of a good number of people would be disrupted; there were a large number of people in my Grandmother's' household alone. My last couple of visits to her house were filled with voices of excitement as well as worry and profound sadness, all interacting in a hazy way. In the kampung where Grandmother lived with Little Uncle and a dozen more relatives, all under one roof, there were over twenty attap and zinc-roofed houses in one street alone. Who knew how many small families that must have meant collectively, each a tent peg for another, a whole web of undocumented history existing simply? Singapore is good to dream with, but not to remember with.*

- *Grandfather's Aquaria*, Gwee Li Sui. In *Balik Kampung* (2012).

Narrative devices like similes, metaphors, and metonyms exert material effects by spatialising imagined and imaginable futures. As Singapore's first Finance Minister Goh Keng Swee (2004:8), whose central role in shaping HDB infrastructure I describe in this chapter, argues: "As simile becomes process, part of discourse, it exerts dynamic force of its own…rather than an illustrative aid to explain policies, the simile-making mechanism becomes part of the recognised political direction of the country." Often the simile itself takes over the narrative and becomes the driving force behind state planning, he says: "simile-

making" is "closely associated with the narrative-making that has been Singapore's forte" (Goh 2004:9). In detailing the relationship of Singapore's storytelling to the future, Goh (2004:13) explains that state planners have created space for Singapore's future in both affective and material ways: "Space is marked by a transcendence, an attempt to go beyond the apparently determined boundaries of the given in order to remap by incorporating what is potentially possible." The Singapore state's future imaginaries, he concludes, have long been spatialised through its city and nation planning projects.

Since independence, Singapore state planning agencies have needed to convincingly project national sociotechnical imaginaries to both residents and other nations, as they had no natural resources to export and scarce land to develop. Both social and technological smartness have long been central narrative elements. As the former Singapore state planner authors of *Imagining Singapore* (Ban, Pakir, and Tong 2004:xii) ask, connecting imaginative and technological elements of the nation's progress narrative: "How can it be otherwise for a nation that was born of imagination, erected on dreams, and has created a network of internal, unseen information to reach beyond herself?" Evoking Bakhtinian dialogicity, the authors argue that state planners have needed to make "practical" material and "mental" imaginative discourses work in parallel, constantly re-signifying a lack of land resources and disparate cultural heritages into shared affective identifications with national "technology and a world culture" (Ban et al. 2004:xi).

In this section, I give a brief history of Singapore's state agency planning practices through the Housing and Development Board (HDB)[9], as it is foundational to the smart home projects I analyse in Chapters 6 and 7. I show how the HDB (the nickname for public housing units created by the HDB state agency) was a smart urban infrastructure through which state planners projected national

[9] For a more detailed history and explanation of the sociopolitical significance of the HDB, see Kong and Yeoh's the Politics of Landscapes in Singapore: Constructs of "Nation" (2003) and Chua's Political Legitimacy and Housing: Stakeholding in Singapore (1997).

sociotechnical imaginaries long before embedding smart technologies into it. In partnership with other state planning agencies, the Board created the HDB as a symbol of and material vehicle for standardisation (through reduction of ethnic and spatial difference); futurity (through rapid infrastructural development and enforcing "Asian Values" of productivity and reproductivity); and connectivity, (through projection of the HDB as an international model and through the universal embedding of a connective domestic ICT infrastructure).

Singapore state agencies' historically continuous replication of these national sociotechnical imaginaries, specifically through urban infrastructure, forms the material-symbolic foundations for the current Smart Nation imaginary. I take Jasanoff's (2015) concept of public performance and focus on the Butlerian (1990) dimension of "performativity" included in it. I explain how continuous re-enactment is necessary to the successful narrative performance of national sociotechnical imaginaries like the Smart Nation, simultaneously generating affective engagement from residents and also shaping their capacities for imagining futures by shaping their domestic environments. A performative method for projecting imagined futures has been especially central to Singapore's continued existence, since a "proper story-generating procedure" has always been "vital to the security of the small state" (Ban 2004:x). Singapore state agencies invent similes "from Garden City to Global City" which are "part of the inner narrative that forms the imaginative text of Singapore" and used in "mobilising and orienting the inner, imaginative direction of the new land" to literally "mark out space" for its future by "compelling them into the consciousness of daily living" (Ban et al. 2004:1). In later chapters, I show how these projected metaphors permeate the technological everyday of the Smart Nation, as state planners in the present replicate them through everyday planning practice and smart planning technologies, and residents replicate and reimagine them through their daily practices of living in smart HDBs.

State planners explicitly imagined building the HDB as both materially and symbolically building the Singapore nation, as articulated in Singapore's National Museum of Design. National museums are key locations where states make their sociotechnical imaginaries collectively held (Jasanoff 2015) and as such are informative to analyse.[10] Following independence in 1965, the state focused on building housing infrastructure and developing a "national identity through national symbols such as state emblems and architecture" (Figure 47).



Figure 47: 1965-1975, "Building a Nation", National Museum of Design, 2018.

An illustrated book-length report published in 1970 by the HDB, reviewing its first decade in public housing, gives insight into the HDB as a material-symbolic resource through which the state has long projected its future imaginaries. Its first paragraph clearly illustrates the sociotechnical imaginary:

> A stake in the future, in stability, prosperity. A vested interest in the maintenance of a well-ordered society. This is the philosophy behind Singapore's public housing programme and explains in part its success and the Republic's stability in the most turbulent corner of the globe. (HDB 1970:6)

[10] In Chapter 5, I describe the school groups visiting state agency gallery spaces and national museums to learn to imagine the future like the state.

The state agency immediately uses public housing to spatialise a particular future, ordering social relations through (smart) urban infrastructure. It does so by narrating a particular history of state planning agencies' central role in stabilising the small island nation through rapid technological development, despite the odds stacked against it, to bring into being an imagined successful future. Housing policy and infrastructure were literally built upon those from the late colonial period, as they were built by elites who would later form the ruling People's Action Party (PAP) following Singapore's independence from Britain (Oswin 2019). I discuss this continuity further below.

> When the PAP "swept to power" in 1959, this is what it purportedly faced:
>
> a quarter of the population lived on the city fringes in the most unimaginable squalor; another 250,000 crammed into crumbling shophouses…in such houses and hovels, criminal elements bred and thrived; Communism found new adherents. (HDB 1970:8)

The state agency report equates residents' material living conditions with negative social effects (criminality) and undesirable governance (Communism). It repeatedly ties the future of the city-as-nation to the physical infrastructure of the home and its residents' behaviours: squatter settlements "scar the face of the island" and continue the "deterioration of a city" (ibid). Reminiscent of Grosz' (1998:385) theory of city-body relationships as "interface" or "co-building", the Singapore city-state is imagined as a body with a face that can be scarred by the residents who repeatedly create it. The report reproaches that Singapore's 1.7 million residents, concentrated into 40 square miles of land, were mostly "transients" unconcerned with "proper housing", which it explicitly connects to their lack of concern over the "future of the city…even as they were making it" (HDB 1970:9).

The HDB report correspondingly imagines the home as the site of intervention in these undesired social, political, and infrastructural futures, transforming the physical landscape of the home to transform the social landscape of the nation: "a good home…gives the ordinary working man much impetus to keep his country stable and orderly" (ibid). This transformation of the home is prominently

pictured in a two-page spread of the report, under the header “URBAN RENEWAL IN ACTION” (Figure 48—Figure 49)



Figure 48: Living Room Before Relocation, First Decade in Public Housing 1960-69 (HDB 1970).



Figure 49: Living Room After Relocation, First Decade in Public Housing 1960-69 (HDB 1970).

Physical relocation of residents literally makes space for state futures borne by state urban planning. The need for "slum clearance" and "Urban Renewal" goes beyond "social betterment" to "ensure proper and speedy development of the country," to make space for "bold planning…to ensure that the country can progress and expand according to plan" (HDB 1970:59). As he envisions the next decade, the first Minister of Law and National Development (Barker 1970:6) imagines a totally new skyline, a "city made anew". This view of the city is reminiscent of Boey's poem *The Planners*, quoted in the epigraph, where the planners "knock off useless blocks with dental dexterity" to make history "new again." Zhang et al. (2015:236) note over forty years later that "The Singaporean rationality is to put everyone in their 'rightful place' according to carefully calibrated visions and plans." The continuous spatialisation of state-imagined futures is evident, as putting people in place describes and enacts both material and symbolic change.

During the timeframe of the HDB report, Land Acquisition Acts passed in 1966-7 enabled the state to control most of Singapore's urban space (Straits Times 1963). The acts, still in place today, allow the state to reclaim and repurpose land from residents and corporations (Wong et al. 1985). The nascent Singaporean state could claim so much land, according to first prime minister Lee Kwan Yew, because "people had no confidence in the future of Singapore" (Haila 2015:75). Continuing that precedent, the state has near absolute power to determine the land's use. In the 1970s, resettled residents from older HDBs, making way for further urban infrastructural change, were offered special rental conditions to afford to upgrade to new flats, though they had no say in whether or not they moved there (HDB 1970:69). This practice of relocation—of making space for the future—continues today, as residents must make space for state planners' smart urban infrastructures and the smart futures they materialise.



Figure 50: Leaving the Kampong, early 1960s. National Archives of Singapore. Those who rallied to stay were labelled "extremists" by the state (CLC 2019:60).

The state explicitly positions housing as giving residents a stake in Singapore's bright future, asking them to imagine themselves in this future through practices of dwelling. Rather than forcibly resettling residents immediately, HDB brought kampung (village) dwellers by the busload to tour the new HDBs, outfitted with amenities like plumbing and running water. On these tours, HDB narratively used these housing amenities as a material-symbolic resource, tying them to an increase in the nation's wealth which it had provided through urban infrastructural transformation (Chua 1997; Kwek 2019). A 2013 CLC report written with HDB terms this material metaphoricity "turning squatters into stakeholders" (Centre for Liveable Cities, Ministry of National Development, and Housing and Development Board 2013).

This signification process, aimed to produce an affective response of wonder and national pride, prefigures a language of material-symbolic trade-offs that pervades the Smart Nation today. The state agency made HDB flats enough of an increase in material quality of living to counterweigh social losses and provided residents a map to future improvements in material wealth: through reproduction (having more children) and waged labour. Thus public housing "became the chief instrument of social change"

in postcolonial Singapore to "mould the semi-autonomous residents into model citizens of the high modernist nation-state" (Koh 2009:140). This moulding of citizens through domestic space is illustrated in the report's measure of "housing success" as the "total failure" of Communism and communalism, as well as a decreased crime rate (HDB 1970:9).

As architect Weng Hin, who was a small child when Singapore gained its independence and grew up in HDB flats which evolved over the years, puts it:

> These flats…have become so much a part of the Singaporean environment that they seem to exist as an 'invisible' backdrop where daily life unfolds…HDB towns by virtue of housing 90% of Singaporeans have evolved to be our 'vernacular' landscape. It is inextricably a part of society and identity, embodying both strengths and weaknesses, for better or worst.

The way the Ministry of National Development (which contains both the HDB and URA agencies) begins one of its public-facing blog posts (2013) powerfully illustrates the state's material-symbolic use of the HDB to create collectively held national imaginaries:

> HDB living for Singaporeans is like apple pie for the Americans: it is a very Singaporean way of life...like NS [National Service] for the boys, HDB living should be part and parcel of growing up for all Singaporeans. It is the best way to experience from young multiracialism, religious tolerance, communal living, hawker centres, markets, etc which collectively characterise Singapore and the Singaporean kampong way of life.

State planning agencies have historically leveraged the HDB's material-symbolic significance as testament to their technological prowess to justify sweeping sociotechnical changes to Singapore's urban infrastructure, both before and as part of the Smart Nation project (Chua 1997; Kong and Yeoh 2003). Thus Singapore's smart city storytelling did not begin in 2014 with the announcement of the

Smart Nation plan. It is continuous with a long-term smart city sociotechnical imaginary, materialised and replicated through state plans.

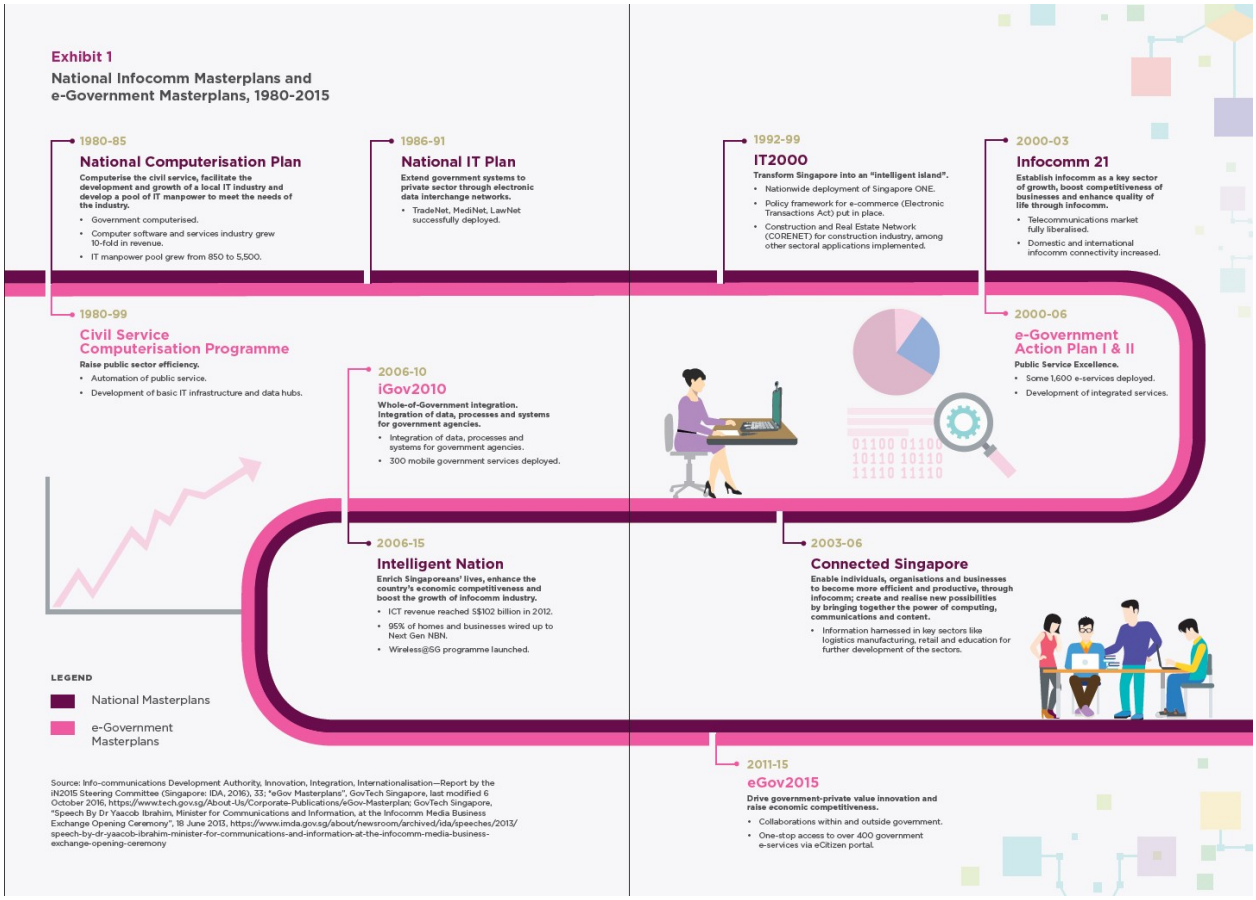


Figure 51: Infocomm Masterplan Genealogies. Infocomm Development Authority 2016.

The history of infocomm Masterplans (Figure 51) provides a further illustration of how sociotechnical imaginaries are projected and replicated through engagement with material plans and infrastructures over time. The National Computing Board (NCB) was founded in 1980, making Singapore "among the first countries in the world to establish a government agency to promote computerisation and IT industry development" (Tan and Zhou 2018:7). The imaginary of futurity is deployed here (Singapore as ahead of the pack), as development of the nation is historically linked to its computerisation effort, replicated through government agencies. The first National IT plan was made in 1986, a "bottom-up initiative involving various agencies coming together to articulate the…new version

of the plan," as Wong, who was at the NCB at the time, recalled. "The planning process was quite chaotic. It could be one person, with a personal idea, but it had to eventually embrace the whole group and then the whole country. The power of the plan comes from getting it accepted." His words echo the same modularity as many state planners I cite in this thesis: imagining a scalar expansion of the imaginary from single person, to group, to entire country.

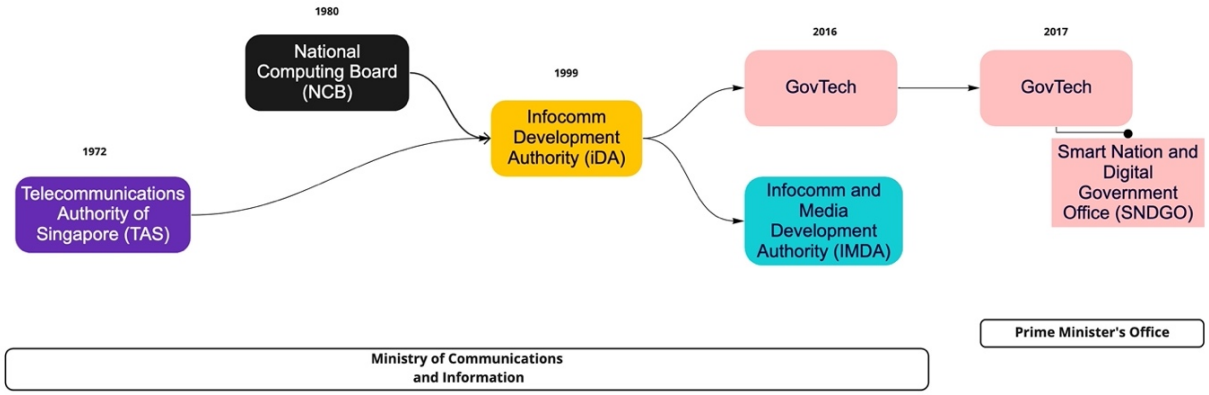


Figure 52: History of ICT-Related State Agency Restructuring.

In 1992, another 10-year National IT Masterplan was launched, planning to transform Singapore into an "Intelligent Island" over the following 15 years (Lim 2002) (Figure 53). The "Intelligent Island" was to be materialised in part via the creation of a nation-wide fibreoptic cable network connected to each HDB flat, in collaboration with HDB. It also merged the NCB with the Telecommunication Authority of Singapore (TAS) to integrate computing and physical domestic communications infrastructure into a unified "intelligent" city planning approach (creating the new Infocomm Development Authority, or iDA).[11] "We started building our infrastructure far ahead of everyone", a minister who participated in

[11] I explain the strategic merging of state agencies in Chapter 5.

this merger said in an interview. The goal then was to become an “Intelligent Island” by the year 2000; now, the “world’s first Smart Nation” by 2025.



Figure 53: Living on an Intelligent Island, Straits Times, 9 August 1995."IN THE YEAR 2000, WHEN THE VISION OF IT2000 IS REALISED FULLY."

The Intelligent Island imaginary is remarkably continuous with the Smart Nation imaginary. It has standardised components: a focus on Singapore’s intelligence and smartness, driven by futuristic technology putting Singapore ahead of other nations, connecting Singapore both in terms of relationships with other nations and technological infrastructures. Thus rather than being a new development created to increase private corporate profit, in the national context the smart city imaginary does important nation-building work by continuously synthesising imaginative and technological development, materialising state sociotechnical imaginaries in smart urban infrastructure.

In subsequent chapters, I refer back to this history to explain the national storytelling practices that state planners use to signify their smart city sociotechnical imaginaries through repeatedly enacted national stories of shared culture and technological progress through the domestic space of the HDB and smart home. I now explain the historical narration and material-symbolic projection of these foundational national imaginaries of standardisation, futurity, and connectivity in turn.

3 PROJECTING STANDARDISATION

Despite the HDB's cultural and geographical specificity, state agencies use the material-symbolic resource of HDB standardisation to project Smart Nation futures, imagining their "building block" smart home model as exportable from a single HDB flat, to an HDB block, to a township, to the imagined collective nation, and to other "global cities." This projection relies on an imagined standardisation within and commensurability between each of these spheres, developed through repeated performances of social and infrastructural HDB standardisation. In this section, I show how state planning agencies have long used this material resource of the HDB to project Singapore as a "living lab" due to social and technical HDB standardisation. The social-symbolic element of the state's imaginary is "racial harmony", its population positioned as a standardised stand-in for a "multiracial" global population (Ong 2015). The technical-symbolic element is the HDB's uniform "total environment" and domestic ICT infrastructure, each flat positioned as standardised enough to test and export smart home technologies.

3.1 RACIAL HARMONY (SOCIAL)

Making space for a new future requires narratively and spatially foreclosing other futures. A 2019 report from the Centre for Liveable Cities (CLC), housed in the Urban Redevelopment Authority (URA) and written by former HDB employees, makes this socio-spatial process clear in its title: "Resettling Communities: Creating Space for Nation Building" (CLC 2019).

The socio-spatialisation of the state's cultural standardisation process is projected through the collapsing of the Malay, Indian, and Chinese-Singaporean home, traditionally laid out very differently, into the standardised space of the HDB (Chua 1997:75). The plans in Figure 54—Figure 56 illustrate the different typical layout and orientation of each home, based upon different cultural values: the Chinese-Singaporean home was classically built to enact symmetry and family hierarchy, the Malay-Singaporean

gender separation, and the Indian-Singaporean domesticised ritual purity. Because the "vernacular house-forms…were spatial expressions of the cultural practices of each ethnic group", state planning agencies' homogenisation of variations in house forms also sought to standardise these daily practices into nationally shared ones (ibid). As Chua (1997:106) puts it, "it is to these standardised flats that the three ethnic groups must adjust their symbolic universe and actual behaviour", connecting urban infrastructure to social and behavioural change and creating citizens of Singapore (above any ethnic identifications) through domestic space. I detail some of these resident adjustments to their everyday embodied domestic practices in Chapter 6, as they have not always standardised as the state hoped.

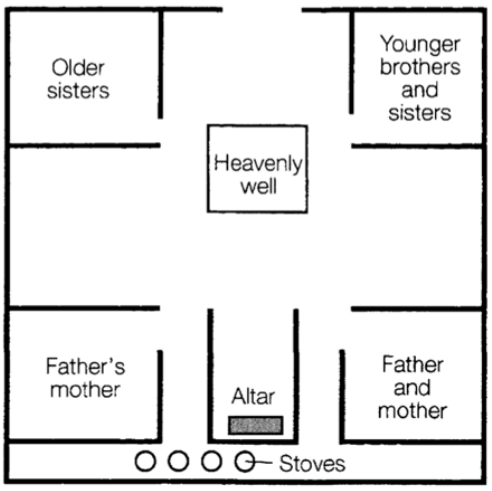


Figure 54: Typical Chinese House Layout (Chua 1997)

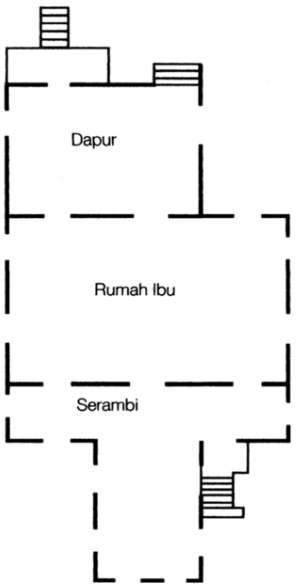


Figure 55: Typical Malay House Layout (ibid).

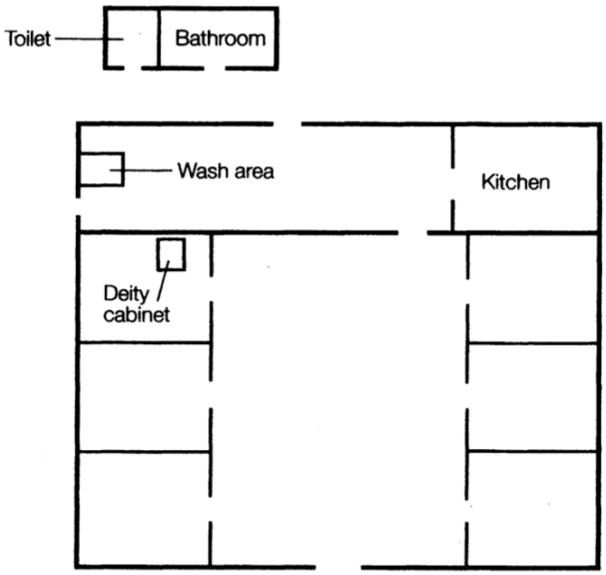


Figure 56: Typical Indian House Layout (ibid).

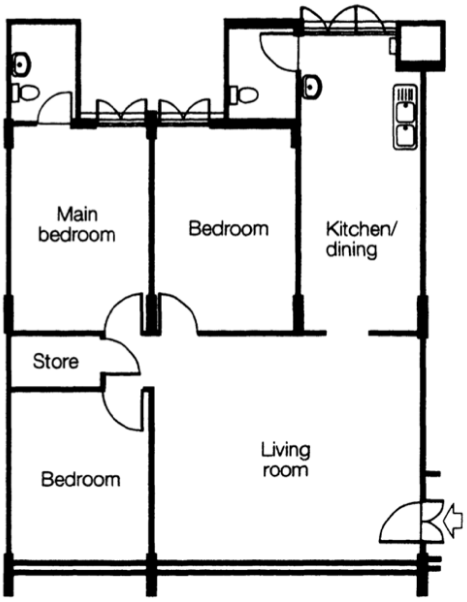


Figure 57: HDB Layout for 4 Bed Flat, 1984 (ibid).

The state has further spatialised its policy of ethnic integration through the HDB. As another standardisation policy, to promote what it terms "racial harmony", HDB imposed still-existing ethnic quotas mandating that HDB blocks must reflect the population's ethnic makeup: 80 percent Chinese-Singaporean, 15 percent Malay-Singaporean, and 5 percent Indian-Singaporean (Haila 2015).



Figure 58: "Fly Our Flag" Poster in HDB Block, Community National Day Celebrations, 2016.

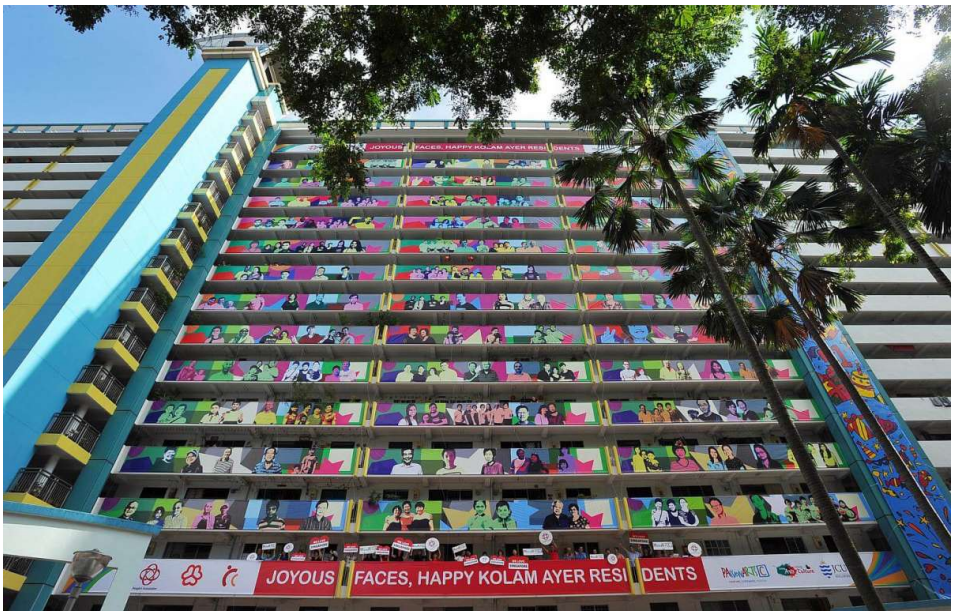


Figure 59: "Joyous Faces" National Day Celebration Art Project. Multicoloured Faces of HDB Residents Painted on HDB Block 11 in Kolam Ayer. Photograph by Lim Yaohui, 2016.

National Day celebrations exemplify how state agencies repeatedly enact collective national imaginaries of racial standardisation through the HDB. These celebrate the Singapore nation as the "best

home", metonymically expanding the material-symbolic racial standardisation in each housing block, by portraying citizens living together in multiracial harmony. This standardising practice is mandatorily materialised and replicated yearly, tied to the affective experience of "showing our love for Singapore" (Figure 59). As smart home resident Yishan told me, as he pointed outside his 35th storey window:

> Look, each HDB comes with flag holders. We get a packet in the mail, and we must put up flag for exactly one month before and after national day. And we can't throw it away…instructions come on how to discard properly. [Gestures to multicoloured building art] The government try to avoid the racial problems that existed in neighbouring countries like Indonesia. And ghettoisation like in New York. So they put ethnic quotas in the buildings, but it means there is discrimination against non-Chinese-Singaporeans even though it looks like equality. Because it's harder for Malay and Indians to get housing.

This state invisibilisation of Malay and Indian-Singaporeans via racial quotas is central to its imaginary of racial harmony and underpins its citizenship imaginary, stipulating who can be "in place" in Singapore. Keeping Chinese-Singaporeans the majority is part of that imaginary: when the Malay-Singaporean birth-rate became double that of Chinese-Singaporeans, the state increased quotas for mainland Chinese immigrants. Some residents also disturb that racial harmony imaginary through exclusionary HDB rental practices, on the same racist grounds. A commonly seen rental advertisement for an HDB stipulating "no Indians/prcs" (Figure 60) exemplifies this infrastructuralised racism. So does the common experience of being turned away from housing based upon one's skin colour and name (Figure 61). I expand on this troubling of standardisation and spatialisation of inequality throughout this thesis, showing how national belonging and smart citizenship is conditionally mediated by public housing access: who is allowed to be "in place", represent the nation, and (re)produce its futures.



Figure 60: HDB Rental Advertisement "No Indians/Prcs".



Figure 61: WhatsApp Chat showing discrimination against non-Chinese-Singaporeans.

Thus standardisation as a sociotechnical imaginary, expressed through HDB infrastructure, is central to this projection of racial harmony and projection of normative, exclusive futures imagined by state agencies. State planning agencies have historically needed to "re-signify" disparate cultural heritage traditions "towards technology and a world culture", projecting a shared set of "Asian Values" and a national focus on "information sciences" to create a sense of collective nationhood (Ban 2004:xi).

This technological focus is manifested in the historically continuous projection of Singapore as "living lab", to which I now turn.

3.2 Building Domestic ICT and Sensor Infrastructure into a "Living Lab" (Technical)

In part due to this social standardisation project, the HDB has since its founding imagined HDB estates as standardised microcosms of society as a whole: "all the Board's major estates are compact townships of their own" (HDB 1970:9). It maintains that economies of scale, due to standardised HDB design, allowed for affordable accommodation: "mass production required standardisation, meaning fewer signs and lower costs" (ibid). HDB terms this the "Total Environment" policy, ensuring each estate has complete, standardised amenities.

The historical development of domestic ICT infrastructure plays a large role in this standardised "Total Environment" imaginary and in making resident biometric data accessible to state planners. A 2018 CLC report explicitly makes the historical connection between infrastructure and imaginary, arguing that "while the term 'smart city' was popularised only in the 2000s, the Singapore government has long tapped on ICT for planning and service delivery. This forms the foundation for the country's Smart Nation initiatives" (Tan and Zhou 2018:1). State agencies have continuously aspired toward imagined scalar ICT expansion, mapping it onto a vision of national "smartness", replicated in state practices. Tan Chin Nam, the NCB's first General Manager (formerly Minster of Defence, subsequently Minister of Manpower, then Chairman of the Media Development Authority), argues:

> The beginning of our national computerisation effort was very modest, but the vision was big. It was about preparing the whole country to become information savvy, information literate for our economic competitiveness and quality of life.[12]

[12] Tan Chin Nam, "Interview by CLC", Centre for Liveable Cities, Ministry of National Development, 31 July 2017, transcript, accession number CLC/042/2017/001.

The CLC report calls "comprehensively and constantly updated ICT infrastructure" central to Singapore's position as a global city, attracting foreign investment. It directly links physical transformation of urban infrastructure through technology to a long-term imagining of Singapore as a global city and living laboratory, which remain crucial dimensions of the Smart Nation imaginary:

> The application of ICT has also helped to shape the physical environment and development of the city. Various systems and tools have been developed to support urban planning and land management, housing, transport, municipal services, utilities management, construction and more. Singapore's development experience over the last half-century has also made the city-state *a living laboratory for urban solutions.* (Tan and Zhou 2018:3)

This continuous re-enactment of the state's global city sociotechnical imaginary happens through the urban infrastructure of the home in particular, making the smart home's history traceable through the history of public housing itself. URA and CLC report "Making Space for Future Infocomm Infrastructure" (2018:30) details how digital technologies have long been interwoven into home space:

> years back, building codes in Singapore had already imposed a requirement that all high-rise buildings had to be equipped with a Main Distribution Frame (MDF) room to house equipment that provided telecommunications services to the building's occupants. By December 1994, all MDF rooms in the Central Business District (CBD) and 75% of all public housing blocks were linked by an optical fibre network. By August 1995, it was estimated that some 158,000 km of optical fibres have been laid, covering 80% of all high-rise buildings in Singapore.

The state's focus on everyday domestic practice as the locus of intervention extends to technological progress, as "mundane" domestic technologies were viewed as the vehicle for future development. Jacqueline Poh (then Managing Director of the iDA and later CEO of GovTech[13]) sees domestic networked Internet infrastructure as the foundation of the Smart Nation:

> The nationwide broadband network was an endeavour to bring fibre broadband to every household...this should not be underestimated; I think too many people take this for granted today.[14]

[13] In 2016, GovTech was created to focus explicitly on Smart Nation development, replacing the iDA and leaving the new Infocomm Media Development Authority (IMDA) to oversee and regulate national media. I detail these agency splits and mergers further in Chapter 5.

[14] Jacqueline Poh, "Interview by CLC", Centre for Liveable Cities, Ministry of National Development, 5 December 2017, transcript, accession number CLC/042/2017/007.

Sensor technologies in smart homes rely on this standardised fibreoptic connectivity to participate in the modular building of Singapore's future, as data they produce must be exportable and interoperable. The smart home therefore has several standardised sociotechnical infrastructural layers: the non-digital material layout of domestic space; the ICT connectivity built into each home; and the smart motion and contact sensor layouts discussed in Chapter 3 and further in Chapters 6 and 7 (Figure 62).

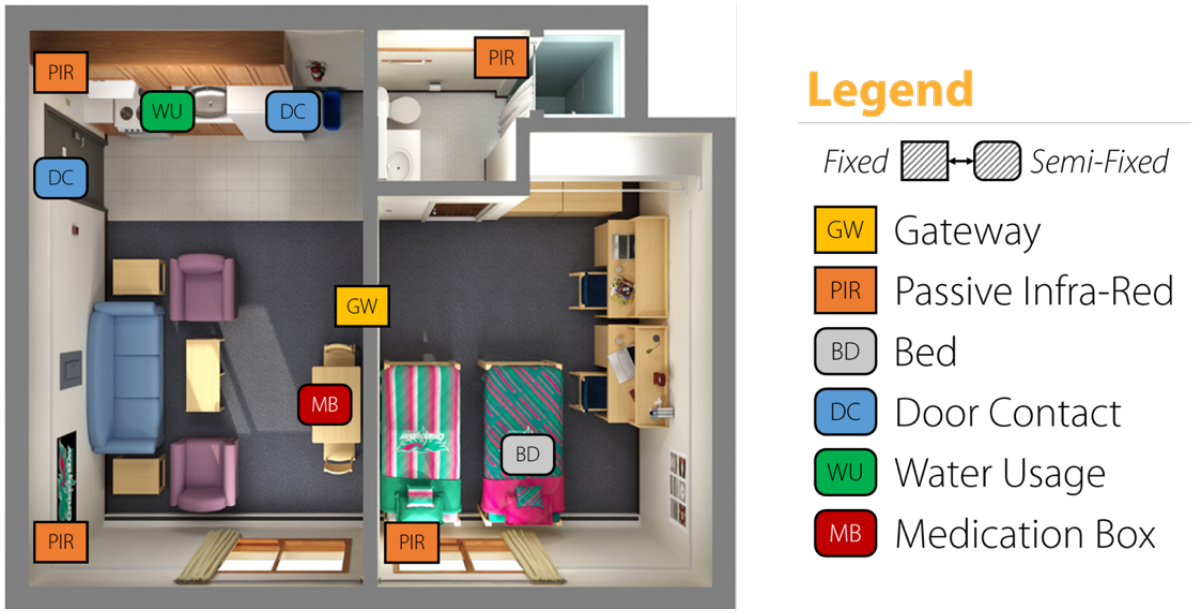


Figure 62: Bird's Eye View of Sensor Layout in HDB Flats. iHome Lab.

This social and technical standardisation is not only used to create an affective identification with Singapore as nation. It is also crucial to the imagining of the Smart Nation as scalable: in order to project it into the future and to other nations, models of smart living must be standardisable. State planning agencies educate smart home development teams from both Singaporean and international universities about this "Total Environment" policy to position Singapore as a "living lab": a place where they can build a smart technology system, then export that "Singapore model" to other global cities (Woods and Kong 2017). The Singapore state claims its multiracial population sample represents "Asia" and the world, metonymically projecting its population as a standardised genetic "living lab" where other nations can come to do better biotech research (Ong 2015). But as I show in Chapter 6, these imaginaries of standardisation do not always manifest in expected ways, causing friction in the projects.

Imaginaries of standardisation underpinning Singapore's smart city planning model rely on its geopolitical specificity, including the spatialised socio-political realities detailed above, where most residents live in public housing open to sociotechnical projects of state intervention (Woods and Kong 2017; Chua 2011). As a city-state in which the vast majority of its residents were immigrants, it had no rural landowners or hinterland, nor a long history of landed human habitation to dismantle. Thus exporting its model to other cities like Bangalore, which require the urbanisation of rural land, often fails (Goldman 2011). Yet the state strategically projects the Singapore model as standardised and exportable to other global cities through metonymic narration using the material-symbolic resource of the HDB and the biometric data of the populations inhabiting it. This exporting relies on an imaginary of Singapore as a "futuristic" global city, ahead of other cities on smart urban development timeline, which I turn to next.

4 Projecting Futurity

In this section, I show how the state has historically used the material resource of the HDB to project itself as futuristic, using social-symbolic resources of the national family and filial piety: what the state generically terms "Asian Values" (also a method of standardising ethnic difference). It pairs these with the technical-symbolic resource of rapid technological development: Singapore as ahead of the global city pack, a place where the future lives. It predicates this rapid technological development on specific domestic arrangements—replicated through "Asian Values"—that power this technological productivity. State planning agencies have repeatedly performed this spatialised futurity as precarious due to Singapore's small size, inculcating an affect of urgency, a need to collectively conform and work hard to stay ahead. As one smart home resident told me: "Growing up in Singapore, you have a passive relationship to the future. The future is told to you by the government from birth, so you don't really have to worry about it."

4.1 "Asian Values" (Social)

4.1.1 Building the "National Family"

The Singapore state uses the HDB to project reproductive and productive futures, imagining the family as material and symbolic building block of the nation's future (Oswin 2019). In doing so, it materially and symbolically displaces those it considers outside of the "national family" from its smart futures: queer residents, single parents, foreign workers, and others who inhabit domestic space in undesirable ways. It also expresses tiered citizenship, where it provides higher-educated, higher-income Chinese-Singaporean residents who have children better access to housing resources. It instantiates these relationships through policies and plans determining what family arrangements receive purpose-built public housing. Citizenship imaginaries are thus projected in and through HDB space.

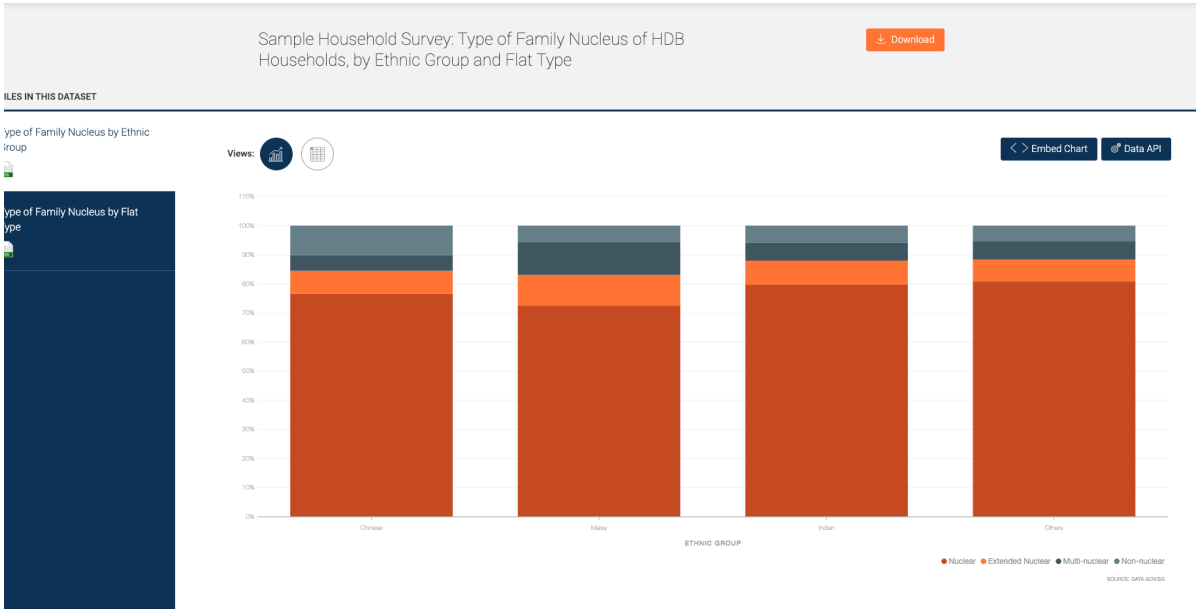
The semiotic and socio-spatial processes of standardisation detailed thus far co-produced the rise of waged labour as the state attempted to rapidly technologically advance. The state tied reproductivity, materialised in the single-family home, to productivity, materialised through the gendered division of labour which that home enabled. It spatially isolated women to the domestic space of the single-family home where they became solely responsible for homemaking and childcare, symbolic reproducers of the nation (Chua 1997).

The state's narrativisation of kampong residents as slum-dwelling, criminal and Communist figuratively and literally erased the social and familial organisations that pre-HDB housing arrangements enabled (Hassan 1977). Resettlement broke extended kinship, clan, and ethnic ties enabled by former housing structures, as newer public housing atomised nuclear family structures (Seng 2009):

> Forced resettlement in flats not only split up communities but, as the flats were designed for nuclear families, also split up generations and ensured that the nuclear family became the basic social unit. Thus, HDB residents were moved from an extended family context with an active community life of mutual support and a sense of local identity and security into serried ranks of self-contained concrete boxes. (Tremewan 2016:50)

The family as building block of society, sustained through domestic living spaces, has been intimately linked to the Singapore nation's future since before its independence. Housing policy and infrastructure were literally built upon those from the late colonial period, by elites who later created the ruling PAP after independence (Oswin 2019). The late colonial administration worked with elites (who were largely Chinese-Singaporean) to create new housing infrastructural policies that persist today, based upon planning surveys conducted in the 1940s and 50s.

Two of the most influential surveys were performed by Goh Keng Swee, cited at the beginning of this chapter, who became the PAP's Minister of Finance following independence. He stressed the transformation of houses into households, building social structures into material infrastructures, imagining biological nuclear families as the basis for both housing infrastructure and the nation. As Minister of Finance, he intentionally literalised the metaphorical link between the family unit and the future economic success of the nation (Ooi 2010).



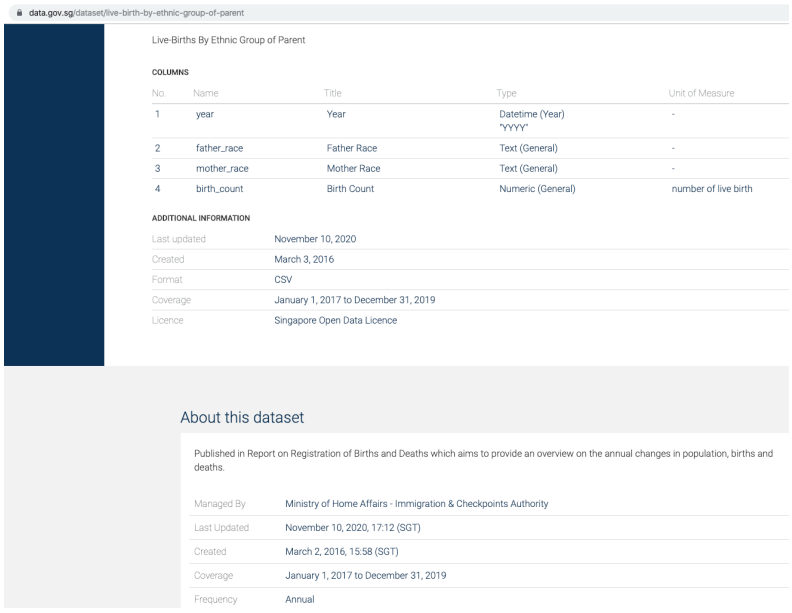


Figure 63: Ethnic/Racial Birth + Housing Data from the Immigration and Checkpoints Authority, 2020.

Continued gathering of race, age, and marital status data (pre-digital biometric data) with respect to domestic living arrangements enables the projection and replication of these imaginaries. Those "Sample Household Surveys" were replicated year after year, data through the present day now digitised on the data.gov.sg website (Figure 63) and enhanced by the smart home sensors in HDBs I detail in Chapters 6 and 7. Notice that these data are collected by HDB and managed by the Immigrations and Checkpoint Authority, showcasing the connection between the intimate domestic sphere and citizenship management. HDB's description on the dataset of who "counts" as part of the household is also telling: "Subtenants or maids dwelling in the same housing unit as the lessee(s) or registered tenant(s) do not constitute part of the household." Domestic workers are both excluded from these data and from the housing and citizenship access they mediate. These biometric data are continuously loaded into the smart city planning software I describe in Chapter 5, facilitating state planners' replication of the sociotechnical imaginaries and citizenship exclusions detailed in this chapter.

This historical analysis allows us to trace longer histories of Smart Nationhood and its component sociotechnical imaginaries, identifying "those moments when enactments of surveillance reify racial boundaries, borders, and bodies along racial lines" leading to "discriminatory treatment of those who are negatively racialized by such surveillance." (Browne 2015:16). I argue that this surveillance not only racialises, but also queers and ages residents in ways that exclude them from the state's citizenship imaginaries and futures.



Figure 64: Our Home Magazine, May/June 1973, Housing and Development Board. National Library of Singapore.

The state only asks certain people to literally "join the national family", as the welcome pack from Immigration and Checkpoints Authority, which reads "shape our future here—our Home" invites.[15] Heterosexually coupled white collar workers, dubbed "foreign talent" by the state, who can be permanent residents receive this packet. Foreign workers, in stark contrast, "have no future in Singapore" (Oswin 2019:101) and have no path to access such citizenship rights. Domestic workers, who order the home, and construction workers, who literally build the Smart Nation, are nonetheless explicitly forbidden to reproduce: the state does not consider them building blocks of the nation's future

[15] http://www.ica.gov.sg/

(Yun 1996; Yeoh and Huang 1999; Yeoh 2006; Teo 2010). Marriage and pregnancy are both illegal without explicit state permission and are grounds for deportation.[16] Foreign construction workers are spatially excluded from the home and from the nation's imagined future, forced to live in dormitories with other single men (Goh 2005). In 2008 residents of a wealthy housing estate even forced the creation of a "buffer zone" and separate access road, saying that the estate was "family oriented" and thus should be protected from "single men" (Oswin 2019:104). An interlocutor confided: "the living conditions up by the border with Malaysia so bad, it's dormitory style living, very grim." The state therefore expresses and restricts citizenship access through domestic space and the intimate practices taking place in it.

The state-produced magazine "Our Home", which ran from 1972-1989, illustrates the repeated everyday enactment of futurity through the HDB as affective resource. The magazine had the largest circulation in Singapore at the time, attempting to "instil civic consciousness" and "shape the tastes and aspirations of flat-dwellers" through interventions into everyday domestic life (Loo 2018:1).[17] The pages included recipes, interior design advice, instructions for neighbourly use of HDB amenities, and advertisements for modern appliances, always addressing an imagined woman as "homemaker" or husband as "breadwinner" responsible for "building and reproducing the young nation" (Loo 2018; Oswin 2019:88).

Advertisements showcased a future "perfect home" accessible through technology (Loo 2018), prefiguring the smart home advertisements promising smart futures to come, as technologies "joined the family." This focus on the family and gendered division of labour is visible in the Our Home cover (Figure 64), with the text "every woman can be beautiful" (note the aspirational "can" as something that must be worked towards) alongside an image of a young mother with her child in front of the HDB. 39 of 42 magazine covers are of families in the home: including grandparents as "active participants" in

[16] https://www.mom.gov.sg/passes-and-permits/work-permit-for-foreign-worker/sector-specific-rules/work-permit-conditions
[17] https://www.roots.gov.sg/learn/collections/listing/1401996

everyday HDB experience (Oswin 2019). Weng Hin described his excitement moving into his first HDB as a child in the 1970s:

> My parents, baby-boomers employed in the Education Service with stable income and CPF [Central Provident Fund] savings, fitted snugly into the demographic profile of targeted buyers. Ten years after the launch of the HDB Home Ownership Scheme, purchasing a government flat had become a modern rite of passage for young Singaporean couples building their nuclear families. It was a life-long commitment to finance the largest family asset, a home, that would take decades of productive work life. Home Ownership could be seen as a huge driving force of industrialisation and productivity.

The state pairs these family structure-based eligibility requirements for public housing access and HDB infrastructural designs with "constant exhortations" to marry and reproduce through resources like "linked media" and state agencies dedicated to running dating campaigns like "Romancing Singapore" (Teo 2007:425; Leong and Sriramesh 2006).

The family norms underpinning HDB access and built into its infrastructure have changed very little. At present, one has to form a "proper family nucleus": be at least 21 years of age, married or engaged.[18] One can have children, parents, and siblings in the home. The only substantial change is that unmarried individuals (including single parents) can buy a flat at 35. As interlocutors belaboured, these flats are significantly inferior: unmarried people can only access resale, not new, flats and have a much smaller subsidy than those married or married with children. Thus the state only invites certain categories of people into Singapore's smart future. These citizenship imaginaries are coded into state smart city planning technologies and replicated through their use, as I detail in Chapter 5.

4.1.2 Spatialising Filial Piety

Filial piety is another social-symbolic resource repeatedly materialised through the HDB. The URA and HDB both symbolically mobilise what they term traditional "Asian Values" of filial piety to encourage multigenerational living arrangements, so that children (specifically women) care for elderly parents

[18] https://www.hdb.gov.sg/cs/infoweb/residential/buying-a-flat

who are no longer productive or reproductive (Khong 1995; Yuen and Soh 2017; Teo et al. 2006; Phua and Yeoh 1998). State agency advertisements for public housing portray stereotypical representations of Asian familial relationship conflicts—between wives and mothers-in-law, for example—and present HDB flats and smart homes as solutions (Hiramoto and Teo 2015).



Figure 65: 3Gen Housing Model. URA 2014. ura.gov.sg/Master-Plan/Themes.

State planning agencies have built these sociocultural and economic expectations of children into HDB infrastructure. They have focused on building "3Gen flats" and dual-key apartments which emphasise the official position of the family unit as building block of society (Wong and Yeoh 2003; Mehta, Osman, and Alexander 1995). Multi-generational housing has standardised layouts, materialised in the Master Plan by HDB and used by the URA: a given number of bedrooms, multiple entrances, and room sizes that accommodate a standardised number of children, parents, and grandparents.[19] In Chapter 5, I show how these Master Plans and sociotechnical imaginaries projected through them form the basis of GIS maps used to plan Smart Nation futures.

[19] https://www.ura.gov.sg/uol/master-plan/View-Master-Plan/master-plan-2014/master-plan/Key-focuses/Housing/housing



Figure 66: URA Website (ura.gov.sg). 24 Aug 2018.

In 2009, the head of the National Family Council and the Minister for Community Development, Vivian Balakrishnan—crucially, now the Minister-in-Charge of the Smart Nation Programme as well as the Minister for Foreign Affairs—wrote:

> The Family remains as an anchor for individuals and the cornerstone of society. Strong and stable families are crucial to our wellbeing. They serve as the first line of care and support for an individual, and lay the foundation for the building of communities, and eventually, the nation. The Family is the only institution that creates and nurtures the next generation. It is therefore the cradle of our future.[20]

State planners consistently frame the Family as crucial to an aspirational global smart city imaginary, "necessary to Singapore's well-being and national survival, particularly to sustain a sense of local identity and moral standards as Singapore casts its lot as a global node" (Weiss 2005:285). Note the metonymic way that state agencies, via their ministers, imagine Smart Nation building: individual, community, nation, and globe (exporting this "Singapore model" to other global cities) (Woods and Kong 2017). This modularity is also temporal, extending into the future through reproduction. In the next section, I explain how the state intertwines this narration of the national family's productivity and reproductivity with the narrative of rapid technological development to repeatedly enact its sociotechnical imaginary of futurity.

[20] "Family First." State of the Family Report 2009, Singapore National Family Council and Ministry of Community Development. https://www.msf.gov.sg/research-and-data/Research-and-Statistics/Documents/NFC-StateoftheFamilyReport2009.pdf

4.2 *Rapid Technological Development (Technical)*



Figure 67: Encouraging youth to learn Building Information Modelling. Ministry of National Development Blog, August 2nd, 2013.

State planners have compensated for Singapore's small population and geographical space through a narrative of rapid technological development, shared across state planning agencies. They create and replicate an urgent sense of futurity, a need to stay "ahead of the pack" to survive. State planners do so in large part by "turning the electronic dimension into space" to "widen the scope of the island", spatialising that future through its smart urban infrastructure (Ban 2004:5). Urban planning (done by the URA) works in tandem with housing planning (done by the HDB) and technological research (done by A*STAR) to project the Smart Nation.

Due to its lack of natural resources, projecting Singapore as a space where the future lives has been a critical part of state planners' work since independence (Bunnell and Goh 2018). This interweaving of the Singapore nation-state, as both symbolic and material space, with smart urban technological development is visible in its digitally mediated city-space, saturated with references to smart urban futures. The urban infrastructure of one-north, Singapore's science and technology research hub where A*STAR is located, is packed with symbols signifying it as the place where the future is made (Bunnell, Gillen, and Ho 2018). one-north was designed by Zaha Hadid in 2003, commissioned by the state's Jurong Town Corporation (JTC) due to her globally recognisable hyper-futuristic architectural style (Wong and Bunnell 2006). It is still expanding as of 2020. Fischer (2015:208) describes its contribution to Singapore's futuristic aesthetic using hyper-stylised, almost cyberpunk language, evoking Thrift's (2009:123) sense of "bathing in an affective ether of signs" in the digitally mediated city:

> Under the hyperpostmodern skin of the city, hypomantic worlds of various sorts pulsate…the hyperskin, or membrane, of the city sparkles with financial and casino towers at one end and new knowledge-economy biomedical research laboratories at the other end, each referring to

> the other in their architectural designs. The Moshe Safdie ship now lofted above the skyline, held up on three ancestor tablet- like hotel pillars with, down below, a lotus-offering shaped Museum of Science and Art and a casino, gestures with its double-helix bridge toward Biopolis—the life sciences research complex at One (degree) North (of the equator), which also contains Fusionopolis for engineering, Mediapolis, and George Lucas's Sandcrawler Digital Production headquarters. This Zaha Hadid–designed complex is intended to flow like an amoeba, fracture like crystals, and from its ganglion of dendrites and axons reach out in many directions to help excite and activate new developments in the universities, medical centers, and engineering complexes around the island, the region, and the world.

one-north's aesthetics invoke a futuristic, sci-fi affect which stimulates the inhabitant's imagination. I analyse this material-symbolic effect in Chapter 6 when I describe the international smart home developers' experience working in one-north.



Figure 68:"The Future Starts Here", Jurong Town Corporation LaunchPad @OneNorth.



Figure 69: Zaha Hadid's Master Plan for one-north. https://www.zaha-hadid.com/masterplans/one-north-masterplan, 2018.

State planners have tied this project of becoming futuristic to the development of an information economy, linked intimately with a story of science and technological progress. As the popular Straits Times-published coffee table book I found in many cafes and homes, *50 Things to Love about Singapore*, says:

> You have got to love what those shiny towers of scientific endeavour symbolise to a young nation: the tremendous financial clout that Singapore has been able to wield to make it happen so quickly: and the lofty hopes for a better future, be it for an individual or a society or the world. (Chang 2015: 172)

This spatio-temporal relationship of Singapore to the future is projected in the storytelling done by the National Museum of Singapore, an important location where states make their sociotechnical imaginaries collectively held (Jasanoff 2015). Singapore has long projected itself as a "global city" through connective urban infrastructural development, tying its "economic survival" to a "bold vision" of the city (Figure 70).

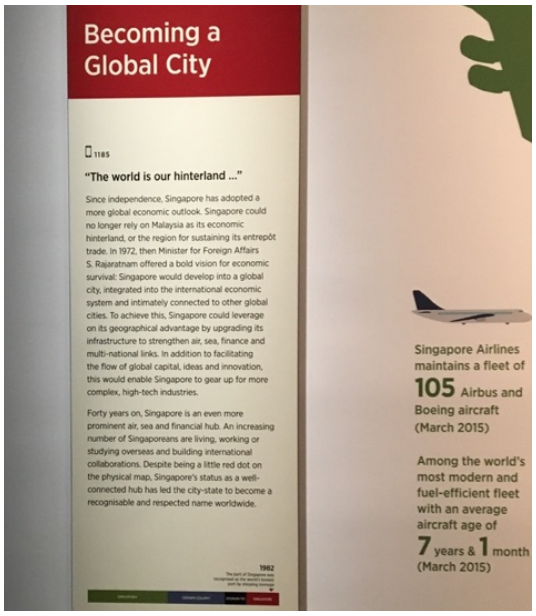


Figure 70: "Becoming a Global City", National Museum of Singapore, 2019.

States also generate a shared sense of risk or threat to make national sociotechnical imaginaries collectively held, repeatedly presenting sociotechnical development as a safeguard (Jasanoff 2015). The state narrates its historical role as protector against threat by staying one step ahead, justifying its actions and creating a shared culture in support of its future imaginaries. As my interlocutor Hin put it:

> The Smart Nation will work, if it works, because the political condition is right. You have the vulnerability of a small state which means that constant awareness has been necessary from the beginning. This makes surveillance more acceptable because you imagine it is doing good.

The sentiment of collectively overcoming the threat of erasure through technological infrastructural transformation echoes throughout the reports, government documents, and speeches produced by the state over the 60 years since independence. In 2007, PM Lee Hsien Loong echoed a similar sentiment:

> When it comes to issues like the economy, technology, education, we better stay ahead of the game, watch where people are moving and adapt faster than others, ahead of the curve, leading the pack.[21]

In 2016 Vivian Balakrishnan, Minister-In-Charge of the Smart Nation initiative and Minister for Foreign Affairs (recall, formerly the head of the National Family Council and the Minister for Community

[21] https://www.straitstimes.com/politics/full-parliamentary-speech-by-pm-lee-hsien-loong-in-2007-on-section-377a

Development) cited a rapid global "pace of change", asking what "we as a society, as a political entity, as a state can do about it." He answered that the "real determinant of success is culture", linking social and technological development. The right national culture, he argued, is one with the ability to:

> invest in and to apply new technologies that will succeed. And the ability to execute, and execute well, that will make the difference between success and being left behind. That is how the Singapore Government looks at this issue, and that is what the Smart Nation Initiative, led by the Prime Minister, is really all about…we are in the leading pack.[22]

As architect and smart home resident Dustin told me, citing a temporal frame tying technological development to becoming more futuristic oft-used by the state:

> Singapore has an anxiety about being behind. In China they have contactless payments everywhere. Even in the markets, if you don't have AliBaba or WePay, they don't accept. In Singapore it's not like that yet. But they've realised it and are rolling out cashless systems everywhere, so they will catch up.

The last panel in the National Design Museum's exhibition states that "Singapore designers are poised to forge ahead—mediating between the East and the West, while drawing on the resources offered by a Smart Nation." This framing links geospatial and temporal imaginaries: "as Singapore designers reinvent and shape their creative futures, there is a sense of reflection and continuity from the past" (Figure 71). The gallery concludes with the "nation's fervour" to take on the future.

[22] Opening Speech by Dr Vivian Balakrishnan, Minister for Foreign Affairs and Minister-in-Charge of the Smart Nation Initiative at the Internet of Things Asia Conference, Singapore Expo, 30 March 2016.

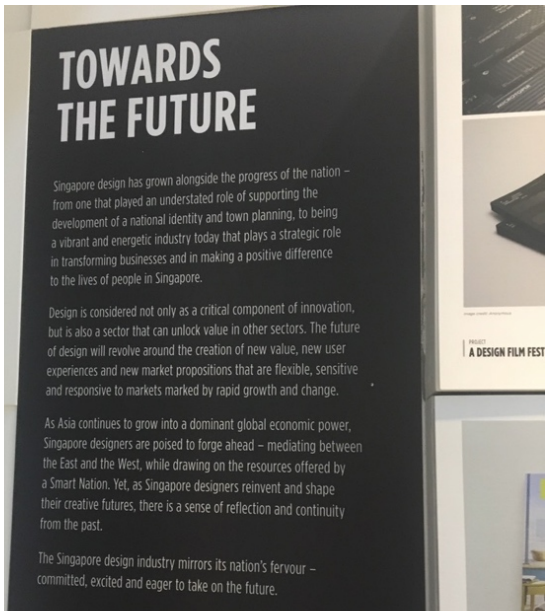


Figure 71: "Towards the Future", National Design Museum, 2019.

A foreign planner doing a temporary Singapore state agency residency reflected on Singapore's Smart Nation project:

> Singapore like the UAE is a future-facing country of a particular laboratory like scale, where the inevitability of automation is written into national policy…like Dubai, Singapore is trying to make a smart city with data as its main operating resource…the future is moving gradually Eastwards.

The planner's evocation of Singapore as "living laboratory" replicates the sociotechnical imaginary of Singapore as standardised discussed in section 3. He also spatialises the future in Singapore, in the smart city of the East. In the next section, I describe how state agencies repeatedly tie Singapore as standardised "living lab" and "spatialised future" to Singapore as a connected "digital port" and "global city," together creating the material-symbolic foundation of the Smart Nation sociotechnical imaginary.

5 Projecting Connectivity

> *Like countries in the past that capitalised on the first industrial revolution to reap great power and economic wealth, Singapore is well-positioned to gain a head-start by capitalising on the digital revolution. I hope that the lessons from Singapore's experience in planning and developing infocomm technology infrastructure and services, and our current endeavours to create a Smart Nation may guide future generations of policymakers and practitioners in Singapore and elsewhere. We are happy to share our journey.*
>
> - Vivian Balakrishnan, World Cities Summit 2019, Singapore.

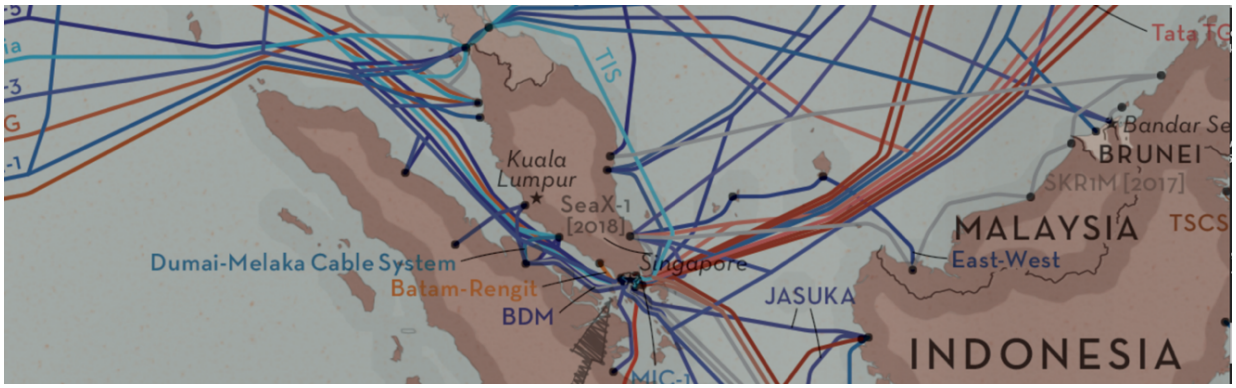


Figure 72: Submarine Cable Map of Singapore, 2017. http://submarine-cable-map-2017.telegeography.com/

A state agency interlocutor told me: "We have a smooth Smart Nation plan—we have a clear vision for what that looks like." To enact that plan, the state projects the material-symbolic resources discussed in previous sections: sociotechnical and spatio-temporal futurity through standardisation of smart urban infrastructure like the HDB. In this section, I argue that state agencies also project and replicate the symbolic resource of connectivity, both through international partnerships with other nations and connective technological infrastructures. They spatialise the Smart Nation sociotechnical imaginary in part through smart city projects, connecting developers from other countries with Singapore state agencies to work with local residents and connecting Singaporean planners, developers, and researchers to global multinational corporations.

Using sensors and fibreoptic cables connected to HDBs, state agencies gather and input resident biometric data into smart city mapping technologies to make and share maps of the future. Tracing Singapore ICT history alongside HDB history shows how continuous state institutional practices bolster, and are bolstered by, the sociotechnical imaginary of Singapore as a connected "global city" (from "Intelligent Island" to "Smart Nation"). It also shows how this imaginative development co-produces increased access to data from continuously updated state urban infrastructures embedded in residents' homes and workplaces. Smart home projects are both materially and imaginatively built upon these connective infrastructures.

5.1 International Partnership Projects (Social) and Global Digital Port (Technical)

State planners have long imagined centralised IT infrastructure as crucial to sharing both data and future imaginaries: vital to the connectivity of the Smart Nation plan, both to connect state agencies inside the nation and to connect Singapore with other nations around the globe. The first National IT plan was made in 1986, an " initiative involving various agencies coming together to articulate the…new version of the plan," as former NCB employee Wong articulates. This plan codified IT's centrality to the state's development plan writ large and created a centralised IT infrastructure (an Electronic Data Interchange platform, or EDI) which enabled data sharing between state agencies, local companies, and international companies.

TradeNet, one such platform, decreased the wait time for trade permit approvals from two days to fifteen minutes in 1989, later reduced to less than a minute. Similar EDIs were created at the time, including PortNet, MediNet, LawNet, and BizNet. Later in the 1980s and 90s, School Link, an immigration system, and an automatic national registry of birth were also created (Tan and Zhou 2018). Centralised IT infrastructure remains central to Singapore's Smart Nation plan, as it enables these smart city platforms. It permits the high level of regulation required by the Singapore state to happen at speed, creating an "open" business environment nonetheless highly controllable by the state. It allows planners to access transportation data from rideshare corporations and sensor data from public-private smart home collaborations and incorporate them into the state's larger vision through GIS maps they use daily.

State agencies paired centralised IT infrastructure with centralised data servers, located in three giant data hubs dedicated to land data, human data, and enterprise data, in 1987 (Tan and Zhou 2018). These hubs were created to "facilitate data sharing" across agencies and "allow greater control over operations", according to my URA planner interlocutor Amit. Data stored in these hubs were linked by

the government network "IDNet", accessible to all government agencies and encouraging them to share data due to "one-stop, non-stop" access.[23]

Connectivity is both a social and technical symbolic resource, as this infrastructural connectivity maps directly onto the imaginary of being a global node and digital port in a network of smart cities. Singapore's "global city" imaginary, Ban (2004:4) argues, emerges from the foundational metaphor of the connected "network": "In place of the psychological and physical space that had meant so much to the metaphors of nationhood, Singapore would substitute a metonymic network of 'global cities'". "Shaping metaphoric space" due to a lack of physical space has thus been important to the state since before independence: British colonist Raffles founded Singapore on a simile of the "free port" (Goh 2004:11). Translating "simile into reality" became a spatial practice, whereby the simile would "redraw new space for the transaction of business" in Singapore by "incorporating the diverse energies of many nationalities" (Goh 2004:9). Connectivity emerged as both a social and technical imaginary, materialised through "tentacles of technology" which "form a chain of cities" linked through international relations and bolstered by its marketable standardised multiracialism (Rajaratnam 2004:4).

Balakrishnan makes this connection explicit and links it to a continuous story about Singapore's place in the world, spatialising the future in Singapore through a story about its past tied to infrastructure. He symbolically draws upon Singapore's history to imagine its place in the future, both temporalising and spatialising the imaginary:

> we must continue to be one of the best-connected places in the world. If you think about Singapore over the last 200 years, since 1819 when Sir Stamford Raffles arrived. We were a port; we were part of the maritime Silk Road—we connected Asia to Europe. It was about things, not the Internet of Things, it was about real objects traded between Asia and Europe. In the digital age, it would not just be about things, in fact, it will be about bits, it will be about designs.

[23] Supercharging Singapore. Straits Times in collaboration with the Infocomm Development Authority (iDA), 2015. http://graphics.straitstimes.com/STI/STIMEDIA/Interactives/2015/10/35-years-of-ict/supercharging-singapore/the-1980s.html

> Therefore, it is important for us to be part of the digital silk road of the future. To be a port, a nodal point, for digital bits of the future. That is where our future is: to be a digital port.[24]

Balakrishnan cites well-connected domestic fibreoptic infrastructure as an example of Singapore's sociotechnical future-preparedness and global connectivity ("if you dismantle the optical network box in your home, you will see two fibres"). He explains that the "single layer of government" allows the Singapore state to "make full use of technology" to "shape the evolution of our identity and cohesion as a society." Importantly, he attributes Singapore's futurity to its sociotechnical ability to use technology to create "population-wide habit" and "alter behaviour."

The projection of this smart urban image to other global cities to connect with foreign partners is historically continuous: the state terms this practice "Technopreneurship" (Phua 2018). In 1970, HDB envisioned an urban landscape in which "low-cost housing will merge with a tourist complex of hotels, sky-high nightclubs, cable cars, and other exciting features" (HDB 1970:9). To do so, HDB imagined public-private partnerships to create building projects "designed to give scope and variety to attract local and overseas entrepreneurs" (HDB 1970:59). It sought to export its model even then, in 1969 (a few years after independence) becoming a "Colombo plan training ground in public housing…Trainee planners come from India, Burma, Malaysia and Ceylon. Arrangements are now being made for Indonesians to be trained here. Fiji, too, has had the assistance of Singapore's architect-planners in their public housing development" (HDB 1970:6).

Replicating them by continuously re-enacting these historically traceable material-symbolic resources, the first HDB report lauds Singapore's "spectacular" urban infrastructural transformation in the face of "fantastic odds" faced by the newly minted Housing and Development Board in 1960, which built 23,000 housing units in its first two years of operation (ibid). Using the same aforementioned

[24] Opening Speech by Dr Vivian Balakrishnan, Minister for Foreign Affairs and Minister-in-Charge of the Smart Nation Initiative at the Internet of Things Asia Conference, Singapore Expo, 30 March 2016.

sociotechnical, spatio-temporal language, the report lauds the new Queenstown neighbourhood as a "model of imaginative planning," taking Singapore "bigger, bolder, better...into the future" (ibid). The imaginary of futurity is intertwined with global connectivity to spatialise the future in Singapore.

Repeating the projection of urban infrastructure as signifier and material enactment of the state's "global city" imaginary, Toa Payoh Town Centre's high-rise public housing block (Figure 73), erected in the 1970s, was "intended as a progressive symbol of the HDB's successful social housing programme, showcased before an international audience" (Weng Hin Ho 2009:5). It served as the Athlete's Village during the Southeast Asian Peninsular games in 1974.[25] Queen Elizabeth II was given a tour in 1972 to showcase Singapore's advanced technological infrastructural development (Figure 74). Forty years later, it was demolished to make space for even bigger and bolder futuristic emblems of the state's housing success: smarter urban infrastructure like smart homes (Figure 75).

The state intertwines ICT and HDB development in its material-symbolic storytelling practice, mapping onto the historical layering of domestic and infocomm space in Singapore's nation-building. In the 1980s, according to my interviews and archival interviews with former state planners recounting National Computing Board (NCB) history, the NCB also invested in connective international partnerships. It created "IT training collaborations" between Singapore and Japan, Germany, and the United States to make Singapore a globally attractive place to invest, and to attract "foreign talent" to move there. I elaborate on the NCB and these ongoing ICT training collaborations in Chapter 5 to show how present-day Smart Nation planning practice continues to replicate these connectivity imaginaries.

[25] https://eresources.nlb.gov.sg/history/events/fc25b85a-6d97-4f9f-b9ae-b018109994e4



Figure 73: Strategically positioned 1970s HDB block at Toa Payoh Town Centre. Photograph by Jeremy San Tzer Ning.



Figure 74: Queen Elizabeth II on a State Visit Views HDB Blocks. Photograph by Nanyan Siang Pao.



Figure 75: Toa Payoh in 2011, with New High-Rise, High-Density flats. https://www.straitstimes.com/multimedia/photos/in-pictures-public-housing-in-singapore-through-the-years.

State agencies attempt to forge these international connections to secure Singapore's place as a connected Smart Nation, a node in a network of global cities. Balakrishnan, in a speech addressed to a large international audience at the IoT Asia Conference, builds upon his notion of Singapore as "digital port" to echo HDB's 1970 sentiment, deploying all three technical imaginaries (standardisation through Singapore as "living lab"; connectivity through Singapore as connected to "cities and countries all over

the world", and futurity through providing "urban solutions for the future" in the current "best place in the world"):

> It is important for us to be the best place in the world for the latest and the brightest ideas to be tested, for proof of concept. Prototype your product or service and upscale it if it works. If you have an idea that works and will improve the lives of Singaporeans, we will test it, we will buy it, and we will be your reference customer. You can then use your success in selling that product or service to us as your calling card when you offer those same services to cities and countries all over the world.[26]

His rhetoric shows the living lab's foundation in this longer-term global city imaginary. Its subtext communicates that Singapore is a place where future imaginaries can be materialised more quickly than in other places. Drawing on these connective global partnership genealogies, Balakrishnan continuously spatialises the future in his speeches by promoting Singapore as the place global future imaginaries can be materialised, positioning the living lab as a mutually beneficial location for international technologists and corporations:

> So I urge all of you, especially those of you here with bright ideas, new products and new services that will address urban challenges and provide urban solutions for the future, to come and make your pitch to us, and let's see whether we can turn your ideas into reality…Just last month, we launched the Smart Nation Fellowship Programme, to enable top data scientists, technologists, and engineers from all over the world to come in and try to hack our government. Not to hack our government in the security sense, but to make us better. You are familiar with what is available out there, so spend a few months with us. If of course, we can convince you to join us permanently, that is fine. And even if we cannot, give us three or six months of your life to do something interesting, and have the pleasure of seeing it operate in real life.[27]

I use two of these international smart home partnership projects, historicised in this chapter, as long-term ethnographic field sites.

Such pace of realisation can occur due to Singapore's non-standard geopolitical context: the aforementioned continuity of planning practices due to the city-state's single-party government and

[26] Opening Speech by Dr Vivian Balakrishnan, Minister for Foreign Affairs and Minister-in-Charge of the Smart Nation Initiative at the Internet of Things Asia Conference, Singapore Expo, 30 March 2016.
[27] Opening Speech by Dr Vivian Balakrishnan, Minister for Foreign Affairs and Minister-in-Charge of the Smart Nation Initiative at the Internet of Things Asia Conference, Singapore Expo, 30 March 2016.

single governance layer. Multiple interlocutors, both Singaporean and foreign, also cited the lack of data privacy laws as reason for using Singapore as a "living lab." As one smart home developer said:

> We come here because there's no regulation or data protection—can you imagine doing this in France? You'd have to go through so many hoops to do it. Here you can just collect whatever data you want.

These reasons undermine the standardisation required to export the Singapore model to "connected" global cities: how can the Smart Nation model be easily exported when it relies so heavily on Singapore's social, political, and geographical specificities? I explore how sociotechnical imaginaries like the Smart Nation can cohere and persist despite contradictions in the chapters that follow.



Figure 76: Presentation of Smart Singapore (including "Smart HDB Home") at the 2016 World Cities Summit.

6 Discussion

In this chapter, I analysed the history of housing and ICT infrastructure in Singapore to foreground the Smart Nation's pre-digital underpinnings and argue against framings of the smart city as a "digitally enabled corporate enterprise" (Luque-Ayala and Marvin 2020:210). Bringing anthropologies of infrastructure to bear on critical smart cities literature shows that the smart city is not always a generalised, abstract corporate technology intensifying capitalist accumulation wherever it is applied.

Instead, actors like state planners use it to project specific futures through the materiality of infrastructure. Smart city projects do not follow the same script everywhere, as they do not always emerge from the same profit-driven corporate fantasies: states in particular tie infrastructural development projects to prior nation-building projects, often strategically working with corporations without being dominated by their logics.

Scholars framing the smart city as an intensification of corporatisation often argue by extension that the smart city "de-politicises urban processes", leading to the "hollowing out of the polis" (Luque-Ayala and Marvin 2020:4).[28] But tracing the state's imaginative investment in smart urban infrastructure shows how thoroughly political, rather than depoliticising, these projects are. Infrastructural projects historically do not depoliticise subjects: they are usually symbolically invested with affective meaning that is highly political, since their creators seek to materialise shared national future imaginaries. States have long used infrastructural projects as vehicles of change (Mattelart 1996; Mattelart 2000; Edwards 2003) to elicit strong affective connections to the nation by stimulating the "enthusiasm of the imagination" (Mrazek 2002:163). Infrastructural projects are made to produce affective responsive of desire and awe, inculcating a sense of shared futurity and political subjectivity. These infrastructures symbolise futures, often national futures borne by technological progress, and are therefore loaded with political significance. Finally, states have used residents as sociotechnical infrastructure (Simone 2004)—as "vehicles for the nation's future"—long before they carried smartphones or domestic sensors detected their daily movements.

The political significance of these technological infrastructural projects is well-documented by anthropologists of development showing how development projects embody hope for imagined futures (Ferguson 1999; Barker and Barry 2005; Street 2012; Sliwinski 2016; Khan 2006). This affective, political

[28] In Chapter 7, I further trouble the oft-repeated use of the "polis" as an idealised democratic public sphere that existed before the smart city and is corrupted by its corporate logics of control.

significance is often most clear when infrastructural projects fail to fully materialise those futures, transforming into symbols of distance or exclusion (Yarrow 2017; Hadjithomas and Joreige 2013; Lea and Pholeros 2010). Technologised infrastructures like the smart city produce particularly strong affective connections with imagined futures, as "technologies come to represent the possibility of being modern, of having a future, or the foreclosing of that possibility and a resulting experience of abjection" (Larkin 2013:333). Postcolonial and post-Soviet analyses of infrastructural projects show the deep emotional investments involved in building ICT infrastructures, tied to a literal sense of building the new nation into the future (Boym 2001; Humphrey 2005; Collier 2011; Dalakoglou 2012; Lombardi 1999; Larkin 2008). Infrastructures thus "encode the dreams of individuals and societies" and "are the vehicles whereby those fantasies are transmitted and made emotionally real" (Larkin 2013:333).

The exporting of the "Singapore model" exemplifies the political nature of smart city development and how it aims to materially produce affective connections to imagined futures. As Larkin (2013:333) argues:

> Many infrastructural projects are copies, funded and constructed so that cities or nations can take part in a contemporaneous modernity by repeating infrastructural projects from elsewhere to participate in a common visual and conceptual paradigm of what it means to be modern.

The Singapore state is not selling an abstract corporate smart city fantasy, but rather a dream of (smart) nationhood (what Jasanoff (2015) terms "dreamscapes of modernity"). As this chapter evidences, it is selling the future, as it has historically done by narrating its sociotechnical infrastructural development in affectively resonant ways using material-symbolic resources.

Rather than depoliticising the subject, such infrastructural projects are explicitly made to build residents' affective connections with the state's imagined futures, inculcating "deeply political" feelings of investment and producing changes in their daily affective and material practices (Abram and Weszkalnys 2013; Simone 2001; Holston 1989). These projects are therefore explicitly not just "rational in any narrow economic sense", problematising analyses which see the smart city as an extension of

corporate rationality (Pedersen 2011:45). Todorov (1994)'s analysis of the factory in the USSR exemplifies how infrastructural projects generate political subjects by inculcating repeated daily material-symbolic practices. Factories were meant to produce symbolic meanings, not just commodities, and to train subjects in how to relate to state power. Their "failure" to produce commodities was therefore not a failure in the eyes of the state, since the goal of the factories was not purely economic. By deeming instantiations of the smart city "failures" because they do not materialise corporate blueprints or produce economic wealth as promised, critical smart cities scholarship might similarly miss many goals smart city actors have—and the different kinds of political promises and perils they produce for residents seeking smart citizenship. Instead, analysing actors' material and symbolic use of smart city imaginaries produces a more nuanced understanding of specific projects' goals and effects.[29]

In the case of Singapore's Smart Nation, the smart city is an extension of the state's historical use of infrastructure to project its political imaginaries, shaping what futures residents can imagine and enact and who "belongs" as a smart citizen. Thus far from being a new capacity of digitally enhanced cities, the "transition of environments from habitats and spaces of dwelling to objects of planning, management, and control" (Beverungen and Sprenger 2017:4) has been a longstanding project undertaken by state agencies, not always tied to corporatisation. The smart city may increasingly be an "urban laboratory" (Barns 2020) for experimentation, but as evidenced by Singapore's longer-term "living laboratory" imaginary, this framing also has historical roots, pre-dating digital technologies, illustrating its political significance in different contexts.

In short, the smart city is not a completely new 21st century abstract corporate imaginary, does not always depoliticise subjects, and does not always follow the same process of corporatisation. My analysis in this chapter shows how infrastructural projects like the smart city seek to change the affective

[29] I elaborate on state actors' strategic use of corporate smart city imaginaries further in Chapter 6.

and material practices of residents, making them productive of state future imaginaries. It also shows how political these projects are, since they determine who gets to reproduce the nation's future and who is left out of it: mediating (smart) citizenship itself. Further, these political mediations of citizenship do not just happen in the polis or "public sphere", but through intimate domestic spaces like the home which have long been sites of nation-building.

7 CONCLUSION

In this chapter, I explained the roots of the Smart Nation as expressed through the HDB's history and infrastructure, which state planning agencies position as a standardised, futuristic, and globally and technologically connected "living lab" for other nations to test smart home technologies. Projecting Singapore as a technologically advanced, futuristic "global city" which attracts such international connections has long been central to the state's nation-building project. Intertwining sociotechnical imaginaries of standardisation, futurity, and connectivity, the state projects its Smart Nation sociotechnical imaginary through the material resources of the HDB and smart home (Table 3).

		SOCIOTECHNICAL IMAGINARIES		
		Standardisation	**Futurity**	**Connectivity**
RESOURCES	**Material**	HDB + Smart Home + Smart City Planning Technologies		
	Symbolic – Social	Racial Harmony/Quotas	"Asian Values" (productivity and reproductivity via filial piety and national family)	International partnerships and "exporting the Singapore model"
	Symbolic – Technical	"Total Environment" and "living lab"	"Ahead of the pack" due to rapid technological advancement	Connected ICT Infrastructure

Table 3: Smart Nation Sociotechnical Imaginaries and Material-Symbolic Resources

I argued that the state mobilises these technical-symbolic resources, imagined stories about the role of technology in the Singapore national imagination:

1. Standardisation: Singapore as "living laboratory" where other nations can test smart technology in its standardised domestic "Total Environments".
2. Connectivity: Singapore as "global node" and "digital port", through connected domestic ICT, mapping and sensor infrastructure and data that "flows like water" across Singapore and the world.
3. Futurity: Singapore as a spatialised future, "ahead of the pack" due to rapid technological development, a place where the future lives. To use Suchman's (2011:2) language, that "the future arrives sooner here."

State planning practices repeatedly tie these technical-symbolic resources to social-symbolic resources about imagined normative sociality in Singapore:

1. Standardisation: through public housing policy and infrastructure building "Racial Harmony" by standardised housing racial quotas.
2. Connectivity: through international partnerships and foreign investment in Singapore and "exporting the Singapore model" to other global cities.
3. Futurity: reproductive and productive futurity secured through "Asian Values." These include the family as the "building block" of the nation and filial piety, as the responsibility to care for the elderly who no longer work.

These social and technical symbolic resources are expressed through these material resources:

1. The HDB.
2. Smart City Planning Technologies (Digital and Analog Maps).
3. The Smart Home.

Asking *how* sociotechnical imaginaries become collectively held, I showed how repeated institutional practices of national storytelling about standardised infrastructure and population data, connective international partnerships and ICT allowing data to "flow like water", and smart urban

futures spatialised through rapid smart technological advancement and well-disciplined populations, perform collective sociotechnical imaginaries. I also showed how state agency-sponsored smart home projects, part of the Smart Nation project, are continuous with state attempts to project national futures through domestic space and international partnerships.

Storytelling practice is central to the projection of the smart city, as stories make things come to matter (Ghertner 2015; Fortun 2008). Drawing upon the rich literature on imagining futures through sociotechnical projects of city and nation building in Singapore (e.g. Ban, Pakir, and Tong 2004; Bahng 2017; Fischer 2015; Kong and Yeoh 2003; Clancey 2012; Bunnell and Goh 2018; Ho 2017; Klein 2018; Koh 2005), I argued that the state repeatedly projects specific futures into the city's urban infrastructures, made to shape resident behaviour and future imaginaries. Describing the materiality of the metaphoricities state planning agencies use to project national sociotechnical imaginaries (Pandian 2019), I detailed both the stories they have told and the material and symbolic resources they have used to tell stories with.

My analysis builds upon longstanding social theories of the story as central to nation building, through practices of collective remembering and forgetting (Bhabha 1990). It also builds upon feminist STS' demonstration of scientific and technological stories "exerting brutal forms of power" when used by institutions (Martin 1998:30) and Browne's (2015) analysis which calls for attention to the far longer histories productive of modern sociotechnical assemblages, particularly as they replicate historical practices of racialising surveillance as technologies of nationhood.

This chapter showed how state storytelling does not just take place through speech, but also through a "metonymic march of images" limiting what can be represented, seen, and replicated: making representations that can be "incorporated and ingested" while "what cannot be incorporated…that which does not go with the ongoing narrative of dominant simile, must be removed" (Goh 2004:12).

Goh's words evoke writer Gopal Baratham's (2001) characterisation of Singapore as "the City of Forgetting." This is enforced through the narration and materialisation of national history, as a generationally transmitted system of signifiers:

> History, the circumstances of what one is born into or the system into which the signifier…is inserted into, is always potentially repressive in that it prescribes a particular reading through what is already there. The signifier must then flex its own power in order to re-write the boundaries of its own existence and meaning… within this, the destiny of Singapore remains very much a rewriting and re-imagining by each generation of what is possible.

National architect Goh's (2004:19) reflection suggests that the telling of other stories through the reimagining of these signifiers opens up space for other futures, while replicating the signifiers re-enacts the same stories. The everyday embodied practices of state planners, developers, and residents illuminate how the imaginary is replicated and reimagined through differentiated repetition, sometimes rupturing and sometimes perpetuating the futures imagined by the state. These replications and reimaginings have implications for the citizenship projected and mediated through the domestic sphere and the smart home.

In the next chapter (Chapter 5), I show how state planners repeatedly replicate these imaginaries in their current creation of smart urban infrastructure through their everyday planning practice, as they are given the material-symbolic resources detailed in this chapter to do the work of building the Smart Nation and imagining its future.

CHAPTER 5: REPLICATING SMART NATION FUTURES

1 INTRODUCTION

In this chapter, I continue to answer my first research question:

> *RQ1: How does the state project its future imaginaries through the digital and urban space of the smart city?*

Much existing literature has positioned the smart city as a corporate imaginary sustained through corporate storytelling and divorced from the pre-existing cultural, historical, and spatial realities of the city it seeks to reshape through smart urban infrastructure (Greenfield 2013; Hollands 2015; Söderström, Paasche, and Klauser 2014). Arguments that smart city imaginaries are divorced from the "lived experience" of residents subsequently suggest that the smart city fails due to a gap between state or corporate imagination and resident lived realities, the former thought to be abstract oversimplifications unable to "capture" the real, material complexity of the latter.

Less work analyses the smart city as a form of *national* storytelling, contextualising the practice in a long history of state storytelling to forge collective national-cultural imaginaries (Anderson 1991; Appadurai 1996; Bhabha 1990; Renan 1882), or sees that storytelling itself as a material practice. Rather than being recently generated fictions or abstract ideas, I argue that these national stories have been projected in and through smart urban infrastructures and replicated through the everyday planning practices of state planners as they work with and through material technologies. I argue that both state and resident actors have lived experience, a "technological everyday", through which they continuously replicate and reimagine future imaginaries (Amin 2007). Rather than seeing the state as a static, monolithic entity, I describe the material-symbolic resources that younger state planners are taught to use by senior planners to replicate a shared vision of the Smart Nation through their everyday planning practice.

In Chapter 4, I argued that state planning agencies have historically used domestic infrastructure to project national stories about Singapore's smart future and who "belongs" in it, materially and symbolically structuring resident behaviours, affective identifications, and imaginable futures. In this chapter, I argue that state planning agencies replicate the same sociotechnical imaginaries: (1) Singapore as a standardised "living lab", through racial harmony and uniform domestic infrastructure; (2) futuristic, through socioeconomically-productive "Asian Values" and rapid technological progress; and (3) a connected "global city", through international partnerships and domestic ICT. I analyse both the practices and technologies that encourage planners to replicate, rather than reimagine, these imaginaries in their daily practice. I show how planners often unconsciously re-deploy signifiers of national identity repeatedly generated by state planners since independence to create shared affective identifications and citizenship imaginaries. In replicating smart urban infrastructures, through smart city planning technologies they use together, state planners also replicate the normative future imaginaries projected through them.

State planning agencies replicate smart city sociotechnical imaginaries with and through the smart infrastructure they use and create. Through training performed by senior state planners, new planners learn to replicate imaginaries given to them through the smart city planning technologies (like GIS maps) they use to create smart urban infrastructures. Previous Master Plans—and the continuously gathered biometric data informing them—form the basis of the GIS maps. Planners continuously re-incorporate the data those smart urban infrastructures gather back into smart city planning technologies and use them to perform further smart city planning work. The systems that store and visualise smart city data for planners, created by planners, encourage them to replicate Smart Nation sociotechnical imaginaries and project them into smart urban infrastructure.

These recursive engagements are relationships of performativity, replicated corporeally by individual planners with and through material smart urban infrastructures. The acts that individual planners perform are "in a sense, an act that's been going on before one arrived on the scene" (Butler 1990:272). I use Kelty's (2008:15) notion of "recursive publics" to break down unhelpful analytical distinctions between abstract imaginaries and material practice. Like state planners, the actors he describes both have "shared moral and technical understandings of order—and can inhabit and transform the thing that creates those understandings." Normative future imaginaries, far from being abstract and divorced from reality, are intimately tied to planners' repetitive, material daily practices as they internalise and externalise the Smart Nation through smart city planning technologies.

My state planner interlocutors argued that the smart city is "not just technology" but a "coordinated system" involving "smart people with smart ideas." Their Smart Nation is made up of (1) people, like smart planners and "smart citizens" contributing to the "whole of nation" effort to build the smart city; (2) systems, that state agencies use to perform shared planning functions; c) data gathering and storage technology, like sensors, ICT infrastructure, and GIS maps that planners use to collectively visualise and enact the future nation. In this chapter, I first detail the daily practices of Alvin, a composite of my state planner interlocutors' actual experiences, to show the material (smart city planning technologies and state agency structures) and symbolic (historically-rooted stories about Singapore's future) resources that state planners interface with daily as they co-produce the "technological everyday" of the smart city. I then analyse each site of Smart Nation replication in turn: smart people, smart systems, and smart data. Each, I argue, explicitly reproduces the place of standardisation, connectivity, and futurity in the nation's origin and success story. Smart Nation planning practices seek to standardise people, connect systems, and enact the future.

I answer Luque-Ayala and Marvin's (2015) call to analyse practices of smart urbanism in context: how smart city planning coheres and enacts normative future imaginaries and what possibilities exist to construct alternatives. Answering *how* planners are encouraged to replicate state smart city imaginaries, with what materials, shows what literal and figurative space exists to reimagine them and how they come to have such a powerful imaginative hold on a range of actors.

2 The "Technological Everyday" of a State Planner

Alvin wakes up at 7:35 on Monday to the vibrations of his Huawei P Smart phone alarm. Bleary-eyed, he rolls out of bed and walks into the kitchen of the small one-bed HDB flat where he lives alone. After getting ready, he takes the lift down from the 30th floor.



Figure 77: HDB from Below, 2016.

Once downstairs in the common courtyard, he walks a few metres to the bus stop outside his HDB block, passively noticing the new state-sponsored advertisement for the Singapore science fair. The advert presents STEM fields as building blocks for Singapore's future, literally spatialised atop a map of the nation.



Figure 78: "Build Your Smart Future", Singapore Science Festival, 2016.

He checks his smartphone for live bus updates. It'll be a minute late, and there are only a few seats.

When the bus pulls in, Alvin queues to enter. He taps his EZ Link card on the reader but stays standing for the few stops to the nearest MRT (Mass Rapid Transit) station. He taps out when he disembarks and his card is charged the exact fare price between the two stops, like every workday morning. A wave of humidity hits him when the bus doors open and he hurries to the subway stairs, latently registering the bus advert he passes.



Figure 79: "The Future is Yours to Create", Advert for Singapore University of Technology and Design, 2019.

After tapping his EZ Link card again to enter the MRT, he sees another state-sponsored advertisement, which he reads while he awaits his train. This one is by A*STAR (the Agency for Science, Technology, and Research). In partnership with a wealth of multinational corporations, it invites the public to Fusionopolis, the high-tech hub where the smart home developers he works with create their test homes, to "discover the latest advances and exciting trends that will transform the future and our lives." He tells me later that he won't attend, as the Digital Planning Lab doesn't usually have to go to A*STAR's public-facing smart technology events: they are mostly about the smart technologies that pique the public and other international visitors' sci-fi imagination, not the more "mundane" planning technologies he works with. He'll see the developers at their next periodic meeting to check progress and get their most recent sensor data.



Figure 80: One North Festival MRT Advert, 2016.

His train arrives on time, and he squeezes into the busy subway car. The crowd eases after an exodus at Raffles Place in the Central Business District (CBD), and he gets off at the next stop, Tanjong Pagar. After a sweaty six-minute walk to the Urban Redevelopment Authority (URA) offices, he walks

through the automatic doors and feels a rush of cold air. He is met with the familiar sight of a large, airy atrium with floor-to-ceiling windows framing an open-plan gallery space on the ground floor.

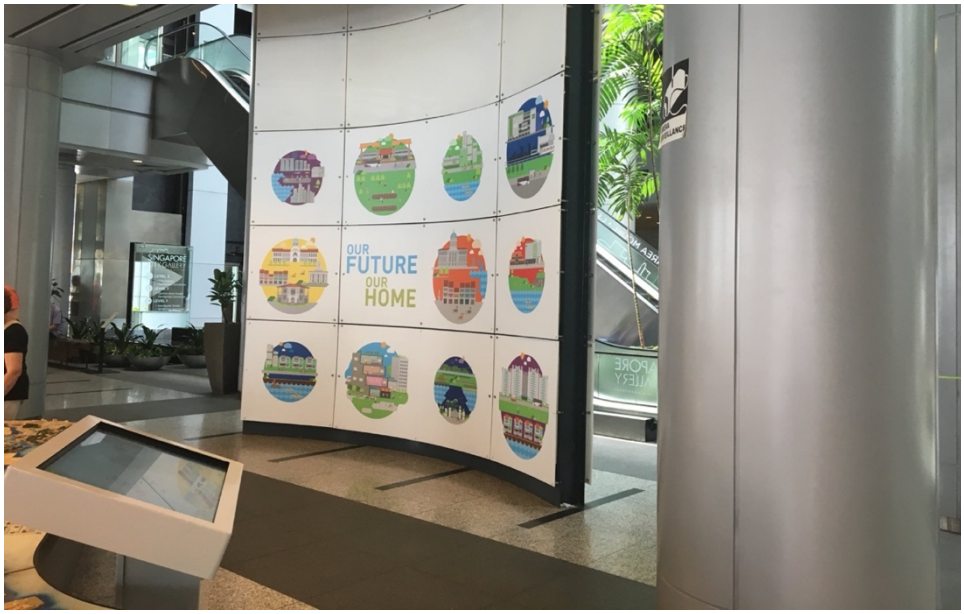


Figure 81: "Our Future, Our Home", URA Singapore City Gallery, 2016.

He walks through the public-facing Singapore City Gallery every day to get to his office on the 6th floor (Glass (2018:237) calls this gallery a "performative enactment of the state's vision for Singapore"). Barriers tucked in the back-left corner, accessible by ID card only, block the lifts used by planners to access their offices.

As he heads toward the barriers, Alvin passes the large-scale models of Singapore, avoiding the school group crowding around them. He overhears their guide, one of his colleagues: "The URA looks at time and space," she says, gesturing panoptically over the model island nation. "The land is very built

up. We look at data to do actual work, to keep making this space better for the future. This is a journey, a journey that is not easy at the beginning, and you also need to sustain it along the way."

Later this week, Alvin must give a tour to visiting Australian planners on how the URA uses these models to do Master Planning. Though he works for the Digital Planning Lab, they still use the island maps to do some model work on future development.



Figure 82:Model of Singapore with Visiting Tour Group, URA Singapore City Gallery, 2018.



Figure 83: Future Development, Building Model of Singapore, URA Singapore City Gallery, 2018.

He checks what area is currently under study, preparing for his Thursday visit to the model studio.

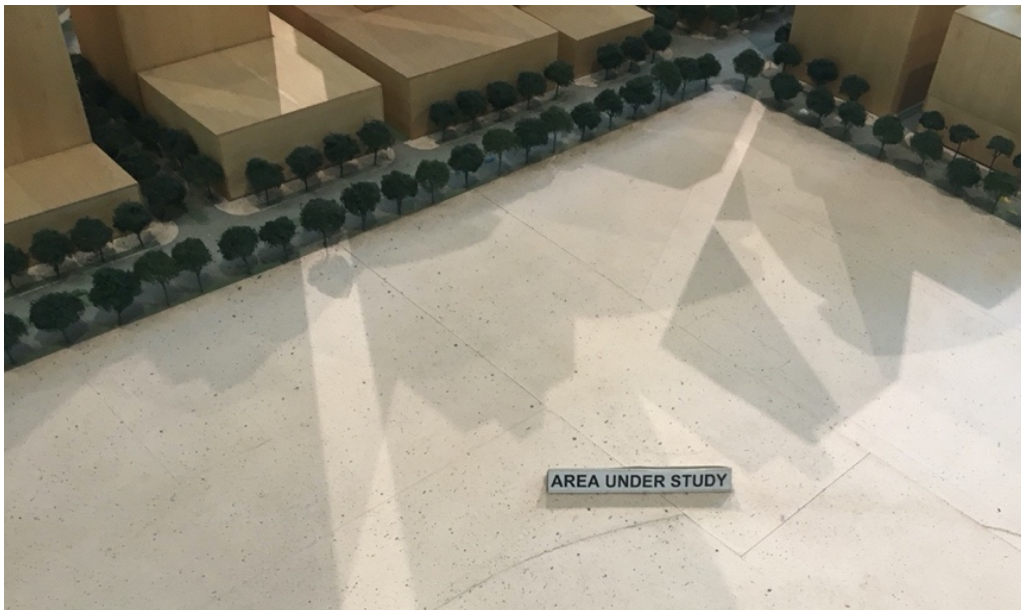


Figure 84: "Area Under Study", URA Singapore City Gallery, 2018.

He peeks in to see his architect friend Michael, who spends most of his time working with the models, but the studio is empty this morning.



Figure 85: Model Studio, URA, 2018.

Scanning his ID, the barriers open to allow Alvin access to the lift lobby. He scans his card again in the lift and presses “6”. The doors open to reveal the clean, minimalistic space of the Digital Planning

Lab. Behind glass double doors is a couch and coffee table covered with glossy volumes on designing social change through urban change in Singapore. The volumes are from the Centre for Liveable Cities (CLC), a think tank hosted in the URA on the floor above Alvin's, which aggregates and shares the state's institutional knowledge on urban planning and development. Alvin recently received an email from the CLC which called him a "building block" of that institutional knowledge and invited him to be interviewed about the history of the Digital Planning Lab. "Soon I'll be in one of these books," he told me, laughing.

Like most planners I watched go through their morning routine, Alvin goes to his desk and logs in to his computer with his state ID and password. Programme icons line his standardised desktop. Double-clicking on the "GEMMA" icon ("GIS-Enabled Mapping Modelling and Analysis", a smart city planning tool the URA designed with A*STAR developers) opens the programme's default page, a birds-eye map of the whole island nation based upon the current Master Plan.

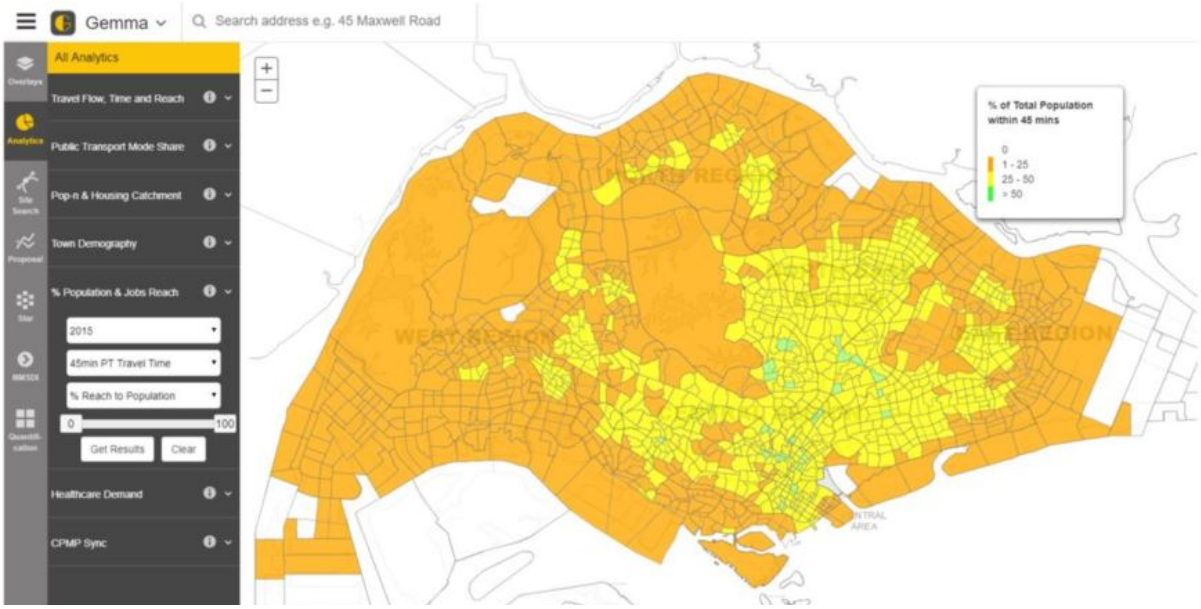


*Figure 86: GEMMA, URA and A*STAR, 2018.*

From there, he opens the latest GIS renderings of two interlinked projects he works on: a new mall to be built where an old HDB block currently stands, and the new HDB block where those residents will be relocated.

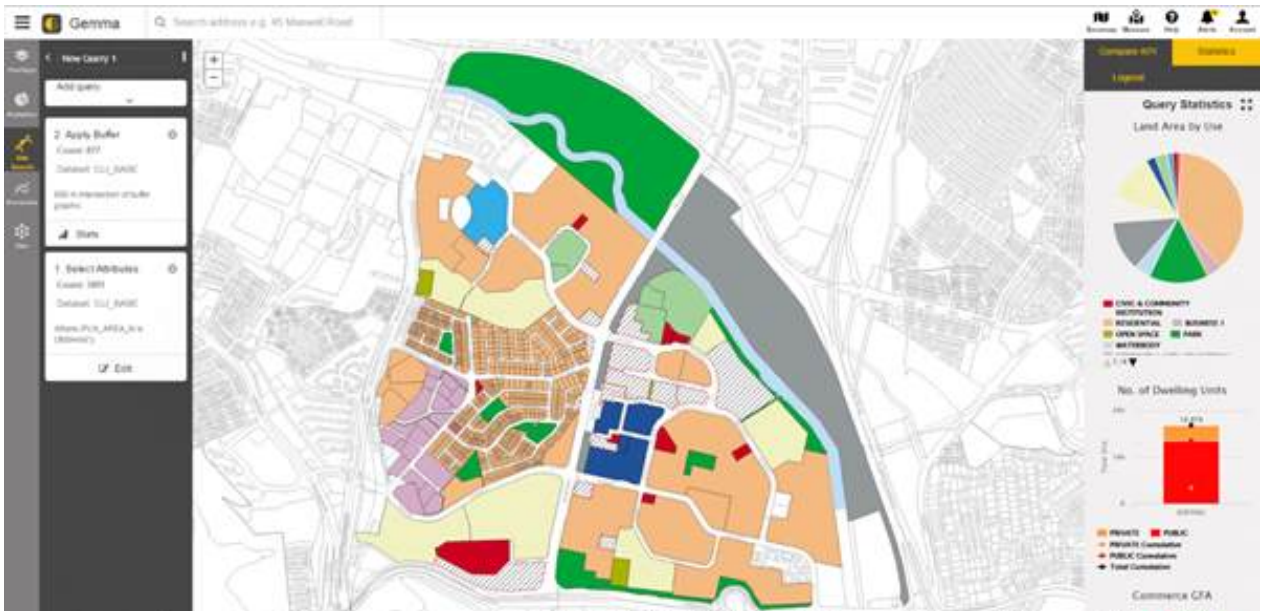


*Figure 87: GEMMA, URA and A*STAR, 2018.*

He opens the map of the old HDB block set for demolition and sees that the Land Transportation Authority (LTA) have inputted their data. Opening that data layer, he now knows the average length of walk to the nearest MRT station and how many mobile elderly people live in the area. This is calculated from how many elderly residents tapped their EZ Link cards on the crosswalks around the HDB block to ask for more crossing time, compared to how many elderly residents live in the HDB block. The latter are data the Housing and Development Board (HDB) already inputted.



Figure 88: Senior EZ-Link Pass Sensor on Crosswalk, 2016.

Grab, a private rideshare company, have also inputted new data into the system. He can see that despite a short walk to the MRT station, many residents still use car-based transport, an ongoing struggle the URA faces as it tries to discourage car use. This transport data will help him plan the new neighbourhood where these residents will be relocated.

He's still waiting on the latest data from the smart home sites in that area. The project is a pilot in partnership with a local university, and the sensor data are not yet reliable or interoperable enough to automatically load into GEMMA. But it will eventually comply with the Housing and Development Board (HDB)'s "Smart HDB Town Framework", already programmed into GEMMA.

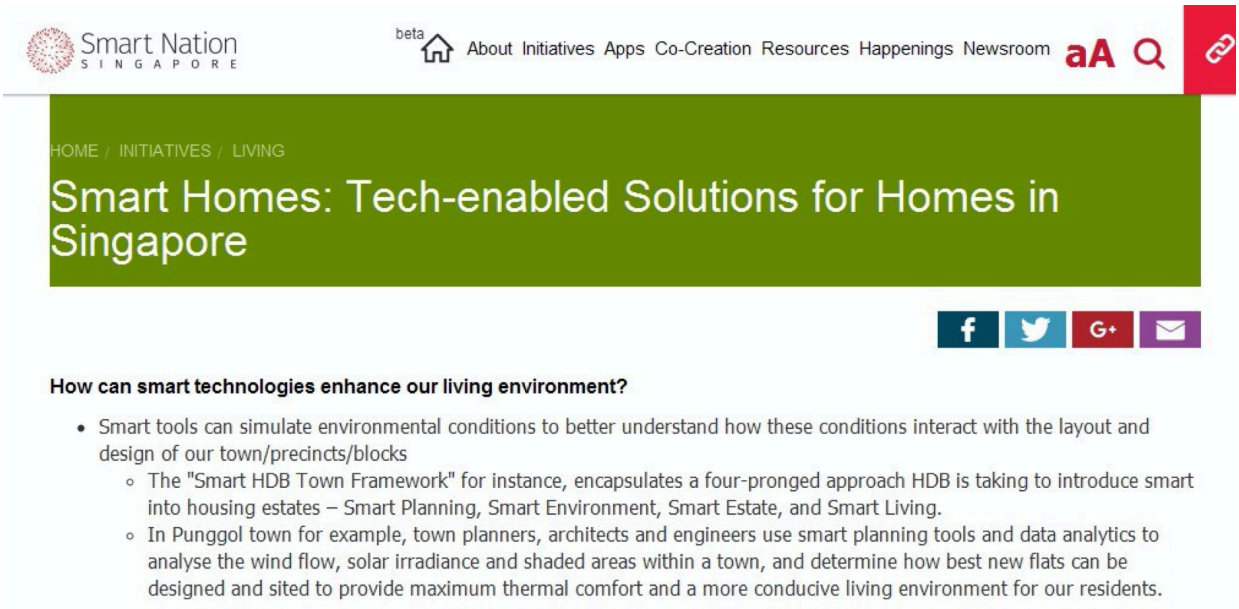


Figure 89: Smart Homes, Smart Nation Singapore, 2018. https://www.smartnation.gov.sg/why-Smart-Nation.

Opening the map of the new HDB, a note from his colleague tells him HDB have loaded their tenancy requirements into the system. He tells me that this information from HDB helps him review neighbourhood planning and zoning permissions to shape which residents can apply to live there and what kinds of consumption, recreation, and educational behaviours URA wants to encourage. This HDB is aimed at younger families and will be mixed-use, with shops, restaurants, and a primary school built in. The data includes the ages and marital statuses of the current residents, their races (Chinese, Malay, Indian, or Other, to ensure the new HDB build meets racial quotas), their citizenship status (all citizens or permanent residents, as no one classified as a "foreign worker" is eligible to live in an HDB), and whether they rent or own their flat and for how long (giving information about their economic status).

Alvin checks his calendar for upcoming meetings. One is a consultation session in the old HDB, where his team will tell residents about the plan for relocation—that the HDB will be demolished to make space for a mall, but they'll be moved to a brand new HDB. He has high-resolution pictures and colourful, approachable sketches of the new neighbourhood—with bright cycle paths, shiny playgrounds, big windows, and happy, multigenerational families. It's farther out of the centre, but he

hopes the nice amenities will make up for that. The residents will complain but will go in the end. They have no choice, he tells me. Another meeting is a roadshow for new smart homes in Yuhua, where he will present planned smart home solutions with an HDB planner to the old estate's residents.



Figure 90: Planned Cycle Paths at Tengah Town, Master Plan, HDB, 2018. https://www.ura.gov.sg/maps.


Figure 91: WoodsVista Gallery, "A Sustainable and Resilient City of the Future", URA, 2020. https://www.ura.gov.sg/maps.



Figure 92: Regional Highlights, Master Plan, URA, 2019. https://www.ura.gov.sg/maps.



Figure 93: Model for Multigenerational Living. Masterplan, URA, 2018. https://www.ura.gov.sg/maps.

Alvin also has an upcoming training session for new planners on using GEMMA for Singapore-specific urban planning. The analytics immersion programme, as it is called, teaches data analytics, data governance, and how different parts of your agency and other agencies use data. Under each course, Alvin organises people into teams of five and gives them a real-world problem. These are topics that the URA's planning departments or other agencies propose, like ageing, childcare, parking, industrial space, and greenery. He then teaches the planners specific techniques to analyse different kinds of data. He tells me his goal is to teach them "governance perspective": the policy or planning implications. They

then visit other state agencies to see how they use the same software and techniques—to develop a shared approach to problems. “This opens up your mind beyond your own agency,” he recounts that Xinyuan taught him in his first training five years ago.

He also has a monthly lunchtime brown bag on Wednesday, taught by a rotating group of planners, to maintain his knowledge of GIS applications for topics like Singapore demography and accessibility—important given Singapore’s rapidly ageing population—to ensure housing and transport models keep up with demographic shifts. In these “GIST” (GIS Training) sessions he also refreshes his knowledge of important technical functions, like reading attribute tables.

It’s a big month, he tells me, pointing to his Master Planning meeting with planners from all the major state agencies. He says these meetings are always heated: “spaces where everyone comes together, and they all have to articulate their problem statements and their visions of what the future looks like. Those visions get materialised in the Concept Plan and the Master Plan.” He quotes advice that Chris, an older planner, gave before his first big meeting:

> you could be working there [another agency] in a few years, so don’t try to get resources at their expense, because that means you’ll be short later, and you need to make sure you can tap on the vision that you built in the other place once you get there.

Chris now works at HDB, he tells me, fulfilling his prophecy. Alvin says he wonders where he’ll go next, and if his future agency employer even exists yet, as agencies are so frequently restructured. He thinks GovTech, which was the Infocomm Development Authority (iDA) a few years ago, and the National Computing Board (NCB) before that.

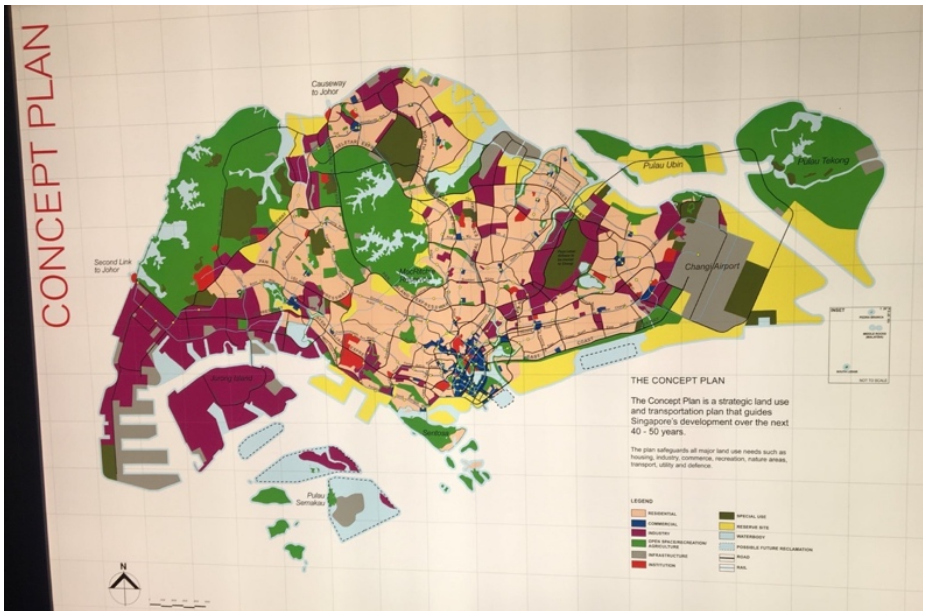


Figure 94: URA Concept Plan, URA Singapore City Gallery, 2016.



Figure 95: URA Master Plan, URA Singapore City Gallery, 2016.

When he's bored, Alvin Instinctively tries to check social media or read the Straits Times—but he can't, he tells me, because his agency computer has no Wi-Fi network connected to the outside world. He can only see the government intranet: only what "they" want him to see, he says—for data privacy and security reasons, allegedly. His friend Kevin, also a planner, thinks it's just state paranoia, or image control, because of a recent embarrassing breach involving healthcare data. The alternative is to

use the iPads around the office to look something up for work-related reasons, but they track what you do, he says. He scans for his manager and peeks at his smartphone instead, winking at me: there's a WhatsApp from Daisy, who works across the street and wants to get lunch.

After lunch at the local hawker centre, he returns for a meeting with other planners in the big boardroom at the centre of the Digital Planning Lab. His manager, Xinyuan, presents on how the URA's "total systems approach" interfaces with the HDB's "Total Environment" policy around housing, writing on the whiteboard.

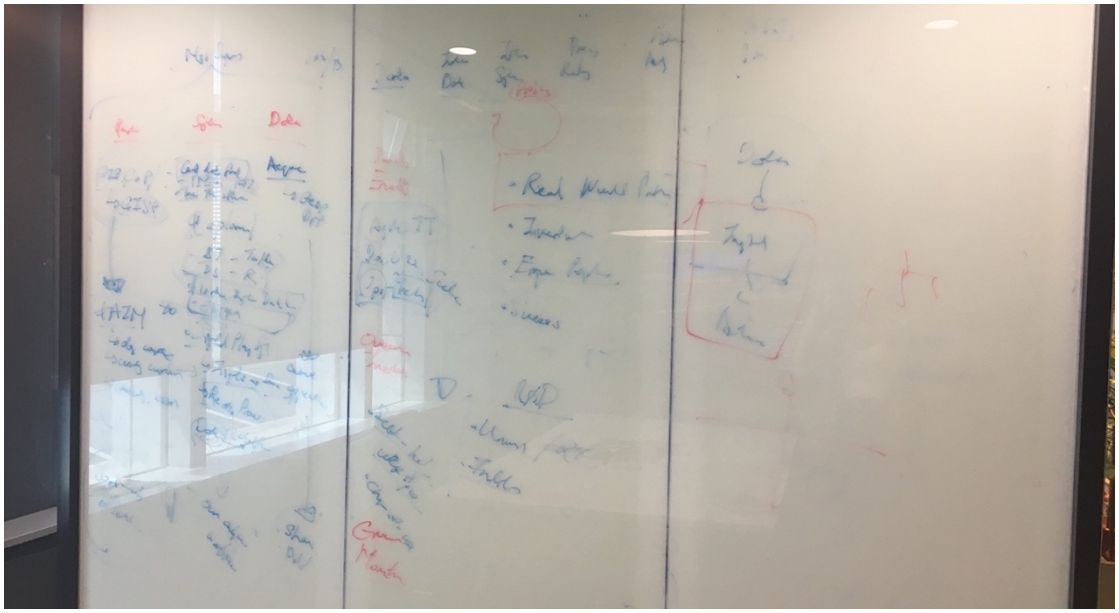


Figure 96: People, Data, Systems. Meeting at URA Digital Planning Lab, 2018.

The URA has created a three-part "whole systems approach" to smart city planning, Xinyuan reminds them: gathering data, building and making available the systems, and "building up the people," training them to think collectively and use data in the same way. She warns them to be critical of primarily data- or technology-focused approaches to smart city planning:

> Some of you ask: what data or technology should I focus on? But really you need all three: people, data, and systems. Because without all three it won't work. If you have people with competencies but they have no data or technology, they will be frustrated and will never be able to do anything. If you just have the system but no data and no one knows how to use it, you'll just be buying a piece of furniture to look nice in your office.

Everyone laughs, and she continues:

> If just data, you store it in a vault and you'll never see it. The value only ever comes about if you can bring those three things together. This is why we at the DPL are better than IBM or other companies trying to sell solutions like city dashboards: we recognised the possibility for us to do more ourselves, move away from outsourcing model, not just building the capability but also transforming the planning process along the way.

After the meeting and more work on the new HDB town's Total Environment, Alvin logs out and performs his commute in reverse, tapping his EZ link card as he goes. He eats at his HDB's hawker centre and heads home to watch Singapore lose to Thailand in the ASEAN Football Federation Championship.

. . .

Planners like Alvin experience a "technological everyday" in the digitally mediated smart city through "everyday, embodied socio-spatial experience" just like other urban residents (Amin 2007; Barns 2019:7). He wakes up in his one-bedroom HDB flat, the largest flat he can currently obtain from the state since he is unmarried. He interfaces with a range of technologies both consciously and unconsciously, many of them smart city technologies, as he moves through the space of the city on his way to work. He transits an urban environment saturated with references to Singapore's "smartness", part of the city-state's "affective ether of signs" (Thrift 2009:123). He gives his transportation and location data through his smart phone, EZ Link card, and state ID card which he also uses to gain access to his workplace (and registers his entrance and exit times). In the office, he engages more deliberately with smart city planning technologies like GEMMA, continuing to engage in a feedback loop or "relation of performativity" with a variety of smart urban infrastructures through the software (Leeker, Schipper, and Beyes 2017:11). These infrastructures "are not only spatial or infrastructural territories transformed or impacted by technologies…they also operate as imagined territories" or "built thought", as "idealised conceptions" are projected through them (Sandercock 2002; Barns 2020:54). Alvin "works through" those many interfaces in his daily life (Mattern 2014).

Alvin's experience demonstrates the "precise and diverse configurations" of temporal and spatial resources through which planners replicate existing citizenship access and exclusion in daily practice, and the kinds of "technical agency" planners have to imagine other futures (Rose 2017:789; Neff et al. 2012). Drawing upon Alvin's experiences, in the rest of this chapter I argue that normative future imaginaries are projected through the smart urban infrastructures that the planners work with. Planners replicate these imaginaries in their everyday practice and as they use these infrastructures to enact smart futures. I argue that they replicate these imaginaries, not always as state planners consciously repeating fully-formed understandings of existing state-mandated futures, but through an accretion of small learned and practiced repetitive everyday actions. Planners often unconsciously re-enact normative stories about the future in using digital maps to visualise and build the smart city the way they have been trained to.

3 Replicating the Smart City through People, Systems, and Data

Xinyuan assigned me homework before we met, ensuring my familiarity with Singapore's ICT history so she could guide me through the acronym soup of planning agencies responsible for Smart Nation infrastructure. She spent interviews energetically diagramming on the planning lab's giant whiteboard. When I asked about smart city creation in Singapore, she replied: "initially the smart city concept was companies trying to sell solutions, like the IBM city dashboard, combining data and technology." She said the Smart Nation actively moves away from this smart city model, because it recognises that planning is a "mix of the qualitative and quantitative, art and science." Singapore's smart city model instead "transforms the planning process" in a "whole systems approach, which has 3 aspects."

The aspects, as she taught Alvin and his DPL colleagues, are people, systems, and data. "If you have no data, cannot talk about data." But data is not enough, which she said many people do not understand. "To be smart is more than data. You must have the system, tool, tech, to allow you to work with data

and be able to get data easily, fast, get results you want more quickly." And finally, she said, both data and systems are useless without smart *people*: "You need people who know how to use data, know how to use tech and systems. Also who are able to translate what you get in findings to real applications in day-to-day life. Need to know what to *do* with the data."

The smart city as primarily corporate-driven was also challenged by planner Daniel, on the same basis that it required such complex, repeated institutional work from cities and states:

> They've [corporations] realised that it takes too much coordination effort. There's a lot of work that goes into it, getting the agencies to work together, the private sector, all the different parts. It's a lot more complicated than they thought it was at the beginning. So the companies don't do smart city stuff anymore. They don't know how to build cities. Now they're into AI, that kind of stuff. Cisco, companies like that, they were into IoT [Internet of Things] but not at the urban planning level. They've backed away. Because they realised it was an urban governance problem too, and that's so difficult. Now those companies are coming to Java [Indonesia] and trying to sell them stuff, it's terrible, because they know it won't work and are just trying to profit.

As a result, the URA rejects profit-driven corporate outsourcing models, as Xinyuan expressed to Alvin in the training meeting. It instead uses a "whole systems approach" to planning the Singapore smart city, defining "smartness" as smart people, smart systems, and smart data. In the following sections, I describe state agencies' use of people, systems, and data to replicate shared Smart Nation sociotechnical imaginaries of standardisation, connectivity, and futurity.

4 Standardising People

Senior state planners like Xinyuan imagine smartness in the Smart Nation model to be more about people who think in standardised ways than about cutting-edge smart technology. Agencies train state planners to be "smart" about the use of systems and data to solve Singapore-specific problems, to imagine and replicate its future in continuous, standardised ways. Playing on Scott's (1999) *Seeing like a State*, I conceptualise this training in how to visualise the smart city as *Imagining the Future like a State*. In this section, I first detail two institutional practices that encourage spatial and temporal replication of the state's existing future imaginaries: cycling ministers through different agencies and restructuring

agencies themselves. In these practices, smartness is repeatedly enacted both as a social capacity of citizens (including ministers and planners) and a technical capacity of technology. I then show how planners train other planners to replicate existing smart city sociotechnical imaginaries, using material-symbolic resources like those detailed in Chapter 4.

4.1 Smart People Imagining Smart Futures in Smart Agencies

Many state planners I interviewed, like Xinyuan, envisioned people as crucial smart urban infrastructure. This theme of smartness as *human* smartness resonates with Singapore's state minister model. Ministers are highly educated and highly paid, the "best and brightest." The state pays for students to attend prestigious international universities. In exchange, students sign a contract bonding them to a Singapore state agency for three to seven years, ensuring that newly produced smart citizens remain in the Smart Nation.

State planner smartness is more than an abstract value: it is materialised and replicated in state hiring and manpower circulation practices. Ministers and other state planners strategically cycle through state agencies (note the many agencies each minister I cite has been employed by), ensuring a lateral and temporal continuity of imagination. Recall what Chris said to Alvin about inter-agency cooperation:

> if you know you could be working there in a few years, you aren't going to try to get resources at their expense…you need to make sure you can tap on the vision that you built in the other place once you get there.

This phenomenon illustrates how sociotechnical imaginaries become collectively held: by cycling ministers through different agencies, agency storytelling policies and practices become increasingly continuous across time and space, replicated through repeated enactment. Smart ministers create smart agencies which create smart cities that create smart citizens (replicate ad infinitum).

Vivian Balakrishnan, who I cite extensively in Chapter 4, exemplifies this practice. Now Minister-In-Charge of the Smart Nation initiative and Minister for Foreign Affairs, he was formerly head of the

National Family Council and the Minister for Community Development. His stories about the national family as the building block of the nation's future have cycled through state agencies with him, becoming part of Smart Nation discourse. His stories of rapid technological development as the nation's future have also cycled through state agencies with him. In his new position, he cites Singapore ministers' prestigious STEM educations to inculcate a collective sense of state smartness:

> Almost half of our cabinet consists of engineers. Our Prime Minister is a mathematician. He studied computer science almost four decades ago in Cambridge, and he can still code. Please check out his code and you will see the functioning of an elegant mind that understands what this is all about. In other words, we get it.[30]

According to Balakrishnan, this smartness of ministers produces the smartness of the city, because smart ministers who are technologically savvy know how to use data and systems intelligently. Smart city technology procurement is complex. As URA planner Abbi, who previously worked in Paris and London, articulated:

> You have to make sure that you have people in government who understand what they are asking for technologically…one of the big problems in other cities is you have people in procurement who were like, 'I don't know, that seems easier, like that big click and collect system.' So the idea is you have people who are able to discern between different kinds of technologies, know what is best.

Tan Kok Yam, former head of the Smart Nation Programme Office (SNPO) and subsequently Deputy Secretary of Smart Nation and Digital Government Office (SNDGO), thinks that building the smart city means getting people to build a sense of collective identity: "A smart city is one where…we can allow people to say, "I'm building something that is bigger than myself. I'm not just downloading."[31] This smart people concept is expressed in the Smart Nation slogan, bringing residents into a shared national space: Many smart ideas, one Smart Nation.[32]

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[30] Opening Speech by Dr Vivian Balakrishnan, Minister for Foreign Affairs and Minister-in-Charge of the Smart Nation Initiative at the Internet of Things Asia Conference, Singapore Expo, 30 March 2016.
[31] Tan Kok Yam, "Interview by CLC", Centre for Liveable Cities, Ministry of National Development, 1 December 2017, transcript, accession number CLC/042/2017/006.
[32] Smart Nation Singapore: Many Smart Ideas, One Smart Nation. Government Technology Agency of Singapore. April 11, 2017. https://www.youtube.com/watch?v=c1oLdM6wcpw

Creating and sharing the Smart Nation imaginary as a “strategic national project”, another minister argued, does material work to bring funding for the smart urban infrastructures that make up the Smart Nation. When I asked why “Smart Nation”, he responded: "By adopting term 'Smart Nation' rather than 'smart city', it sends a clear message that a whole of nation effort is needed.” This “whole of nation effort” resonates with Tan’s need to inculcate in citizens a sense of building something “bigger than myself”. This sense of national belonging takes imaginative and material work to create and maintain, work that state planners in Singapore perform. As planner Hin put it: “When you know you won’t be out of office in four years, you can make big infrastructural plans and actually carry them out.”

4.2 Restructuring State Agencies

Agency structure tells a story about how Smart Nation futures become replicated through planning practices. Planning agencies responsible for the Smart Nation project are distributed across and integrated into each Ministry: National Development, Trade and Industry, Transport, and Communications and Information (Figure 97). The Smart Nation and Digital Government Office (SNDGO) lies under the direct purview of the Prime Minister’s Office (“his pet project”, as an interlocutor who used to work there put it) (Figure 98).

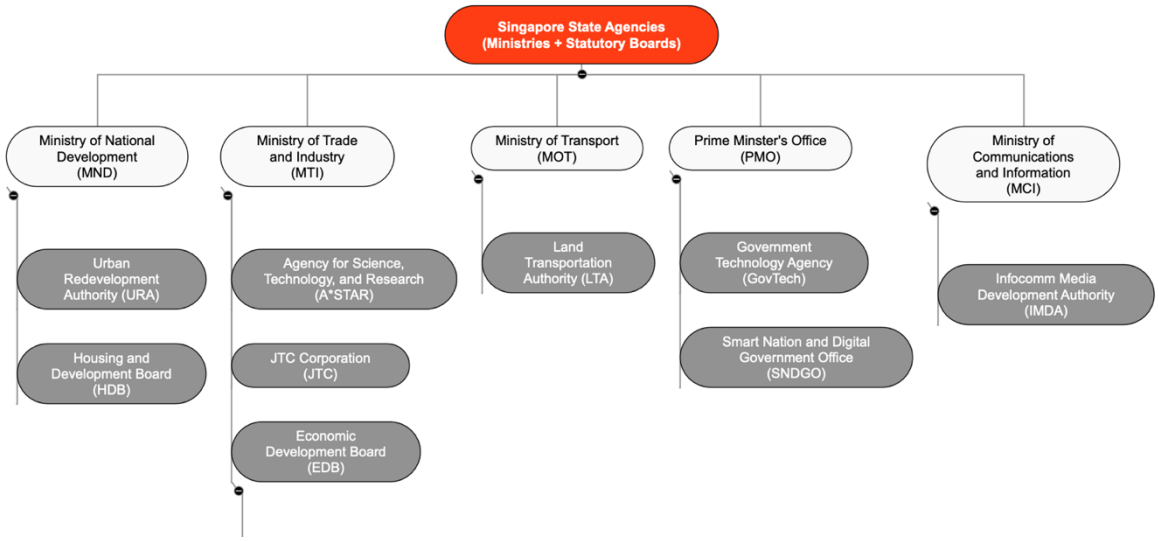


Figure 97: Relevant Singapore State Agencies

As Alvin is well-aware, planners cycle through different agencies to ensure continuity of imagination and planning practices. He also knows that agencies themselves are frequently restructured and merged to ensure each enacts the same national priorities. When I began fieldwork in 2015, the now non-existent Infocomm Development Authority (iDA), which used to sit under the Ministry of Communications and Information (MCI), was responsible for Smart Nation technological development, among other media and communications development and regulation. In 2016, GovTech was created to focus explicitly on Smart Nation development, leaving the new Infocomm Media Development Authority (IMDA) to oversee and regulate national media. The Smart Nation programme was given its own group in the Prime Minister's Office to implement changes across the other ministries and statutory boards, globalising its imaginative and infrastructural control (Figure 98).

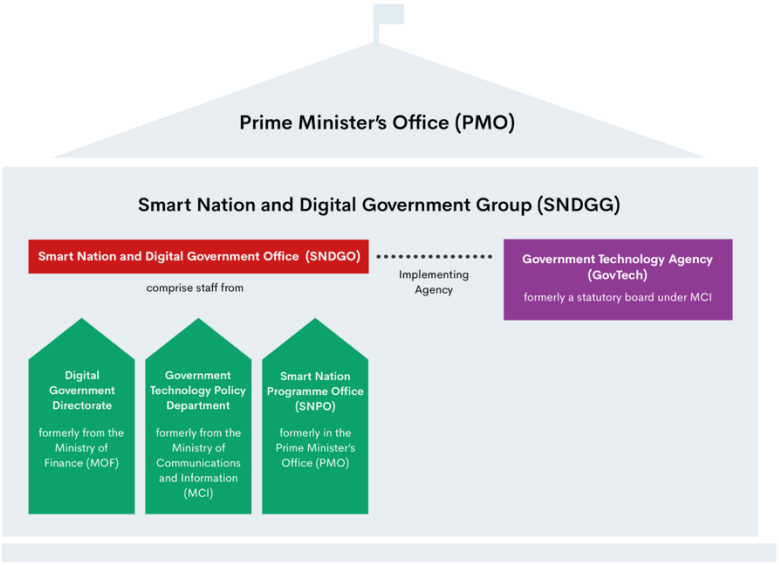


Figure 98: Smart Nation in Prime Minister's Office. https://www.smartnation.gov.sg/why-Smart-Nation/sndgg

Restructuring state agencies to prioritise Singapore's smart city development is not new. As I described in Chapter 4, the iDA came into existence when the National Computing Board (NCB) merged with the Telecommunication Authority of Singapore (TAS) in 1999, because of the IT2000 Master Plan. The goal was to become an "intelligent Island" by the year 2000; now, the "world's first Smart Nation"

by 2025. A former Ministry of Finance (now Ministry of National Development) minister explained the importance of agency mergers and cycling:

> We started building our infrastructure far ahead of everyone. Looking ahead at the merger, you know in 1981, when Hon Sui Sen was Finance Minister, he told me that we had to combine telecommunications and computers. He was far ahead of everybody else. That is why I brought Goh Seng Kim, [who] was then-head of TAS on the NCB Board and Tan Chin Nam from NCB sat on the TAS Board. The idea of bringing these two together started long ago. That was in 1981.

Both the restructuring of state agencies and the training of ministers in technological literacy to replicate state sociotechnical imaginaries is thus historically continuous, as the state, rather than private enterprise, built Singapore's ICT infrastructure. It came into being through a continuity of planning practices replicated through a continuity of state planners across and inside agencies, tied to the story of Singapore as futuristic ("far ahead of everyone") due to rapid technological development.

Thus, rather than solely being a new development created to increase profit of private corporations, the smart city imaginary does important nation-building work. It continuously synthesises imaginative and technological development, materialising state sociotechnical imaginaries in smart urban infrastructure and replicating them through employment and agency restructuring practices.

4.3 Training Planners to Replicate the Smart Nation

As I argued in Chapter 2, people's capacity for reimagining state future imaginaries is not unbounded. Planners' ability to reinvent relies on the material-symbolic resources they have to imagine other futures with (Ahmed 2006) because these processes happen in tandem with the physical environment they think with and through. Further, planners must *learn* how to replicate and reimagine, in part through generational transmission, which can limit what they render imaginable (Rose 2017). These limitations can lead to the reproduction of existing socio-spatial inequality if wider resources and ways of reimagining are not encountered. Alvin engages with a limited range of material-symbolic resources (recall the technological restriction which keeps him inside the state intranet). He learns how to replicate

through generational transmission, as senior planners teach younger planners how to use smart city technologies to visualise and enact the city-state's future in specific ways.

In this section, I argue that repeated state planner training practices have continuously been central to replicating the sociotechnical imaginary of the Smart Nation across, and within, state agencies responsible for literally and figuratively building the nation. In training state planners to visualise Singapore using the same digital mapping tools, those in the URA's Digital Planning Lab explicitly sought to create easily replicable daily practices through which planners could repeatedly project the Smart Nation both materially and imaginatively. These trainings and tools used by the state planners are transmitted genealogically through pre-existing state planning technologies and agency structures.

An interview with a former NCB member illustrates how planners learn to replicate existing state imaginaries, showing how central training people to imagine the future like the state has been to building the smart city both materially and imaginatively:

> I was in the MINDEF [Ministry of Defense] then...leading ten teams of officers from ten ministries, comprising computer professionals from the Computer Services Department as well as the Systems and Computer Organisation in MINDEF to come up with ten plans for the ten ministries. That became the Civil Service Computerisation Programme and it was injected into the National Computerisation Plan, along with a report of a visit where Philip Yeo led a team of six, including me, to visit IBM's training facilities…That led to the idea to form the National Computer Board and to form the Institute of Systems Science (ISS) in NUS [National University of Singapore] as an independent body to train systems analysts, convert non-graduates in IT to information systems professionals and *provide computer appreciation courses to senior management and parliamentarians so that they would be supportive of this National Computerisation Plan*.

Ministers designed training to both train state actors to understand technology and to replicate the state's vision of the role of technology in its national imaginary.

Alvin's experience shows that the URA takes a similar approach in training state planners today. He and Xinyuan do not consider training a one-off occurrence, but rather a process through which the agency creates a "geospatial community of practice." The monthly GIS Training (GIST) brown bag lunches

Alvin attends demonstrate how building this community of practice is an incremental process which expands over time. State planners replicate state sociotechnical imaginaries through these incremental processes, as students become teachers. The smart city is not a monolithic entity created once in terms of technology, data, or people, but instead comes into being through repeated daily acts.

Importantly, the "analytics immersion programme" Alvin went through as a student and now teaches was not just about learning GIS as a general tool. Rather, the program was contextually tied to the building of Singapore itself and its agency structure, on an everyday level. According to his teacher Xinyuan, who Alvin now parrots in his trainings, the software does not need to be created in-house, but the training programmes themselves do, so that everyone knows how to use the technology in the same way. They are not just taught how to use the mapping software in terms of technical function, but how to use it to visualise the city in standardised ways continuous with state planners that came before them.

Trainings focus on the everyday practice of using the technology to replicate a particular vision for Singapore's urban future. As a result, the training course is "fully designed and almost fully run in-house", with the planners themselves "designing course and curating the curriculum and conducting the lessons." Another URA planner, Jiaming, described why this was important:

> When you subscribe to a course provided by software providers, the focus is in teaching people to use function. It is impossible for them to connect it with day-to-day stuff. Having our own planners who know how to use it in day-to-day work, they teach other people how to use it. It's thematic: instead of learning functions, you learn how to investigate a certain theme by using functions…hands-on sessions for all to learn how to use GIS to look at things like demography and accessibility.

Replicating the Smart Nation is in large part about teaching people to think about the role of technology in building the state *in a standardised way*. This practice explicitly and continuously creates a shared smart city sociotechnical imaginary, a plan for the city-state's future blueprinted into practices of the people that build the city.

The goal to continuously create a shared smart city sociotechnical imaginary extends beyond individual agencies, as trainings (coupled with the cycling of individuals through different agencies and the restructuring of those agencies) bring people from different agencies together to imagine city-state futures in the same way. Recall Xinyuan's statement about learning to "open up your mind beyond your own agency" and the trainings with "real-world" problems Alvin does with other agencies.

Xinyuan stressed the importance of standardising and scaling this process, in keeping with the modular imaginary of the Smart Nation project. She explained how the URA trained forty participants in eight to ten different Smart Nation projects per "run." Doing six runs twice a year allowed them to "scale" as the students became the teachers. Within three years, people moved from "zero to intermediate GIS users…fifteen, twenty odd people became three hundred to four hundred architects and urban planners" involved in the programme, just at the URA. This expansion of people also led to the material expansion of the smart city planning technologies themselves, she articulated, as people added more "use cases" to the software for teachers to "choose from and show".

Referencing the interactions between people from different agencies and backgrounds, Alvin and other planners repeatedly emphasised that the Smart Nation is "more than just an IT project." It is about having an "ecosystem", Alvin maintained, where "planners have a grasp on what is possible with different technologies" and "software engineers familiar with technology learn more about planning processes to be able to suggest which are useful."

Alvin described the Smart Nation building process as highly recursive. Early adopting planners first needed to overcome inertia to expand the project to other agencies: "It's a whole organisation that needs to move, with practices that have been in place for many decades, it's not easy to change overnight." Once trained how to use the software, people across agencies felt empowered to contribute their own data and improvements to the system and teach others how to use it. Knowledge transfer,

therefore, does not just occur in a one-way transmission from certain planners who indoctrinate other state planners into a pre-existing state imaginary. It is repeatedly materialised through everyday practice. Once planners like Alvin learn how to use the software, Jiaming says:

> we come back to people and what they do with it. When more data becomes available, tools become more capable, people can also do a lot more things. And the innovation of our project is that it has always focused on real world issues, day-to-day life. Many agencies saw need to go just beyond small independent projects, scaled up today to URA. Now we have joint labs, collaborations, agency-agency level partnerships. Through partnerships we do two things: add new capabilities and modules we incorporate within the tools and work with them on specific analytic studies. Like elder care, social support, industrial issues. Many of these studies must be tied together, bring experience and knowledge for domains.

This focus on standardising daily practice allows the imaginary to be replicated as it expands across different state agency domains. In Chapter 7, I show how this focus on day-to-day repetition leaves space for planners to reimagine normative futures with residents, in small but significant ways. Xinyuan described the interactions between people that make the system and vision evolve:

> As a planning agency, we are upstream. But there are operational concerns that downstream agencies have to deal with—so we ask, is it viable, can they get people to want to use it? We ask what implications they have to deal with. When you do studies together, you can bring upstream and downstream together. We map digitalisation journeys—tasks focused on integrating data, integrating systems, process redesign. This is the task that we focus on—building this together.

Her focus on integration and mapping people's day-to-day digitalisation journeys shows the importance of people in Smart Nation development, troubling analysis of the smart city as inherently based upon abstract corporate models or detached from people's everyday lives.

The combination of state planners with long-term job security cycling through different agencies and the training described above means that "smart" people replicate the Smart Nation sociotechnical imaginary across time and space, evolving (and expanding) it but maintaining its standardised identity as a smart city project and its general future goals. In the next section, I describe the systems these practices co-produce, explaining how state planners build the smart city with the material-symbolic resource of connectivity.

5 Connecting Systems

State planners have long imagined smart urban infrastructure as vital to connecting state agencies and connecting Singapore with other nations. In this section, I follow my interlocutors' focus on "mundane" technologies—centralised ICT infrastructures and interoperable GIS maps—to show how sociotechnical connectivity allows them to share both future imaginaries and data. I first describe how planners create and use shared IT systems to replicate the Smart Nation as a connective sociotechnical infrastructure. Second, I demonstrate how state agencies demand technological interoperability to counter corporate smart city control and ensure interoperability of imaginaries across agencies.

5.1 Creating Shared Systems

Xinyuan jumped to the whiteboard and started writing furiously. "So now people know *how* to use data, they need a way to access it. This is where the systems come in:"

> In terms of the system, we need to enable people to get data fast once they know how to use the software. So we have GIS on your desk, calling data from database. Our questions were based in our practice. How do you enable people to get this data fast and on mobile device? How can we enable planners to be on site and have data at fingertips? Our first tool was called Planner. It was a web-based platform within our environment, where planners can click and press, map will overlay very fast. We went from layer that took five, ten minutes to load to one second. Quantum leap. Enables people to access data quickly.

The main technologies used in Smart Nation planning are GIS-based, accessed through a centralised IT infrastructure. The real smart technologies, planners repeatedly told me, are mundane not flashy (evoking Leszczynski 2020). They frequently asserted that the most useful "smart" technologies involved the smartness of the systems practices themselves, which allowed for standardisation, connectivity, and rapid future planning, not "bleeding-edge" technology like AI. These shared systems allow state planners to have the same vision of the city and, correspondingly, build and implement the same imagined futures for the nation.

These future visions, far from being abstract and divorced from reality, were "based in" planners' daily practices, as Xinyuan articulated. She said bringing planners into a shared imaginative

space, the “geospatial community of practice”, is achieved through daily interaction with the planning technologies: “Because all the data becomes available, it becomes possible to redesign planning process so it’s more collaborative across all the agencies and you have a shared view.”

Practices of data sharing recursively enabled the systems to expand, as seeing the systems in practice encouraged planners to increasingly share data. Planner Amit, part of early digitisation efforts, explained:

> If you have systems where you can actually see it being used, it helps people become more aware and can appreciate value that data brings…because the tools that we built subsequently got extended to many other agencies that work with us, who also need the data, the tools enable us to incorporate more data from different sources and overcame many of the initial concerns.

Amit explained that the URA connected agencies by encouraging data sharing practices. They convinced other agencies by showing them their data in use and through their administrative power over space:

> We took their data and showed them use cases. Since we're here, and since we deal with land use and permits, we already had a lot of data—because *anyone has to go through us to get anything done, whether its land or housing*. So we had a system already built to show them.

The URA operates as gatekeeper to the future of all urban space, and everything must go through their system. Resistance still occurred, Amit said, but because the Smart Nation plan was so supported by the Prime Minsters’ Office, he could mandate changes across all agencies (Xinyuan said the same about being well-supported from “higher up” from the project’s beginning). Amit recounted difficulties in getting initial data from agencies:

> People did not want to share data, they wanted to keep it close. But we had MOF [Ministry of Finance] behind us and we were able to say: if you want to keep things in your vertical, in silos, ok, but you won't get funding. It was effective: you don't share data, you don't get funding. And on an everyday level, we fight. But they are productive fights.

URA’s power to discipline other agencies and the demonstrated efficacy of systems in practice convinced planners to contribute to an increasingly connected, shared Smart Nation vision.

The smart aspect of this technology, according to Alvin and other planners, is that “all of the proposals and consultations are actually done in the same system”, a GIS-based map built from state

Master Plans that "tracks all upcoming and ongoing land infrastructure projects." Jiaming walked me through the planning practices for an ongoing Smart Nation project, Punggol Digital District:

> We look at it as one continuous Master Plan. We want to co-locate and integrate various uses into one district. Business park, university, community spaces, all integrated together. We are trying to provide continuous data—from sensors and buildings. Make these data available for students, researchers, business, to create different apps, products, and services. One of the biggest things I'm excited about is that this project brings together different people—university, businesses, to come together to share resources and ideas.

The smart city's smartness, Xinyuan argued, emerges from people's everyday use of the mapping systems: their capacity for sharing and visualising data together across state agencies (and as Jiaming articulated, expanding to private and university actors) working on an interconnected but large range of urban problems and infrastructures: "A lot of people talk about AI but I think it's about how you really provide better decision support using technology to help them know what to do." This, Xinyuan says, requires focus instead on a "unified, standardised planning practice and technological systems piece. They have to go together." She says the smart city is not about "technology companies" talking about "this or that cutting-edge technology", but instead how you create a shared understanding of the "real world" you are planning for:

> If you know how to use technology but don't have info you need, that's a problem, and vice versa…I see globally many technology companies talk about this or that cutting-edge technology but I strongly believe that end of the day what you need is to have the capabilities and what you use be able to apply into the right domain, and it has to be focused on the real world…how to go from real-world problem, to better understanding of the issue, to an action.

This "total systems" and "real-world" rather than "cutting-edge technology" focus explains why some planners, less excited about practical, everyday smart city technologies than Xinyuan, dismissed the "Smart Nation" as not particularly smart. Kevin is one such URA planner. Like many, he was educated at an elite university abroad. Chinese-Singaporean, he introduces himself as a "Blairite" in the Queen's English accent. He is dating a former URA planner, Clarissa, who is English.

On one occasion, I met them at a restaurant underneath the towering skyscraper where Clarissa works. Kevin grinned impishly. “So you want to know about the smart city? I hope you’re ready to be disappointed.” He launched into his take on the Smart Nation:

> It’s all heat and no fire. Actual smart things aren’t flashy, and flashy things aren’t smart. Everyone loves data dashboards. They want to sit in their offices and see the pretty pictures. When the pictures of the Rio control room came out, everyone was circulating them like 'look at this, it's so cool'. But it's shut down now, totally defunded. It wasn't actually useful. We have a dashboard but it’s not really a dashboard—it's just a way of sharing information. The actual 'dashboard' part that is showing the data is all populated with out-of-date data when funders come by, so they ooh and aah. The thing we actually use is the GIS map—I can upload it and then everyone can see it and make comments, accept, reject. The reason I can do this is that the government has a centralised IT system. If I upload something everyone else can see it, including our partners in the LTA [Land Transportation Authority].

“It's still just a 3D map, essentially.” Kevin said. “It's like a GIS map. It’s mostly incremental, nothing amazing. It's useful, and most of the tech is about efficiency, not about 'smartness’.” His use of the word incremental is particularly interesting, as it describes the processes of differentiated repetition through which I argue sociotechnical imaginaries are replicated: in repeatedly enacted, incremental ways through daily interactions with material infrastructures.

Similarly, Daniel (a planner I interviewed in 2015 and 2018) tempered language about Virtual Singapore, a “cutting-edge” 3D visualisation tool introduced with great hype in 2015 as part of the Smart Nation plan:

> They don't use Virtual Singapore for long-term future planning anymore. That was the dream at the beginning. But it's been scaled down, is more practical. It’s for modelling small things, or short-term future things, like what happens when a terrorist attacks. It's moved beyond the initial hype.

Kevin’s position and Daniel’s description demonstrate how mistaking the corporate imaginary, in the form of data dashboards and tools like Virtual Singapore, for the entire smart city imaginary misses large pieces of what the smart city is and does, its continuous material-imaginative effects. It is the more “mundane” but genealogically continuous technology of the map that is used most to repeatedly enact the Smart Nation.

This attention to smart city planning practice also shows how planners can resist a sociotechnical imaginary like the smart city, yet still replicate it. Kevin and Xinyuan, for example, have seemingly opposed positions on the Smart Nation. Yet upon closer look, both replicate it in their daily practice, repeatedly engaging with the same smart urban planning technologies to do their work.

Despite eye-rolling at the Smart Nation, Kevin still thinks Singapore is the "best" smart city because of another seemingly mundane technological function: interoperability. He lauds Singapore state agencies' commitment to technological interoperability because he says it enables imaginative interoperability, allowing planners to easily co-produce future plans. I turn to this concept in the next subsection.

5.2 Technological and Imaginative Interoperability

Commitment to systems interoperability sustains the ability to share future imaginaries within and across state agencies. Data sharing practices, enabled by this interoperability, help planners replicate existing state maps of the future. Many lauded the Singapore state's "forward-thinking" technological interoperability. Kevin thinks it makes the Smart Nation futuristic compared to other countries:

> Unlike in the UK, Singapore has prioritised throughout the Smart Nation thing that we be safe from corporate non-interoperability. They won't be held hostage by any corporation. Sidewalk [Google's urban planning arm in Toronto] on the other hand is just total corporation control, that's not what we have here. For example, here you can make people's records travel with them. As opposed to the UK where there are no electronic medical health records, so many different IT systems, nothing works. It's like a third-world country…actually, it's better to operate in a system where there's no infrastructure like places in Indonesia, where we can then go and build something robust, than shitty non-interoperable infrastructure. So the UK is further behind than a third-world country.

Rather than being a corporate imaginary, Singapore's smart city imaginary protects *against* corporate logics of control. Planners expressly build this interoperability in active opposition to corporatisation and present it as a futuristic model for other cities. One minister-in-charge of a planning agency told me that interoperability put Singapore ahead of other smart cities, and is why they are widely seen as "the best" smart city internationally:

> The Singapore government is not beholden to private industry and never will be. They [corporations] can operate freely if they play by the rules, but we do not allow them to put their own interests above those of the state. We create a good environment, mutually beneficial, but our visions come first. They know this.

Interoperability means that the state's vision comes first, as the minister put it, and can be freely shared across different state agencies. This capacity makes a replicated imaginary possible both technically and at the level of everyday practice. Interoperability allows for easy sharing of practices, data, and visions across agencies: key considerations for the URA when selecting tools for Smart Nation planning. As Xinyuan described:

> We have different issues in terms of governance. So it is dependent on tech providers whether their business model allows interoperability. For us, technologies are more at an interfacing role. Technologies tap onto them for data. Our requirement for interoperability is very high, so this becomes their enterprise, a mix of business model where they make money if they interoperate for us and follow our guides, speak to the governance requirements we articulate.

As Alvin experiences, this requirement also allows state agencies to control what data do *not* enter their systems, shaping what resources planners can access to design the future of city areas.

In short, interoperability is a key "smart" technology which facilitates the "total systems thinking" required to create the Smart Nation. It enables certain enactments of state power—like the ability to create totalising future visions—but those visions are not strictly corporate or tied to neoliberal capital. Nor are those future visions static or guaranteed, as they must be repeatedly enacted. Instead, these enactments of power through interoperability build upon Singapore state agencies' historical ability to enact their future imaginaries through smart urban planning practices and infrastructure. In the next section, I explain how data sharing enabled by these shared, interoperable systems generates planner mapping practices which replicate Smart Nation futures.

6 Enacting the Future

Tracing current planning practices and material-symbolic resources alongside the HDB and ICT history in the previous chapter clarifies how continuous institutional practices project the sociotechnical

imaginary of Singapore as a standardised, connected, and futuristic smart city (from "Intelligent Island" to "Smart Nation"). In Chapter 4, I historicised Singapore smart city data and the infrastructures that store and transmit it. State agencies gather resident data in part using continuously updated smart urban infrastructures, like sensors and fibreoptic cables connected to HDBs (which make up the "smart homes" I analyse in Chapters 6 and 7). They repeatedly input this data into the smart city mapping technologies discussed in this chapter to make maps of the future. The systems described in previous sections produce shared maps of the Smart Nation, which state actors repeatedly materially engage with in their daily planning practices. Both this planning process and the material maps it produces have genealogies which shape their present material-symbolic meaning and use.

In this section, I ask: what material-symbolic resources are planners given to imagine futures with? I analyse the smart city mapping technologies Alvin interfaces with, and the future imaginaries manifested through his daily routine. I first describe the mapping technologies and their genealogies, explaining how they provide planners a standardised view of the Smart Nation based upon preceding state agency practices, policies and infrastructures detailed in Chapter 4. I detail how state planners produce and input data into these maps and make them accessible to state planners in other agencies, replicating shared visions of Smart Nation futures. I then explain how state planners repeatedly generate the Master and Concept plans which form the basis of these maps.

Throughout, I analyse futures projected through the maps, showing how state planners replicate national imaginaries of standardisation, connectivity, and futurity in and through mapping technologies. I attend to the state's "figural construction of reality in the mapping of the world" (Ban 2004:xi). By detailing those imaginative mapping processes and their material effects, I illustrate how sociotechnical imaginaries are replicated and expanded through engagement with material plans over time.

6.1 *Sharing Data to Map the "Total Environment"*

Maps are the primary existing material resource that planners receive. Alvin works with and through GEMMA, a GIS map that aggregates data from different agencies. State planners' drive to create connected, standardised systems described in the previous section produces this mapping technology. GEMMA gives Alvin a standardised view of Singapore shared by planners in other agencies. Planners using GEMMA repeatedly consolidate different agency visions into a single map of Singapore's future. GEMMA also allows Alvin to physically change the plan for any given space in Singapore, literally making space for other futures.

These GIS maps replicate historical planning practices and the citizenship imaginaries enacted through them. Planning projects like those Alvin works on—that reclaim residential space for smart city development and rehouse residents—are relatively common, as I discuss in Chapter 6. This practice descends from the historical precedent detailed in Chapter 4: the state's history of non-voluntary resident resettlement through housing upgrades (Haila 2015:76). Smart city planning technologies like GEMMA codify who belongs in the Smart Nation. Planners replicate these conditions of belonging through GEMMA's use and materialise those conditions through the infrastructure they use GEMMA to create. Data gathered from housing surveys continuously performed since before Singapore's independence, described in Chapter 4, are also loaded into GEMMA and inform future housing planning: encouraging planners to replicate foundational imaginaries of Singapore as a standardised "Total Environment" through smart city planning technologies shaping smart urban infrastructure.

GEMMA, like all smart city planning technologies, has a history. The GIS mapping technology descends from digital URA land use maps URA SPACE and ONEMAP, created by the URA in partnership with HDB and LTA. Both still exist in public-facing form: URA SPACE largely for corporations, ONEMAP for residents.

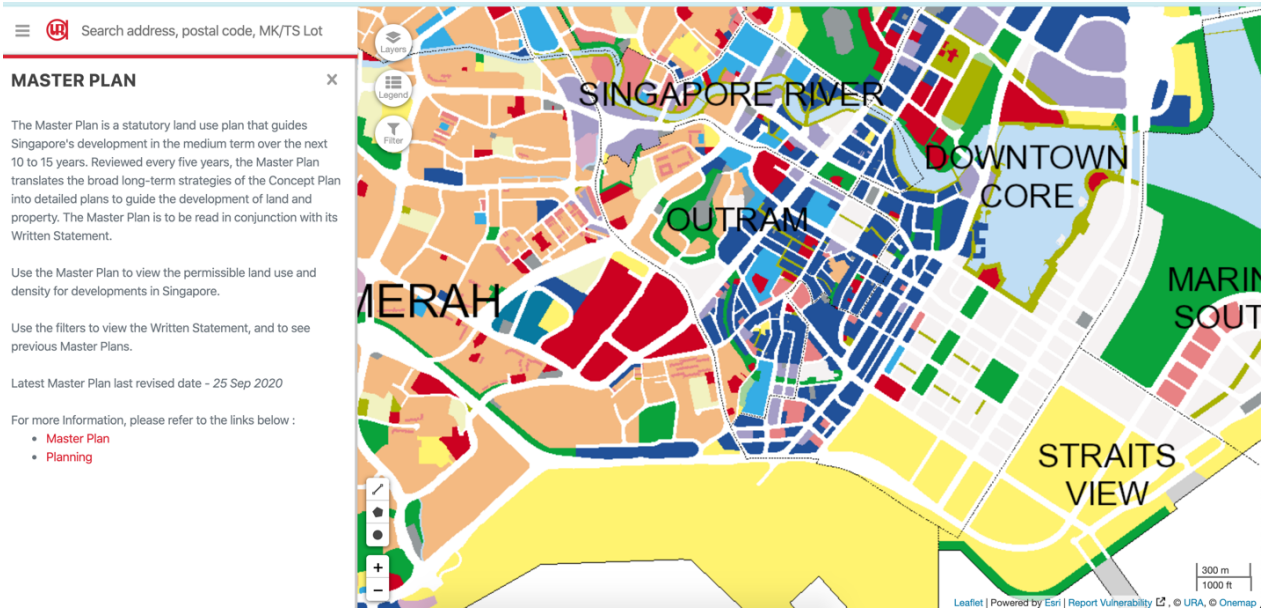


Figure 99: URA SPACE, 2020. https://www.ura.gov.sg/maps.

The first view the URA SPACE map offers, like GEMMA, is the Master Plan for Singapore, guided by the Concept Plan (as the text informs the user). The state's Concept Plan (Figure 94) projects the next 40-50 years of Singapore's future development, and the Master Plan (Figure 95) "translates the broad vision of the Concept plan" and projects in detail the next 10-15 years of future development. Planners therefore materialise Singapore's future in these maps, also using them to enact it.

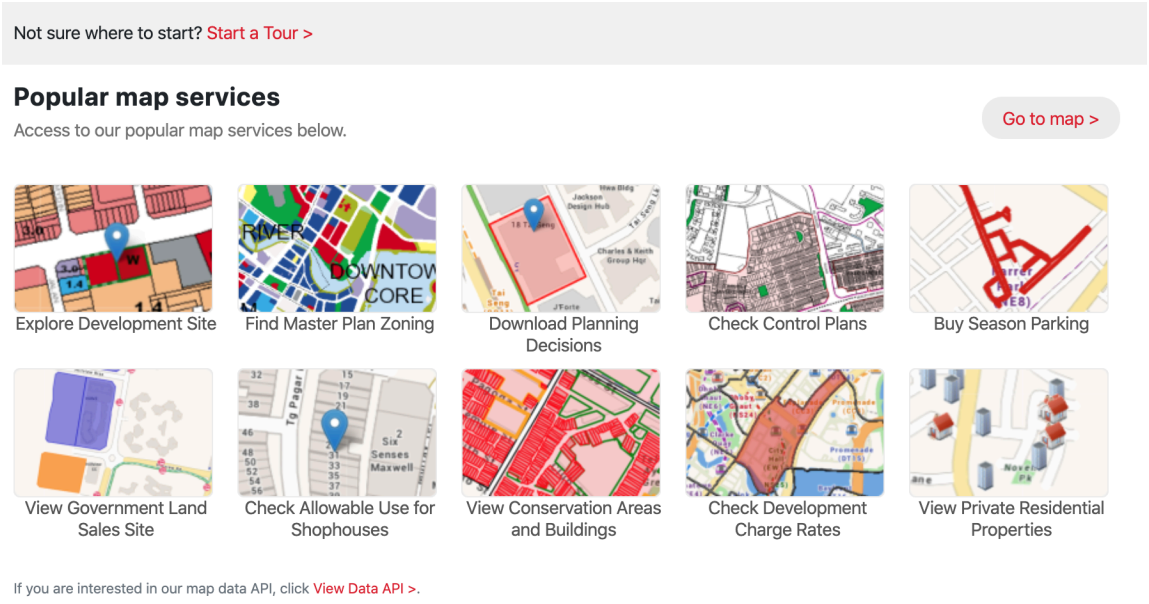


Figure 100: URA SPACE, 2020. https://www.ura.gov.sg/maps.

URA SPACE descends from ONEMAP, a GIS map launched in 2008 with the same layout: opening to a full-screen map of Singapore, data based on the Master Plan. When ONEMAP was released, Asian Surveying and Mapping Magazine headlined: "Singapore uses GIS as an Enabler to Build a Networked Government."[33] The OneMap.sg site displays the headline prominently. It replicates the imaginary of connectivity, connecting the technical capacities of mapping to an imagined increased social and technical connectivity within the government itself. This is tied to an imaginary of standardisation: OneMap, a single view of Singapore as "total environment."

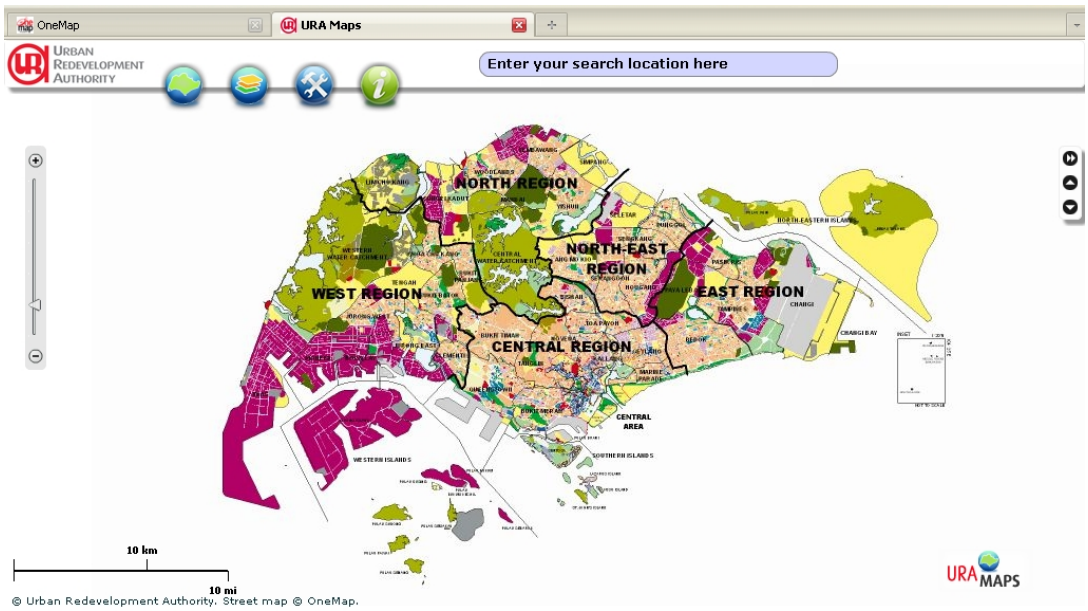


Figure 101: ONEMAP, 2011. https://www.onemap.gov.sg/home.

Like Alvin's current experience, the map overlays planning and zoning permissions information, informing the user what is possible to do or develop for the future in each space. Forms of these mapping applications are available to residents and developers, further streamlining and automating the process of collective understanding around what the land can or cannot be used for, as well as what plans the state has for the future of each land parcel. State practices of accepting or rejecting land use requests

[33] http://asmmag.com/features/feature/1841-singapore-uses-gis-as-an-enabler-to-build-a-networked-government-sp-345.html

are encoded into the platform and almost fully automated: all in "one map", one vision of and for Singapore's present and future, centralised and run by the state.

These automated processes—of approving or denying requested futures—are enabled by the centralised EDI (Electronic Data Interchange) platform created by the first National IT plan described in Chapter 4. To facilitate data sharing between state agencies and companies, state planners paired centralised IT infrastructure with centralised data servers. Data stored in these hubs are linked by the state network "IDNet", accessible to all state agencies, encouraging planners to share data due to "one-stop, non-stop" access.[34] These platforms permit the interoperability and regulation required by the state, creating an "open" yet highly controllable environment. This smart city platform infrastructure allows planners like Alvin to access transportation data from rideshare corporations like Grab and incorporate them into the state's larger vision, as expressed through GEMMA's map. It also means that planners like Alvin cannot see outside of the state agency's intranet—making seeing like a state the only option the technology allows.

ONEMAP now integrates a dizzying data array from a wide range of state agencies (Figure 104), creating what its site calls the "authoritative national map" and "most detailed and comprehensive map of Singapore" based upon "continuous feedback" from residents and state agencies (onemap.sg 2020). Imaginaries of connectivity and standardisation combine to create a continuous, materially-enacted future for Singapore.

[34] Supercharging Singapore. Straits Times in collaboration with the Infocomm Development Authority (iDA), 2015. http://graphics.straitstimes.com/STI/STIMEDIA/Interactives/2015/10/35-years-of-ict/supercharging-singapore/the-1980s.html

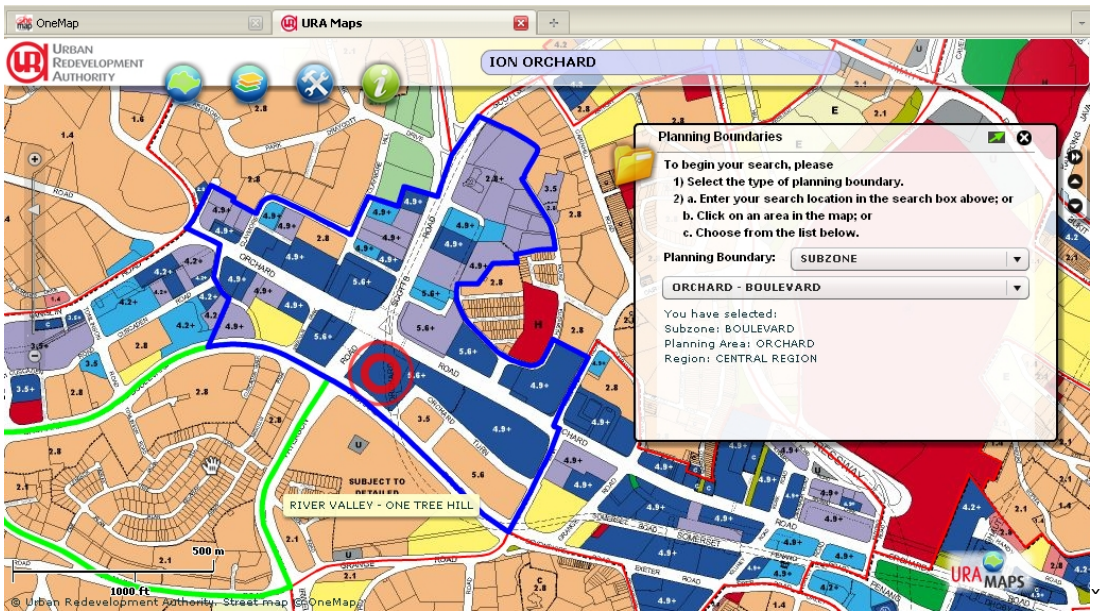


Figure 102: ONEMAP, 2011. https://www.onemap.gov.sg.

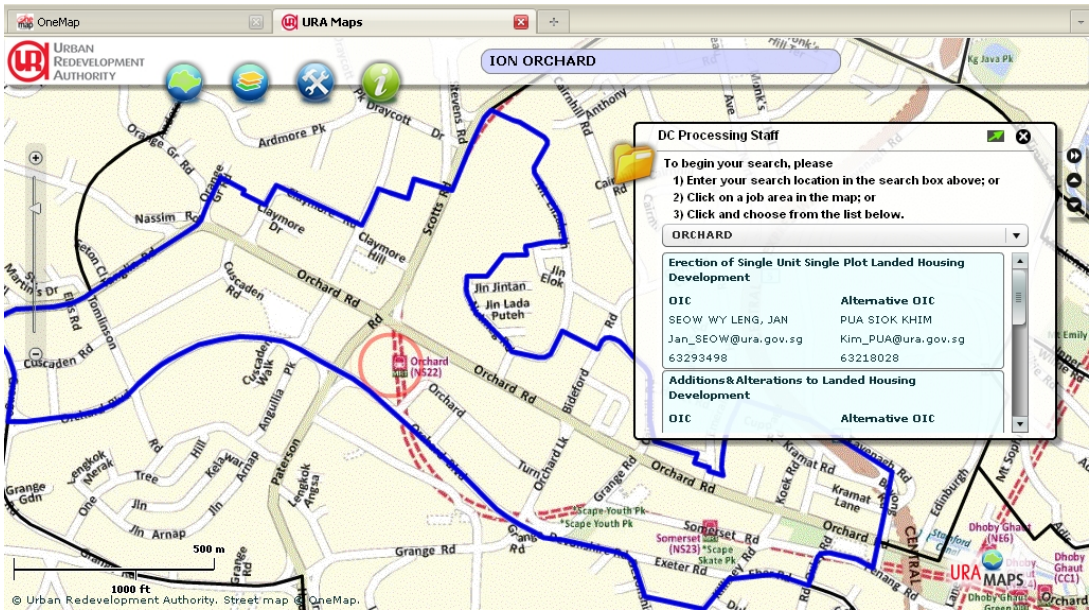


Figure 103: ONEMAP, 2011. https://www.onemap.gov.sg.



Figure 104: ONEMAP Partner Agencies, 2020. https://www.onemap.gov.sg/home.

State planners use these existing data structures to input data into GIS maps and make them accessible to state planners in other agencies: creating, replicating, and even expanding shared visions of the future based upon imaginaries of digital connectivity. Being able to continuously interact with

these GIS maps in real-time, on the level of daily planning practice, reinforces the shared view Xinyuan references:

> Before, they were basically using technology to make graphs. That was the extent of it. And when I wanted to share a plan, I had to go pull it out of a drawer, it was on paper. In the past, we generated plans in draft format, sent via email, then we had to do compilation of inputs. Now people can load the map, click for more info, and add comments. We use a collaborative planning platform and since we developed it ourselves, we can do this quickly. Because data is within, the workflow is within, this enabled workflow to emerge from data. How many people are staying here? How much housing is there? Is this an area where there are gaps? You can see what to do, bring to collaborative platform and ask what everyone thinks.

The systems described in the previous section, tailored to the daily practice of state planners because they are created by state planners, enabled a recursive and expanding uptake of smart city planning technologies. Xinyuan described how the URA gathered initial data to populate its systems:

> The first stage was identifying what data is needed for the spectrum of planning work that the URA does and identify where that data resides and capture it. A lot of data is collected by agencies that actually handle the operations and transactions. We went to them for a lot of data on population, mobility, housing.

As state planners in different agencies increasingly saw the data visualised in shared maps, Amit argued, they were willing to share more data:

> from there, we had a growing momentum. Many agencies could see where value of data came in, they start to see how they could share and add data for their own purposes. If you can grow data *within* the application, amount of data becomes rich. And not just planning data, other operational data: approvals, licenses. It makes it possible to even do other things. Because of the tools and how as a planning process it is not just alone, but working with other parties, many agencies asked if we could extend tools to do their own analysis and workflows.

The vision as Amit described it spatially expands as data increases, expanding the view of state smart city systems to include visions offered by corporate data:

> To do this we need to build new capabilities, overcome knowledge gaps, explore new technologies. Like IoT: how do you make use of information from different sensors, improve understanding of people patterns, mobility patterns, people flows? This also needs good technique to synthesise it. Our Data Science team looks at different techniques to make sense of data, using EZ Link data [subway and bus system] plus Grab data, and *the more we get the more we can see and understand.*

Alvin's daily motions, as he taps his EZ link card on the subway and the bus, also populate the smart city planning technologies he works with. This sensor data also comes from projects which embed data-

gathering sensors in HDBs, which I analyse in subsequent chapters. This data all existing within one standardised system ("our environment", as Xinyuan calls it) accessible by all state agency employees, is crucial to replicating the shared future vision across agencies. The same technologies used to visualise the island are used by all agencies and are also the technologies used to plan its future.

We see this future-making through Alvin's practice. He automatically sees data from the LTA and HDB, which he uses to create the new neighbourhood. Recalling HDBs' restrictive housing requirements detailed in Chapter 4—the racial quotas, the rigid nuclear family structure, the requirements for elderly parents to live with their children—one can see how this data use ends up replicating the imaginary of standardisation through smart urban infrastructure itself. The replication of these social and technical imaginaries of standardisation also appears in the glossy images of the future neighbourhood Alvin produces to show residents ultimately forced to move there.

Jiaming explained how this standardised vision of the island as total environment expands as more state agencies input their data and repeatedly use the system to do Smart Nation work every day:

> Momentum can grow, through data momentum grows, people see value of putting everything in there. More agencies are able to come together into this collaborative platform. So then we start to get even private housing developments, land developments on same platform. Covers bulk of planning workflow across the entire island. So then we can use the map application not just for single topic consultation at small scale, we also use it for massive plan as well, for a massive exercise across the agencies.

His "massive plan" description evidences an increased vision over the physical space of the nation mapping on to an increased collective vision of the nation's future, enabled through the technology. These totalising maps evoke Chua's (1997:49) analysis:

> To the extent that maps are ideological constructs that encourage an impulse to efface blank surfaces by 'colouring' them in (Cooper, 1994:152), the planners have left no space on the island unaccounted for. Singapore is already a fully conquered island in the imaginary, in that every foot of space is already assigned to a particular use, as signified by the multicolour coded planning maps. No space has been left to chance, and even nature has to have the permission of the planning agencies to survive.

His evaluation echoes Boey Kim Cheng's poem "The Planners", quoted in my epigraph: "*They build and will not stop.*

Even the sea draws back

and the skies surrender."

Boey's words are not just metaphorical: the Singapore state dredged up 25% of its current land mass from the ocean floor, upon which the Central Business District (CBD) is built.

Recall the Singapore City Gallery on the URA's ground floor, with the scale models of Singapore (Figure 40). Visitors like schoolchildren see all of Singapore painstakingly recreated in miniature, impressing upon them a total view of the state's future vision for almost every bit of city space. Architect Hin describes why school groups are one of the main visitors to these gallery spaces:

> State is the biggest employer, so people have to be educated to think like the state, so eventually they will recreate the state. This is how you get all those ministers thinking the same thing.

As Alvin's experience shows, planners actually use this model to do their work. This use is demonstrated by the transparent Model Studio adjacent to the models, in which urban planners build the future city in miniature (Figure 85) and by missing parts of the model marked by "AREA UNDER STUDY" cards (

Figure 84). The model is therefore a materialisation of the state's imaginaries as they evolve in practice, rather than a static image of an unchanging future imaginary. As planners end up "thinking the same thing" and "recreating the state" through engagement with maps, they impart that same imaginary upon schoolchildren, which they also used to be—replicating the Smart Nation.

6.2 Master Planning

As Chapter 4 explains, these map-based planning practices have a material and symbolic historical continuity. Singapore's Smart Nation is the latest chapter in a long state smart city story, materialised and replicated through state Master and Concept plans. In this section, I explain how state planners repeatedly generate those Master and Concept plans which underpin digital planning maps.

The first National IT plan was made in 1986, a "bottom-up initiative involving various agencies coming together to articulate the…new version of the plan," as Wong, who was at the NCB at the time, recalled. "The planning process was quite chaotic. It could be one person, with a personal idea, but it had to eventually embrace the whole group and then the whole country. The power of the plan comes from getting it accepted." He echoes Balakrishnan, cited in Chapter 4, imagining a scalar imaginative expansion of the imaginary from single person, to group, to entire country. Current planning practices echo this scalar expansion imaginary. This sense of the material resources (the map-based planning technologies and the data inputted into them) shifting and creating bigger, more totalising visions of the city recalls Kelty's (2008:15) notion of recursive publics: in which actors have "shared moral and technical understandings of order—and can inhabit and transform the thing that creates those understandings." In expanding the infrastructures of the smart city, through the map-based planning technologies they share to do so, state planners also expand the normative future imaginaries projected in and through them.

Alvin's experience shows how these Master and Concept Plans for the future are co-created and embedded into the material maps that planners, residents and developers use to see these future plans. Recall how Alvin described the process by which these plans are made, reminiscent of practices in 1986, but further enabled by shared systems described in this chapter:

> There are spaces where everyone comes together, and they all have their problem statements and their visions of what the future looks like. And that really gets materialised in the Concept Plan and the Master Plan. All these agencies come together and have to articulate their visions of the future.

Jiaming told me that as a result of these meetings "We have a smooth Smart Nation plan; we have a clear vision for what that looks like." The URA Singapore City Gallery also shares these Master and Concept Plan images with the public, performing this continuity of vision.

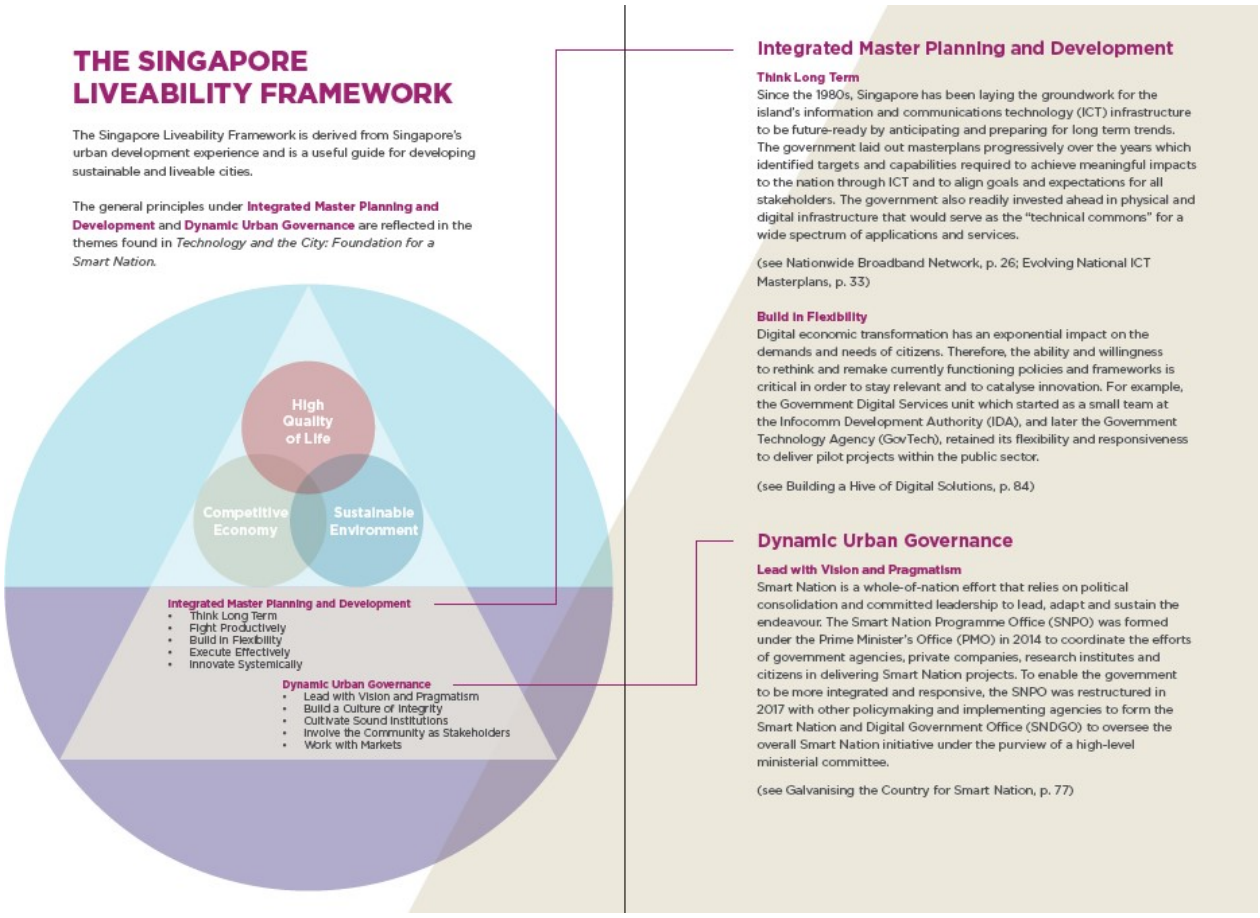


Figure 105: Singapore Liveability Framework: "Think Long Term, lead with Vision". CLC 2018. https://www.clc.gov.sg/docs/clc-csc-liveable-sustainable-cities.

But another planner, a minister high up in his agency, troubled this totalising reading of the Master Plan. He turned my attention to its budget element: "Government budgeting isn't a particularly interesting field, but you'd be surprised in how much power it has in its ability to shape developments." He pointed to the "RDI" [Research and Development Innovation] line of the budget, which corresponds to the white colours on the map (Figure 99):

> I like this bit, its 13 percent whitespace open to anything, 13 percent! That's quite a hard thing to push through. It gives a sense of the kind of humility you need as government: I want to promote something through grand vision, but I don't know exactly what that's going to be like. The budget is a tool to effect some of these things, you leave some space open.

"Leaving space open" is both symbolic and material in his usage, enacted through practices that repeatedly combine the two. Smart city infrastructures *are* a form of imagination—what Sandercock (2002) terms "built thought"—and imagining itself *is* a material act. How much space is left available,

materially and imaginatively, for other futures to be spatialised is a question I take up throughout the rest of the thesis (though I will not furnish a percent total!).

7 Discussion

This chapter offers three key interventions into critical smart cities literature. First, it evidences that the smart city is not just an abstract or cookie-cutter corporate fantasy applied with variable success in different contexts. Rather than arguing that a corporate technological imaginary is being applied everywhere, we must unpack the specific instantiations of smart city imaginaries—some corporate, but some, like Xinyuan argues about Singapore, decidedly not only corporate. Second, it specifies distributed human and non-human agency in the smart city. State planners literally project and replicate specific national futures in and through material smart urban infrastructures every day. The smart city's shortcomings, by extension, cannot be simply diagnosed as a gap between elite imagination and people's everyday lived experience. As I have shown in this chapter, planners have a lived experience through which they repeatedly materialise specific instantiations of the smart city, both consciously and unconsciously. Finally, it demonstrates the smart city's politicising, rather than depoliticising, effects.

First, critical smart cities literature frequently argues that the "infrastructural imagination of the smart city is tied to neoliberal capital" (Halpern and Günel 2017:4). Yet state planners, as I have shown, stress that a one-size-fits-all corporate technology package will not create their smart city. They commit to interoperability explicitly to ensure the smart city is *not* overtaken by corporate interests. They strategically reject corporate models and create an interoperable state agency-driven smart city contextualised in "day-to-day life". This interoperability enables the material-symbolic replication of the imaginaries detailed in Chapter 4 across time and space: from past Master Plans and across state agencies.

As a result, the smart city in the Singapore context is not an example of an abstract elite imagination or a corporate technology package dragged and dropped across cities. This has important implications for the methods we use to study smart cities. Analysing the corporate "emblematic archetypal form" of the smart city (Luque-Ayala and Marvin 2016) through grey literature misses what people do with those forms in practice. Looking beyond those "archetypal forms" shows other, more "mundane" or non-digital technologies used to replicate these imaginaries. In Singapore these smart technologies include people (and the training and employment practices that inculcate shared understandings of what the smart city is for); systems (that materially replicate plans across state agencies); and data gathering and storage technologies (that increase the "shared vision" of smart city futures).

We can see this difference between corporate archetypal form and smart city materialisation clearly in Kevin's indictment of "flashy" data dashboards, which planners largely do not use to do smart city planning work in their daily practice. They use those dashboards for another purpose: to continue generating corporate funding for their governance work. The planners adopt some corporate logics as they try to draw investment from a range of corporate and international sources. But rather than making political debates "take a backseat" (Luque-Ayala and Marvin 2020), the data dashboards take a backseat in Smart Nation planning practice. Stepping back from a focus on such "flashy" technologies and instead following the often "mundane" technologies smart city planners use brings other operational logics to the foreground. It shows how highly political future imaginaries are projected through mundane technologies like maps and homes. It also shows how they are replicated through material engagement.

Second, critical smart cities literature also often gives the smart city generic agency, eliding the work human subjects do to project and replicate smart city imaginaries. The editors of The Fibreculture

Journal's special issue on "Computing the City", for example, see agency in the smart city as something that "aims at its own replication"—without furnishing critical analysis of this replicating work:

> The smart city needs to make no excuses for its failures: it is always only preliminary, failures are part of its experimental character, yet nonetheless it remains infinitely replicable; a model for the coding of urban space around the globe. (Beverungen and Sprenger 2017:4)

Who does the work of expansion and replication is missing in arguments that smart cities "spread their own logics in a protocological fashion as one smart city serves as a blueprint for another, further enabling and reproducing logistical networks through infrastructures" (ibid:5). Instead, in this chapter I showed the conscious and unconscious material-symbolic work state planners do to replicate the smart city across time and space. I show that we can give the smart city material agency beyond the intentions of its creators while also being analytically specific about how and why it expands.

This analytical specificity also shows that planners do not always replicate the same logics embedded in the corporate plans so often studied in critical smart cities literature. Analyses of those logics must think beyond "control" to detail the complex kinds of power enacted through daily smart city planning practice. I have shown how political decisions are repeatedly enacted through recursive processes of mapping and instantiation: imaginaries of standardisation, connectivity and futurity detailed in Chapter 4 are materialised through the Master Plans and GIS maps planners use in their everyday practice. Those mapping technologies then encourage planners to replicate those imaginaries through smart urban infrastructure in the smart city.

Finally, critical smart cities literature often recognises that smart city development is made up of flexible and distributed processes (rather than a single package), yet still largely argues that the smart city universally corporatises and depoliticises urban governance. These literatures then contrast abstract smart city maps created by corporate or state elites with the "messy" quotidian practice of residents (Luque-Ayala and Marvin 2020:213). But Alvin's technological everyday shows how state planners and

smart city developers are also residents—they do not shut down at the end of the day with their computers. As Simone (2018:25) argues, "it is not always possible to assign a particular role or particular value to a particular person because they wear different 'hats' at different times." Planners are also, as evidenced, focused on making sure that the smart city does capture the lived experience and day-to-day life of residents and planners in other agencies. Xinyuan "maps digitisation journeys" to closely analyse how the Smart Nation can intervene in residents and planners' actual lives, for better or worse.

As I argued in Chapter 2, imagination is temporally oriented and spatially mediated, repeatedly materialised through processes of individuation and exteriorisation undertaken in tandem with technologies in the digitally mediated city. Memory is "externalized from human beings and inscribed into specific material forms" in the digitally mediated city "that carry the potential for the transmission of knowledge and affect across time and space within them" (Ash 2012:10). Imagining the future is a process of both externalisation and individuation: projecting imagination into space, while drawing from one's environment to repeatedly produce one's own imaginings: spatialities—and I argue, temporalities—are "symbolically materialized…to be repeated, reinvented, or both" (Rose 2017:784). Exteriorisation makes imaginaries "extend beyond the individual both spatially and temporally to be encountered elsewhere and in the future" by materialising them in forms like smart urban infrastructures and planning technologies (ibid).

Rather than being reflections of an abstract corporate or state imaginary divorced from the realities of ordinary urban residents' lived experience, smart city imaginaries are built and sustained through the repeatedly enacted daily practices of "elite" state planners and developers as well as those of other residents. All experience and co-create the technological everyday of the digitally mediated smart city. Attending to specificities of their "messy" material practices tells us how future imaginaries are projected, replicated, and reimagined. These infrastructural imaginaries may be technocratic and

often totalising, but they are not just driven by corporate imaginaries of neoliberal capital. Nor are they divorced from political imaginaries or local knowledges. As evidenced, the Smart Nation infrastructural imaginary is about making space for certain national futures at the exclusion of others.

Thus tracing the daily practices of state planners troubles the argument that the smart city is inherently depoliticising and produces a better understanding of the power exerted through the smart city. Smart city technologies have an embedded politics, politics that must be continuously embedded into those technologies and are also reimagined through them. This attention allows critical scholarship to more accurately diagnose how power is enacted through the smart city, and what space and materials residents can access to imagine other futures.

8 Conclusion

In this chapter, I argued that smart city futures are replicated through everyday planning practices which involve material engagement with smart urban infrastructure. These smart urban infrastructures include data and digital technology. But the smart city, at least in the Smart Nation context, is also made from people, systems, and the historically continuous material-symbolic resources they use to replicate national sociotechnical imaginaries. Planners replicate these imaginaries through "mundane" smart city planning technologies like GIS maps and centralised ICT infrastructure. Planners thus materially replicate Smart Nation futures in daily practice using existing material-symbolic resources.

I first showed how "smart" state planners are trained in how to use smart city planning technologies to imagine futures like the state. Training state planners in technology systems contextualised in specific smart city planning practices creates "geospatial communities of practice" that standardise how planners imagine futures in their daily work. Employment practices cycle these "smart" people through different state agencies and keep them in state agency positions for long periods, creating a continuity of imagination and technology use. Second, I showed how state agencies connect

people who increasingly use the same connected systems and provide and interpret data in the same way. Finally, I described how planners repeatedly come together to create Master and Concept plans, continuously using the same mapping technologies to visualise the future nation. Their everyday engagement with planning technologies replicates the Smart Nation sociotechnical imaginary as they repeatedly enact it through those same technologies.

These technologies, planning practices, and imaginaries are continuously built from pre-existing ones. Smart Nation imagined futures build upon signifiers of national identity repeatedly generated by state planners since independence to create a collective sense of nationhood and dictate who "belongs" in what spaces, who can participate in the future of the Smart Nation as smart citizens. These imaginaries include Singapore as a "living lab", standardised so the Singapore model can be exported to other nations; Singapore as futuristic, technologically advanced, a place where the future is spatialised and can be accessed; and Singapore as a connected global city, a global port or node.

By analysing the smart home projects emerging from the state planning practices detailed in Chapters 4 and 5, I argue in the next chapter that residents reimagine these Smart Nation imaginaries through material engagement with the smart home. They negotiate the state's (smart) citizenship imaginary through practicing their "technological everyday" in the domestic space of the smart home, a key locus of state intervention into their lives and a place where the state determines who does or does not "belong" to the (smart) nation. I demonstrate how they engage with smart urban infrastructure in ways unimagined by the state, producing "geographic counter-stories" (Kobayashi 2005) that materially and symbolically change the Smart Nation. Rather than ending my analysis with a description of a problematic gap between planner imagination and resident lived experience, I describe how state planners and developers deal with these counter-stories, explaining how the smart city, and the futures projected through it, change over time.

CHAPTER 6: REIMAGINING SMART NATION FUTURES

1 INTRODUCTION

In Chapters 4 and 5, I addressed my first research question:

> *RQ1: How does the state project its future imaginaries through the digital and urban space of the smart city?*

In this chapter and Chapter 7, I address my second research question:

> *RQ2: How do smart city residents replicate and reimagine state future imaginaries through these same digital and urban forms?*

In Chapters 4 and 5 I showed how the state uses the home as a metonymic site of material and symbolic nation-building, through sociotechnical intervention into reproduction, housing access, and residents' affective and embodied experience of its "lived spatiality" (Yeoh and Huang 1999; Chang and Lin 2000; Anthias and Yuval-Davis 1989; Grosz 1995:385). I argued that state planners repeatedly replicate sociotechnical imaginaries through the smart city: Singapore as standardised, through racially standardised HDBs and uniform smart domestic urban infrastructure; a connective global port, through socioeconomic ties to other nations and advanced domestic ICT infrastructure; and futuristic, through socioeconomically productive "Asian Values" and technological progress keeping it "ahead of the pack."

I argued that the state's metonymic process differentiates and queers (data)bodies, imagining some as representing and productive of national futures while excluding others. This process works through state uses of data-gathering and biometric technologies to interpret parts of the body and its motilities and input them in planning technologies as representations of national imaginaries like productivity, citizenship, and belonging in place (e.g. through the ability to access housing). These technologies in turn mediate residents' ability to access and practice citizenship, and their ability to be seen by the state as a builder of the nation's future. This process means that for some residents, what

comes to stand in for them through these data-gathering technologies (e.g. their movements, age, marital and familial status, race, income, citizenship status, sexuality) does not represent the (smart) nation in the eyes of the state, designating them "out of place".

In this chapter, I argue that disrupting these metonymic processes by changing data flows and their meanings, through the material-symbolic resources used by the state to project its imaginaries, changes those state-imagined futures in distributed, differentiated ways. I detail how residents reimagine the state's imagined futures through everyday embodied engagements with biometric technologies and smart urban infrastructures. As evidenced, the state repeatedly uses material-symbolic resources to project its smart city sociotechnical imaginary. Smart city residents are constantly engaging with these material-symbolic resources as they move through the "technological everyday" of the smart city. (Amin 2007). Returning to Jasanoff's (2015) concept of co-production, which happens through repeated enactment, and mobilising Rose's (2017) interpretation of "difference-in-repetition" and Leszczynski's (2020) attention to "glitch" in mundane engagements with digital technologies, I argue that smart city residents repeatedly use these material-symbolic resources in their everyday embodied practice to replicate some of the state's imaginaries and reinvent others.

Residents repurpose smart home spaces and biometric technologies through their everyday embodied practice, purposefully and incidentally reimagining the state's Smart Nation imaginaries of standardisation, connectivity, and futurity. They do so, I argue, through accumulated quotidian practices of refusing and creating new kinds of data flows in the "intimate public sphere" (Berlant 1997), which make space for other futures. These are political acts even if residents do not actively "politicise" them in speech or organised protest (Campt 2014), because they disrupt and change exclusionary state futures based in imaginaries of standardisation, connectivity, and futurity. The state's careful attempts to control its citizens (and who can spatialise citizenship itself) through domestic space often "glitch"

(Leszczynski 2020), just like the data-gathering technologies it uses. This analysis helps smart city scholars theorise participation, resistance and change in contexts of seemingly overwhelming constraint under ubiquitous surveillance.

In the first section, I describe the technological everyday of René, a composite of international smart home developers I worked with, to demonstrate how smart city maps and HDB infrastructures produced by state planners give developers an imaginary of standardisation that they cannot replicate through the smart home. Residents inhabit the flats in differentiated ways, engaging in feedback loops with data-gathering biometric technologies in non-standardisable forms of "smart" living, making them unusable stand-ins for a generalised, global smart citizen.

In the second section, I detail the technological everyday of Esther, a composite of my local smart home developer interlocutors. I show that by breaking sensors or altering the data they gather, residents enact a different imaginary of connectivity than imagined by state planners, creating new domestic and affective arrangements. By creating care networks mediated by digital technologies including and beyond smart home sensors, residents and local developers seek other kinds of connectivity through the smart home and reimagine the "Asian Values" projected by the state through smart home projects.

In the third section, I show how queer and elderly residents' dwelling practices disrupt the state's nuclear "national family" and filial piety imaginaries, refusing its (re)productive and productive futurity. Residents temporally and spatially diverge from state-imagined futures through everyday practices of dwelling. These practices involve evading state surveillance by disrupting biometric data-gathering on marital and HIV status; living in queer family and care arrangements; and rejecting the state's foundational futures trade-offs, no longer behaviourally conforming to state future imaginaries in exchange for guaranteed future material well-being. I conclude by demonstrating how these everyday practices result in material-symbolic changes to the smart city and the futures projected through it.

2 Reimagining Standardisation

As discussed, state planners attempt to standardise HDB estates internally and across the nation through projects of social, infrastructural, and technological design, explicitly imagining each HDB as a microcosm of the Singapore nation. To project the Smart Nation materially and imaginatively across the city, into the future, and to other nations, these models of smart living must be standardisable. This projection relies on an imagined metonymic relationship between each sphere, as well as a scalar and spatial understanding of future progress. As a planner interlocutor I cited in Chapter 5, Hin, put it: "HDBs are homogenised. There's no reason for you to go to another HDB, no internal interest."

As a result, state agencies invite foreign researchers to use HDB flats as neutral "test beds" for smart technologies (Shatkin 2014), to export the Smart Nation's smart living models to their cities. Yet diverse smart citizens' everyday embodied practices create highly differentiated domestic environments, problematising this scalar and spatial imaginary of standardisation. Developers tasked with making smart technologies for HDBs must move between these differentiated sociomaterial realities and those in other countries to replicate a shared future through globally exportable technologies, but these movements encounter friction as they encounter difference, disrupting the standardisation needed for export.

In this section, I show how state planning agencies give international developers the maps, plans and infrastructures described in Chapter 5 to materialise their smart home projects. I describe how international developers find the material-symbolic resource of Singapore as a standardised "living lab" replicated in their smart home model. Residents' homes, however, do not resemble this smart home model, disturbing the imaginary of standardisation central to exporting the smart city. When they do not find such standardisation in resident daily practice, meaning they cannot replicate the smart city as it was given to them, they are forced to reimagine the sociotechnical meaning of the project.

2.1 The "Technological Everyday" of an International Smart Home Developer



Figure 106: Private Condominium, West Coast, Singapore. 2018.

René has a short commute to the Fusionopolis building in the science and technology research complex One North, home to A*STAR's offices and the smart home model lab. He lives in the Vista, a private gated condominium on the West Coast populated with wealthy expatriates from Europe, Japan, and mainland China. Rent is expensive, but not more than Paris, and A*STAR pays him well to perform his



Figure 107: Sandcrawler, Lucasfilm. One North, Singapore.

smart home development in Singapore. He usually takes a Grab directly from his condo to work, which he schedules on his smartphone.

On arrival at One North, he enters Fusionopolis' gargantuan glass atrium and picks up coffee at the café, tapping his iPhone with fingerprint ID on one of many card readers littering the counter. A fellow coffee addict, I often meet him there. Coffee in hand, he scans his ID card to access the Connexis North Tower lift lobby and again in the lift to access the 55th floor. He told me that when he first started working at One North, the fantasy-futuristic names made him feel like he was in a sci-fi movie: working next door to Biopolis, Galaxis and Sandcrawler—Lucasfilm's studios modelled after a Star Wars spaceship (Figure 107)—added to that affect and imaginary.

Plastered on A*STAR's office walls are brightly-coloured quotes from internationally-famous scientists about the power of technological innovation. Down one end of the hall is a model smart home used for public demonstrations, and down the other is an identical model smart home that his ICON team uses as a lab. Entering through the white-padded sliding door, designed to look like a spaceship airlock, René drops his bag at the "dining table" and gets to work testing a sensor as I watch and ask questions. Sitting on the floor with his computer in his lap, he ensures the motion sensor transmits data when he waves his hand.

Jean, a developer from Bordeaux, is already in the office. While fixing the sensors, we chat about René's architecture degree from a university in Paris—where he was born, raised and wants to return. I ask René why he's here. He answers: "Singapore is a test site. It isn't big enough to be its own market and it knows this, so it tries to draw innovation and provide a good place for people to like us to develop." And draw innovation it does, René says. Many other government-university partnerships work on Smart Nation initiatives, including the Singapore-MIT Alliance for Research and Technology (SMART) and ETH Zurich's Future Cities Lab (FCL), René's future employer. But René sighs and sets down the computer:

“It’s just so different from Europe,” he says. “What people want is totally different.” Jean and Rafael, a Spanish computer science PhD student, agree.

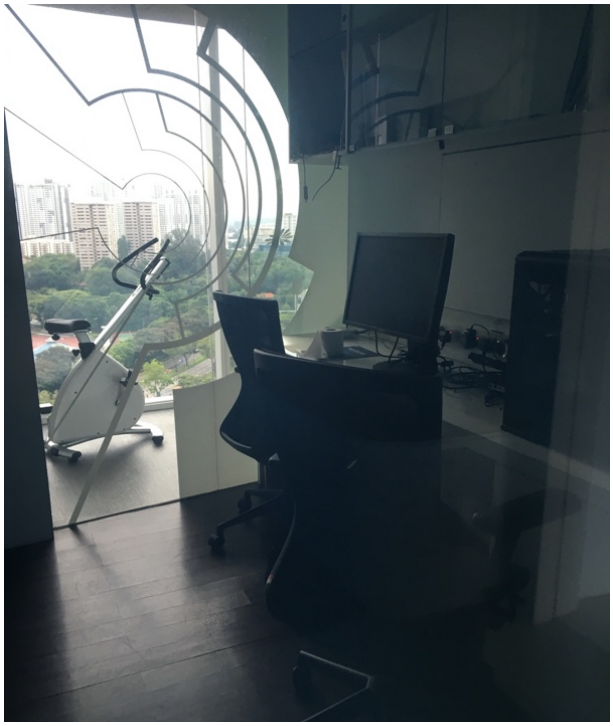
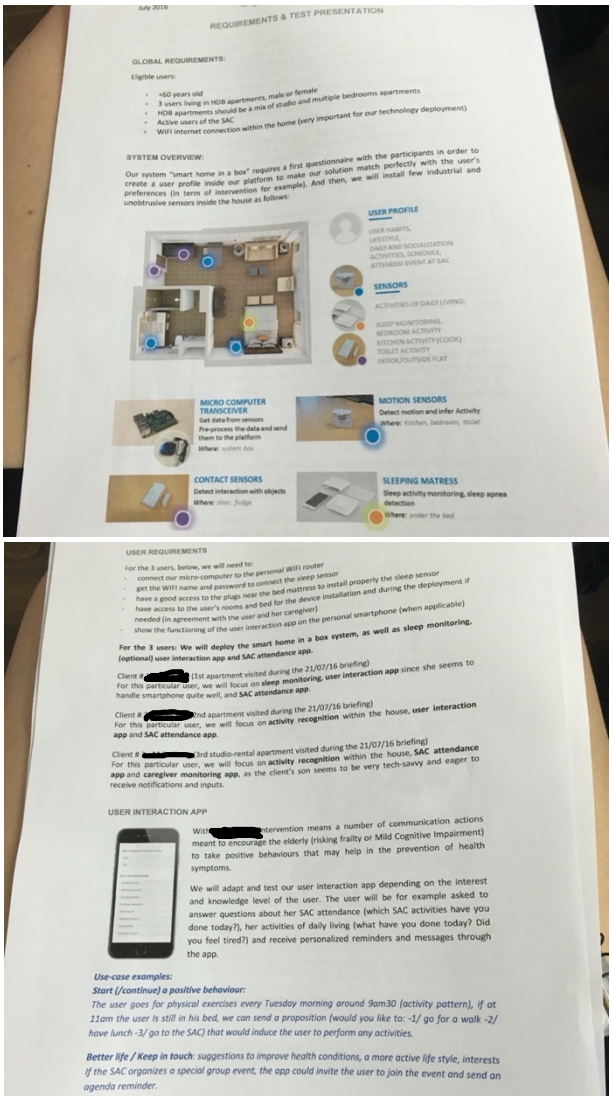


Figure 108: Developer Workspace in Between Kitchen and Home Gym.



Figure 109: ICON Smart Home Technologies and servers, inc. boxes of sensors and Raspberry Pis.

After a morning of fixing sensors and preparing for their afternoon consultation in an HDB estate, we go eat lunch at their usual spot: Timbre+, a stylised, hipster version of the hawker centres where most Singaporeans eat lunch every day. Each pays for lunch with their different smartphone using the Timbre+ membership app.



July 2016

REQUIREMENTS & TEST PRESENTATION

GLOBAL REQUIREMENTS:

Eligible users:

- +60 years old
- 3 users living in HDB apartments, male or female
- HDB apartments should be a mix of studio and multiple bedrooms apartments
- Active users of the SAC
- WiFi internet connection within the home (very important for our technology deployment)

SYSTEM OVERVIEW:

Our system "smart home in a box" requires a first questionnaire with the participants in order to create a user profile inside our platform to make our solution match perfectly with the user's preferences (in term of intervention for example). And then, we will install few industrial and unobtrusive sensors inside the house as follows:

USER PROFILE

USER HABITS, LIFESTYLE, DAILY AND SOCIALIZATION ACTIVITIES, SCHEDULE, ATTENDED EVENT AT SAC

SENSORS

ACTIVITIES OF DAILY LIVING:

SLEEP MONITORING, BEDROOM ACTIVITY, KITCHEN ACTIVITY (COOK), TOILET ACTIVITY, INSIDE/OUTSIDE FLAT

MICRO COMPUTER TRANSCEIVER
Get data from sensors
Pre-process the data and send them to the platform
Where: system box

MOTION SENSORS
Detect motion and infer Activity
Where: Kitchen, bedroom, toilet

CONTACT SENSORS
Detect interaction with objects
Where: door, fridge

SLEEPING MATRESS
Sleep activity monitoring, sleep apnea detection
Where: under the bed

USER REQUIREMENTS

For the 3 users, below, we will need to:

- connect our micro-computer to the personal WIFI router
- get the WIFI name and password to connect the sleep sensor
- have a good access to the plugs near the bed mattress to install properly the sleep sensor
- have access to the user's rooms and bed for the device installation and during the deployment if needed (in agreement with the user and her caregiver)
- show the functioning of the user interaction app on the personal smartphone (when applicable)

For the 3 users: We will deploy the smart home in a box system, as well as sleep monitoring, (optional) user interaction app and SAC attendance app.

Client #[redacted] 1st apartment visited during the 21/07/16 briefing)
For this particular user, we will focus on **sleep monitoring**, **user interaction app** since she seems to handle smartphone quite well, and **SAC attendance app**.

Client #[redacted] 2nd apartment visited during the 21/07/16 briefing)
For this particular user, we will focus on **activity recognition** within the house, **user interaction app** and **SAC attendance app**.

Client #[redacted] 3rd studio-rental apartment visited during the 21/07/16 briefing)
For this particular user, we will focus on **activity recognition** within the house, **SAC attendance app** and **caregiver monitoring app**, as the client's son seems to be very tech-savvy and eager to receive notifications and inputs.

USER INTERACTION APP

With [redacted]tervention means a number of communication actions meant to encourage the elderly (risking frailty or Mild Cognitive Impairment) to take positive behaviours that may help in the prevention of health symptoms.

We will adapt and test our user interaction app depending on the interest and knowledge level of the user. The user will be for example asked to answer questions about her SAC attendance (which SAC activities have you done today?), her activities of daily living (what have you done today? Did you feel tired?) and receive personalized reminders and messages through the app.

Use-case examples:
Start (/continue) a positive behaviour:
The user goes for physical exercises every Tuesday morning around 9am30 (activity pattern), if at 11am the user is still in his bed, we can send a proposition (would you like to: -1/ go for a walk -2/ have lunch -3/ go to the SAC) that would induce the user to perform any activities.

***Better life / Keep in touch**: suggestions to improve health conditions, a more active life style, interests If the SAC organizes a special group event, the app could invite the user to join the event and send an agenda reminder.*

Figure 110: Notes on Smart Home App for Consultation Presentation.

René and Jean call a Grab to the HDB estate. Upon arrival, Rene sets up in the senior activity centre (SAC), checking his presentation notes (Figure 110).

They present the ICON smart home project to the first test group, a room full of middle-aged to elderly residents. Flipping through a glossy PowerPoint, Jean explains in French-accented English what the sensors are, where they will go, how they work and when they will be installed. He also recites the long list of user requirements and the good behaviours the smart home will inculcate in its residents.

He shows the emergency button that residents should wear as a necklace or bracelet to press if they need help, that also has a fall-detection sensor. He explains the smartphone app that notifies their children if the sensors detect any trouble, and nudges residents towards "good" behaviours. Residents also have a daily survey on the smartphone about their mood, with pictures to press. The future goal, René tells them, is to have these technologies connected constantly to their bodies so that detection continues no matter where they are in the city. Finishing the presentation with a bright yellow slide on the future benefits of the technology to living well, he turns to the group with a smile: "any questions?"

Hands shoot up across the room. René looks surprised, but starts taking questions which include:

"Is it okay if I open the fridge at night to get a drink?"

"My son visits afternoon onwards, with his friends: what if they sense him and not me? And friends don't always come."

"I share a bed with my daughter, will that affect the sensor?"

"I don't sleep on a bed; I sleep on floor. Better for back."

"What if one day I get angry, and quarrel with daughter? You hear me?"

"I use the home phone I never use my mobile, will my son still be able to track what I am doing?"

"My son is very busy, he works during the day times, how we going to approach him to install it?"

"I have a new tenant who lives in the back, and I live with one child"

"I don't have smartphone, only old phone"

"My fridge is new; will I have to drill it? Why you need fridge? What if I put grocery away, I not eating then, I get soft drink in middle of night maybe"

"If I incur high costs on my electricity bill can charge you, correct?"

"Will it be hot to touch?"

"I have two toilet, one for bathing one for other uses"

"Can it tell if I am sad?"

"Do I have to tidy my place first?"

"If device gets faulty halfway through, do I have to pay anything?"

"Ladies like bracelets, I don't want it"

As different living situations proliferate, I watch HDB standardisation rupture before René and the developers' eyes. The most destabilising question comes next, a seemingly simple question about daily Internet use: "I turn off my Wi-Fi when I'm not using it, is that a problem?"

René notices heads nodding throughout the room. Jean, panic in his voice, asks: "How many of you do this?" About 75% of hands in the room go up. The developers stare wide-eyed, aghast. Residents must have a continuous home Wi-Fi connection for data captured by the sensors to be transmitted to the lab (see Figure 110: "very important for our technology deployment.") The developers had no idea this was how people generally used the Wi-Fi, like a light switch. If such behaviour continues, René tells me later, this project won't function in this one HDB estate, let alone back in France.

As questions flow, René's expectation of standardisation between HDBs, and between homes in Singapore and France, is further troubled. The developers adopted the expectation because A*STAR and HDB told them: "HDBs are so uniform, so you know that if it works in one place it will work in all the others." He himself had uttered that phrase many times, replicating what he was told by state planners who housed the lab, built and designed the HDBs. Through sessions like this, I watched ICON developers slowly realise they had been enacting a specific imaginary of how people, particularly older people, lived. This imaginary involved two people co-habiting, with family visiting a few times a year, emerging from their experiences visiting their parents in France and encouraged by the generalised, standardised resident represented in plans from state planning agencies. The model home, the sensors embedded in it, and their data interpretation model are clearly based upon this imaginary. Sensor data differs as living

and visitation arrangements differ and is laden with different meanings depending on the embodied living arrangements and social practices residents spatialise in the home, yet the sensors are arranged to process standardised bodies of motion data based upon standardised databodies.

From interacting with residents in the HDB, a more diversified technological everyday emerges. One woman's son visits daily with his friends, another shares a flat and bed with her daughter, another occasionally rents out a room. The sensors cannot distinguish whether the person opening the fridge is the older person, signifying to the developers that they have eaten that day, or a son coming over for a snack, carrying a different meaning. Similarly, sensors under the mattress tracking sleep patterns are disrupted by another person in bed and track nothing if someone slept on the floor. The same goes for toilet sensors, front door sensors, and motion sensors throughout the home. In their daily motions, residents disrupt vital standardisation, challenging the easy transition from HDB to HDB or HDB to Paris home and the smart city sociotechnical imaginary in general: Singapore turns out to not be the standardised "living lab" the developers expected, the metonymic process interrupted.

Exhausted after the session, René takes a Grab straight home. He spends the evening at the condo's pool, working out in the gym and Skyping his girlfriend back in Paris.

2.2 Spatialising Resident Difference, Living Outside the Lab

Many smart city critiques would categorise René's problem as a disconnect between state planner/developer imagination and resident lived experience. But abstract imagination does not belong to states and "elite" technologists, while "ordinary people" possess lived experience. Developers have a lived experience too: they engage with and enact an imagined future every day, through the material infrastructure of the model home and the sensors they embed in it, based upon their interpretations of the significance of the material-symbolic resources they work with and through.

Through encounters with residents, developers realise the model they work through is failing them. When I interviewed René inside the smart home model, he said:

> This smart house facility is under-utilised. We had to stop trying to use it to model anything anymore, it doesn't match up. The government loves it to show the funders around, because it generates money and excitement, but we really just sit in here and program the sensors, check for faults, and try to interpret the data from the test sites themselves.

The smart home model as a material-symbolic resource works to project Smart Nation sociotechnical imaginaries of standardisation, connectivity, and futurity to A*STAR's visitors: potential corporate funders, school groups, other governments, visitors from other nations. A press release dating back to 2006, before Fusionopolis was even built, invoking the smart home as a metonym for the larger Smart Nation sociotechnical imaginary makes this clear (Figure 111). It narrativises each element: standardisation allowing for a "living lab" Singapore, where researchers can "live and work in an environment" and use its "test-bedding infrastructure"; connectivity of both technology ("Singapore's strong foundation in electronics, IT networking") and of international partnerships ("the world market") and futuristic, an "intelligent home of the future" which will "accelerate the development of a digital home industry" where "the best" is "yet to come". Note that the chairman of A*STAR opening the Smart Home programme is Philip Yeo, discussed in Chapter 5: in the 80s and 90s he helped form the NCB, pioneered international IT training partnerships with IBM and domestic training (including the Civil Service Computerisation Programme), and developed the National Computerisation Plan of which that Programme was a part.

November 01, 2006	Showcase of SMART HOME Technologies launched by A*STAR

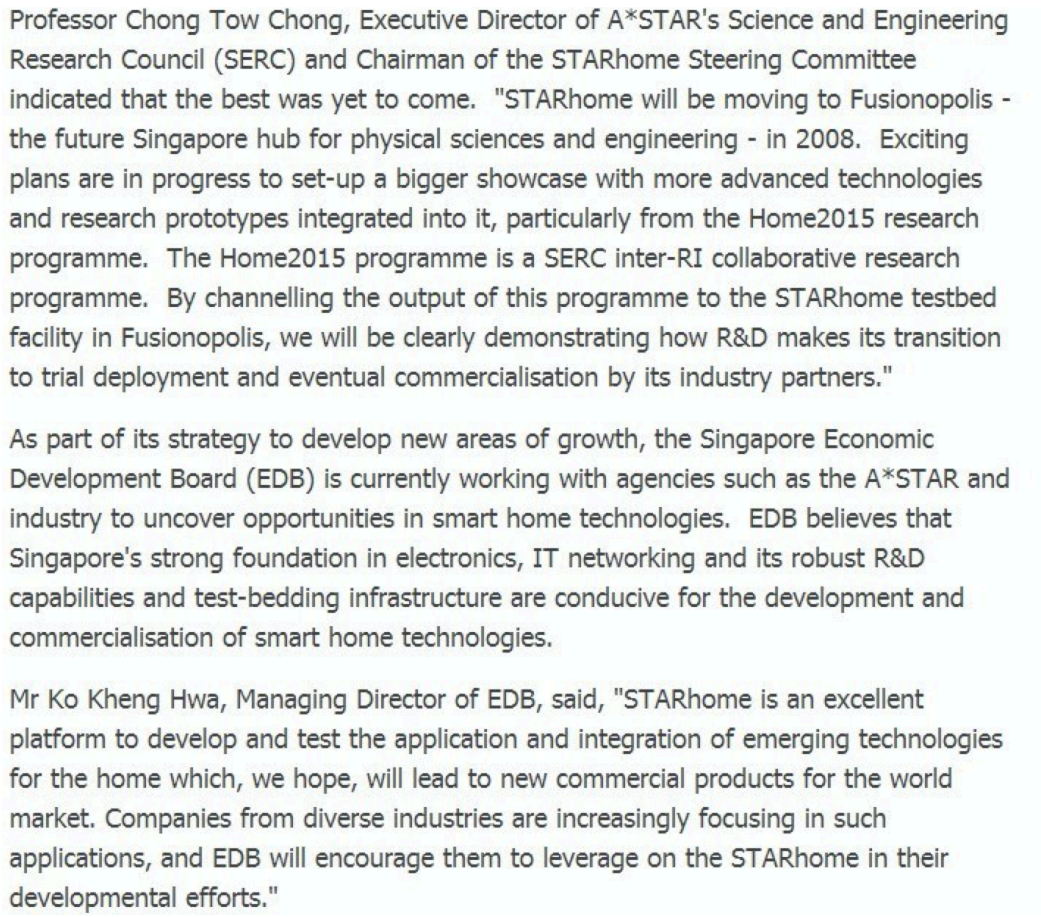
A*STAR's STARhome will be testbed for innovative technologies from RIs, tertiary institutions and industry partners

Singapore, 1 November 2006 - STARhome, an A*STAR R&D technology showcase; providing a platform to explore and demonstrate state-of-the-art smart home technologies from the research output of A*STAR's research institutes, tertiary institutions and industry partners was officially opened today by Mr Philip Yeo, Chairman of A*STAR.

STARhome is a new, fully furnished and functional model home (in the form of a show-flat) with extensive infrastructure to showcase innovative and integrated smart home technologies. Hosted by the Institute for Infocomm Research (I^2R), STARhome is an exciting incubator of innovative technologies, where researchers can actually live and work in an environment that would facilitate feasibility, reliability and usability studies. It is also a place where realistic applications and features will demonstrate the benefits of the new technologies; where companies will have great opportunities to translate these cutting-edge technologies into commercially viable products.

This intelligent home of the future, conceptualized to meet the lifestyle of choice of every family member embodies four major lifestyle ideals: Healthcare & Comfort; Safety & Security; Automation and Control; and Entertainment and Information. Additional information on STARhome is available at Annex I.

Professor Lye Kin Mun, Programme Director of STARhome disclosed, "The response from industry has been very encouraging since we started operating in January 2006. Most of the 12 sponsors from industry were already on board even before the construction of the home was completed." These sponsors include ABB Singapore; Cisco Systems, Inc.; Cytech Technology Pte Ltd; Eubiq Pte Ltd; IDLink Systems Pte Ltd, OSIM International Ltd; Philips; Sensitive Object; Smart ID Technology Pte Ltd; Star Furniture Group; V One Multimedia Pte Ltd and XID Technologies Pte Ltd. This launch marks the realisation of a 'smart home' with the full integration of 12 project prototypes from our research institutes and extensive infrastructure provided by our sponsors."



Professor Chong Tow Chong, Executive Director of A*STAR's Science and Engineering Research Council (SERC) and Chairman of the STARhome Steering Committee indicated that the best was yet to come. "STARhome will be moving to Fusionopolis - the future Singapore hub for physical sciences and engineering - in 2008. Exciting plans are in progress to set-up a bigger showcase with more advanced technologies and research prototypes integrated into it, particularly from the Home2015 research programme. The Home2015 programme is a SERC inter-RI collaborative research programme. By channelling the output of this programme to the STARhome testbed facility in Fusionopolis, we will be clearly demonstrating how R&D makes its transition to trial deployment and eventual commercialisation by its industry partners."

As part of its strategy to develop new areas of growth, the Singapore Economic Development Board (EDB) is currently working with agencies such as the A*STAR and industry to uncover opportunities in smart home technologies. EDB believes that Singapore's strong foundation in electronics, IT networking and its robust R&D capabilities and test-bedding infrastructure are conducive for the development and commercialisation of smart home technologies.

Mr Ko Kheng Hwa, Managing Director of EDB, said, "STARhome is an excellent platform to develop and test the application and integration of emerging technologies for the home which, we hope, will lead to new commercial products for the world market. Companies from diverse industries are increasingly focusing in such applications, and EDB will encourage them to leverage on the STARhome in their developmental efforts."

Figure 111: Starhome Press Release. November 1, 2006. https://www.a-star.edu.sg/News-and-Events/a-star-news/press-releases.

But as a resource for materially exporting that standardisation, connectivity, and futurity, the smart home encounters friction when residents reimagine it by living in actual HDBs with the smart technology in diverse and differentiated ways that cannot neatly stand in for generic populations or "scale". Developers discovered the opposite need: for customisation to unique contexts, rather than standardisation. "We have this platform," Jean said, "but the problem as you can see is implementation...we need to engage the local community centres: to reach out to people and ask them what they need, how they want things to be customised, what they want from the service." Jean had imagined Singapore having futuristic, seamlessly connected technology, but "people have old Nokias from 1999."

Jean and René could not reimagine the mindset that more and better data flows would fix their problems, however. As Jean told me: "The more data we gather—it's the software that's important, that's where the value is. The more information we have the more precise we can be and the more we can tell if something is outside the norm." In the following sections, I describe how residents disrupting data flows, also disrupting the foundational Smart Nation sociotechnical imaginary of connectivity, trouble this notion that more data will make up for the dearth of standardisation developers face.

As evidenced, specific sociomaterial conditions produce the Smart Nation. Those conditions are imperfectly replicated in the project-space of the smart home model, not because it is "abstract", but because the model that ICON developers think with is both materially and symbolically different from residents' homes. It enacts a different metonymic process as it performs standardisation rather than context-specificity. Looking at the objects and spaces people have to imagine with is vital to understanding how imaginaries like the Smart Nation are replicated and/or reimagined. In the next section, I show how these resident disruptions of standardisation also trouble state planners' sociotechnical imaginary of connectivity, as residents continuously use smart technologies in their everyday domestic practices, also creating new data flows through bodily engagements, to reimagine both social and technical connectivity.

3 Reimagining Connectivity

3.1 The "Technological Everyday" of a Local Smart Home Developer

Esther wakes at 6am and slips out of bed quietly, leaving her husband asleep. Like many of her iHome colleagues, she lives on the West Coast in an HDB near NUS, where most of them attended university. She scrolls through her Huawei smartphone while brushing her teeth, chatting with relatives in mainland China on WeChat. Her Slack app has hundreds of notifications, most from the smart home system she helped develop. Every time a resident triggers an alarm, based on a series of sensor movements that

she and other developers have programmed to indicate a fall, she gets a notification. Every time a resident has not left the house for two full days, she also receives an inactivity notification. When a resident presses their emergency button, which happens about once a month, she receives an alert.



Figure 112: View from Esther's Window.

Esther packs her guitar for band practice after work and leaves her flat, taking the lift from the 23rd floor. Her smartphone notifies her that it will rain today (the app displays a puppy in yellow wellies, making her smile) and she grabs an umbrella. She takes one bus straight from West Coast to the CBD every day, but it takes over an hour. Checking the bus progress on her phone, she accelerates her walk through the HDB's playground, where children play before school as their mums and aunties socialise near the market.



Figure 113: At the bus stop. A leading global university...influencing the future.

Tapping her EZ-link card, Esther settles in on the top deck. She uses a music app to rehearse songs for today's band practice. Their next gig is for the elderly smart home residents, who come to the SAC for a monthly party thrown by the developers. Her band learn many songs, because the seniors love to sing karaoke and request songs in Tamil, Malay, Mandarin, and various Chinese dialects. Esther is fluent in Hokkien, Teochew, Cantonese, and Mandarin.

When the bus pulls into the university, Esther taps out with her EZ-Link card and reaches for her employee card to access the Information Sciences building. Surrounded by chattering university students in the elevator, she disembarks at the undergraduate-free 8th floor. She taps in again on the locked glass doors to the iHome lab, seeing about twenty small cubicle desks (including mine) filled with PhD and postdoctoral students working on the smart home project: a partnership with HDB and a multinational private corporation who make the sensor technologies. At her cubicle, decorated with Chinese cartoon animals peeking around her monitor, she logs into her computer with her employee ID and password. She checks her email and sees a morning app design meeting, home visits in the afternoon, then a team meeting. Like many mornings, I go say hello.

Preparing for home visits, she lets me watch her use the iHome system connected to her smartphone's Slack app to check which flats need attention. Gateways with a Wi-Fi stick and power source for the sensors (no longer relying on individual homes to have Wi-Fi, unlike ICON) are faulting in three HDB flats: Mme Fong, Mr. Wong, and Mr. Agarwal. Some sensor batteries need replacing, as do sensors. And Yishuan, a social worker from the voluntary welfare organisation (VWO) caring for the HDB's elderly residents, has reported the system is producing more false positives than she can handle.

Esther walks me through a few resident activity logs. Each sensor has a different line, based upon its location, indicating when a resident has moved in front of it. She interprets frequent activity in multiple rooms to mean that the resident moves around regularly. A drop-off in motion can mean the resident has fallen and is stuck, or the resident has gone out, but requires interpretation: often the

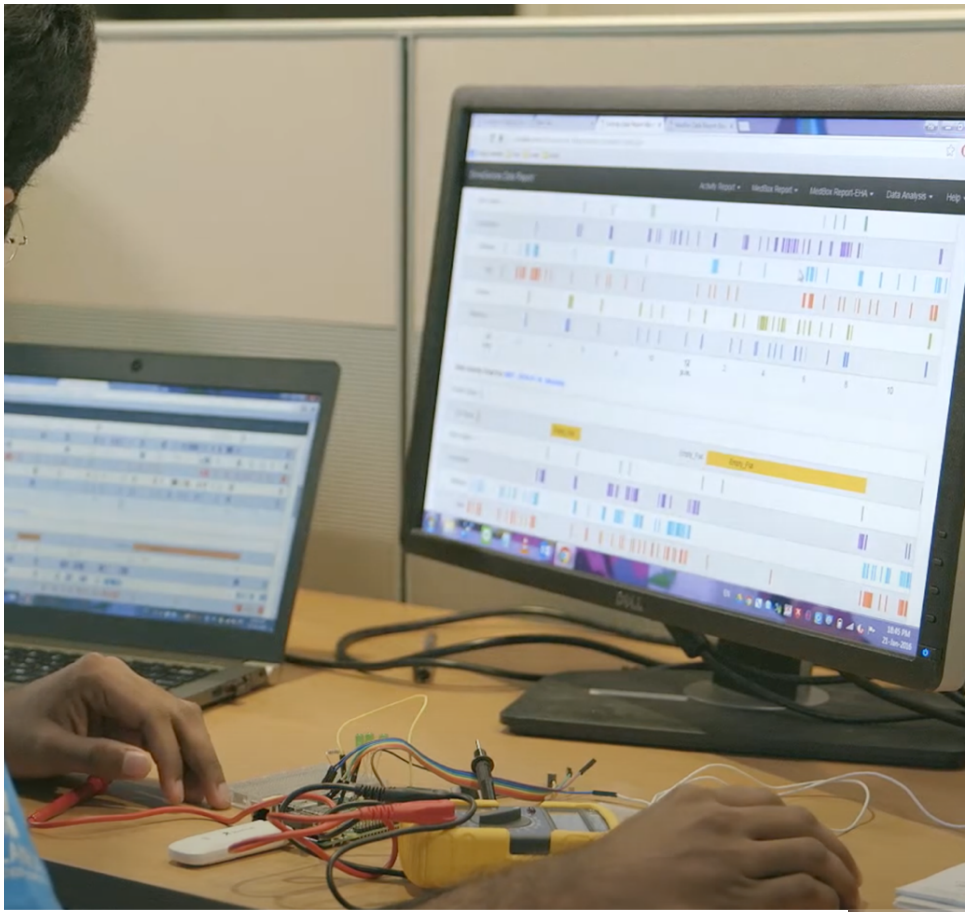


Figure 114: Smart Home Sensor Data Storage and Analysis System.

contact sensor on the door hasn't activated to show the resident has left. She notes residents to check on based upon low activity level and sketches a visit map to navigate the high-rise blocks most efficiently.

"In theory," she explains, "We are trying to create machine learning algorithms that learn the resident's patterns and detect deviations from those patterns. The project goal is to create an almost fully-automated system, where children or care workers get an alert if there is significant deviation. This would also be an early detection system, so healthcare professionals detect and treat minor cognitive impairment early on. But we're a long way away from that," she says, showing me the long list of false alerts and manual fixes implemented by her and a small group of developers who know the project well.

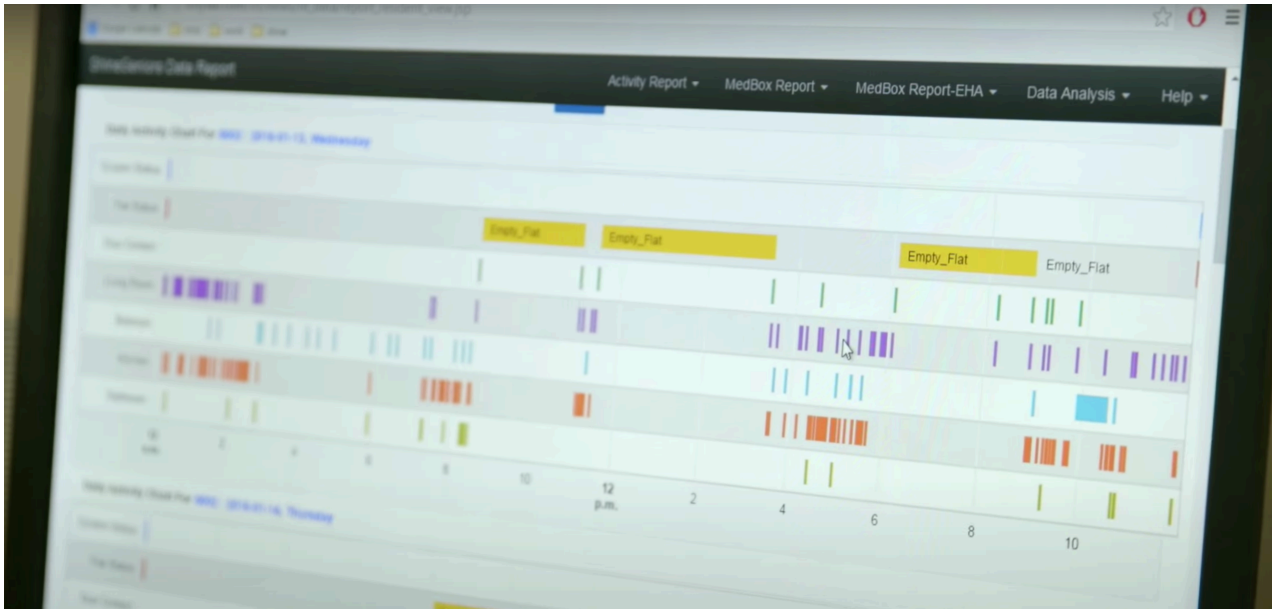


Figure 115: Activity Report, Smart Home Sensor Data System.

We go for coffee in the staffroom with Connie, the personable project manager who joins the home visits. Connie has no engineering or technology background but has developed relationships with all 95 smart home residents. As a result, she is most skilled at translating data into analysis of residents' actual activity. She answers many texts and calls from residents, their families, and the VWO.

We then tap into the lab itself, unlocking another glass door, for a meeting on designing the smartphone app for state agencies and corporate funders of the smart homes, as well as VWOs and residents' families. Jin, the commercialisation team lead, argues that state agencies want a "big map of Singapore on the app's opening screen" to get location-specific sensor data on the elderly for planning maps (recall Alvin's GIS maps in Chapter 5): "They want it, it has to look good, and they have to see how it could be used elsewhere, on the whole island." Postdoc Feng protests. "Do we even need a map? What does this even tell us? If it doesn't give you the info you need, it's not useful. Yishuan doesn't need a map, it's just an extra screen, the more clicks they have to do is bad."

Jin pushes back: "Remember when we brought the agency execs to see the lab, and we had nothing to show but the box of sensors? We need to have something, a demo, to show them the big picture, they like to see everything. So do the corporate funders." He continues sternly: "There will be no app for Yishuan to use if we don't continue the project funding. Of course ageing isn't about technology or data, it's about a support ecosystem, but for funders it's about nice data visualisations." This map he suggests is based upon URA zoning, 55 zones from the last Master Plan. He goes on:

> The way we are doing things currently, it is a ticking time bomb. It works for residents and for the VWO, but if the ministry comes to check on us, we are in trouble. So we need to put together a map app *for storytelling purposes*. When I talked to Jermaine at HDB and floated our low-tech solution, he said 'you will contaminate my solution.' But we need that government funding to continue. These projects are for performance, like Yuhua, they come and go if they don't look good enough. To maintain, we need to maintain government interest in what we are doing, they have to be able to show us off. So we have to keep corporate connection to [corporate partner] or someone international like that. And for planners to be interested, for value, they won't be interested unless we give something like, smart, some logic.

Feng says: "Fine, as long as we do not confuse this for what the VWOs actually need."

Esther stays quiet. She tells me later that as an engineer she doesn't know what looks good to a planning agency ("leave that to Jin"), but that the neatly scaled map images speak to something different from her experience. Residents and the data they produce in the motion of their everyday lives create a flurry of sensor responses, data "very hard to interpret and visualise." She and the other iHome

engineers want the smart home project to continue, she says. But not because it produces a bigger, real-time map of the Smart Nation.

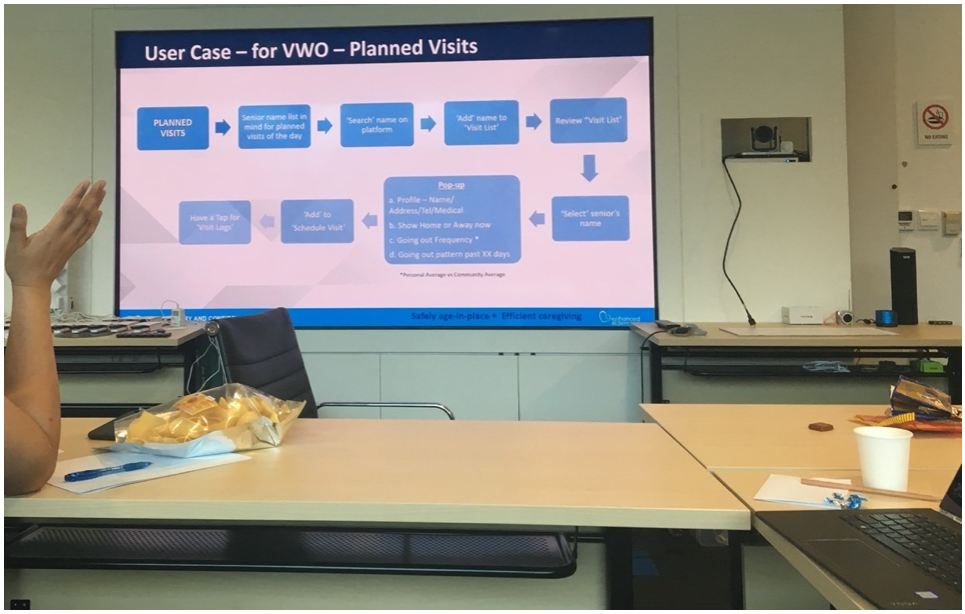


Figure 116: Mapping User Pathway for Smart Home App.

She participates when they start app design for the VWOs, based upon their ongoing everyday interactions with residents. To do this design, they walk through care workers' daily practices and the material tools they use. The developers start from their discovery that workers find smart home sensors useful for one simple task: telling whether a resident is home. Feng says: "We have to go backwards: what is this screen for? We need to understand their existing process, and how we can upgrade the technologies they currently use with this technology to help them do their daily work easier. So how do they schedule visits right now?"

"I think currently they write them on the whiteboard." Esther says. "That's for planned visits." Connie adds: "For ad-hoc visits, volunteers eyeball at the SAC: elderly isn't here, hasn't been present for the last few days, I think we need to pay them a visit." Jin replies: "OK. So instead they can check the system to save efforts of calling on elderly not in, for already planned visits. It can also help them know who to see ad-hoc, who could be socially isolated and who is active."

Feng adds: “Because most information we have in the system comes from notes the care workers and we write, not the sensor activity itself, we need to add a manual tagging system, since so much happens from input from the VWO rather than the automatic sensor detection.” As they update their contextual understanding of residents’ and workers’ movements, how they connect with each other, and what the sensor data signifies to them, they update the smart home app itself. Due to repeatedly ambiguous sensor data, the developers often remove automation in favour of human entry assisted, but not replaced by, technology. They also remove initially-imagined “cutting-edge” functions from the app for easier use.



Figure 117: Inside iHome Lab.



Figure 118: iHome Lab Smart Home Technologies: Sensors, Batteries, Gateways, Emergency Buttons, Power Sources.

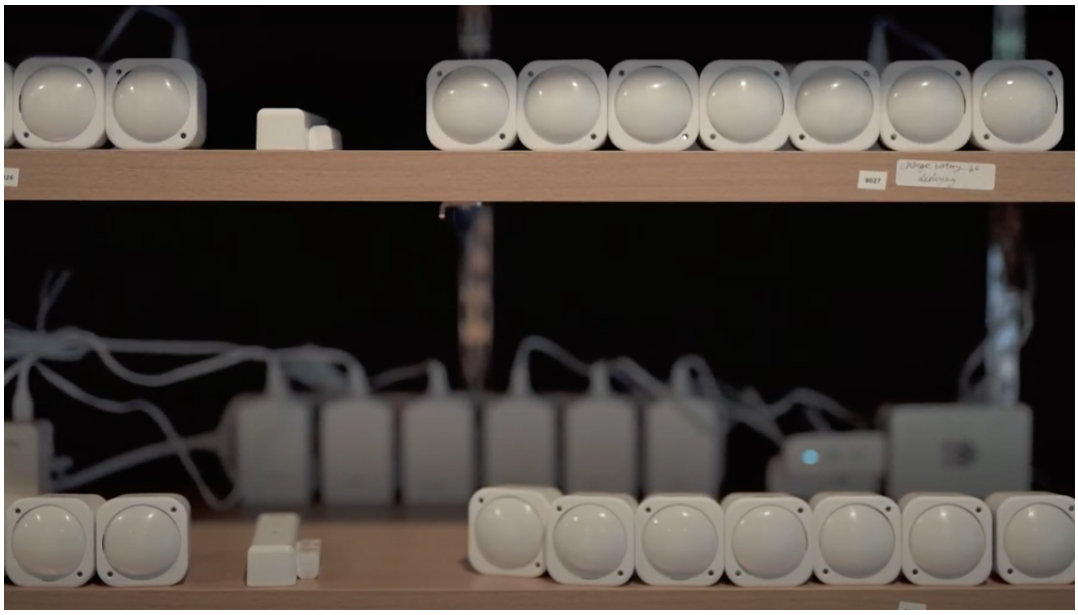


Figure 119: Door Contact and Motion Sensors (Passive Infra-Red Sensors), iHome Lab.

Esther, Connie, and I then take a Grab to the first HDB estate. We head to the SAC to teach the system to new care workers, who are the first responders to alerts and know residents best. Esther and Connie open a slideshow on the old computer in the small SAC meeting room. “The gateway must always be turned on,” Esther explains, “because it’s the power point, without it the sensors won’t work.” One worker asks what happens if residents accidentally turn off the power, which happens frequently. Esther

replies: “You won’t see any technical issues on your display, it won’t tell you that it’s off, just will trigger an inactivity alert. So you have to go check on them. During our maintenance visits, we remind them not to turn off the power or the gateway.”



Figure 120: Bird's Eye View of Sensor Layout in HDB Flats.

She then explains the emergency button. “We know they don’t like to wear it, but if they aren’t feeling well, tell them to. Press the button in an emergency to send an alert, but also call EMS [Emergency Medical Services].” Next, she explains the beacon on residents’ keychains: “The beacon tracks activity, so it lets us know the elderly person is active. It’s connected to a sensor in the centre, so we can detect when they come in.”

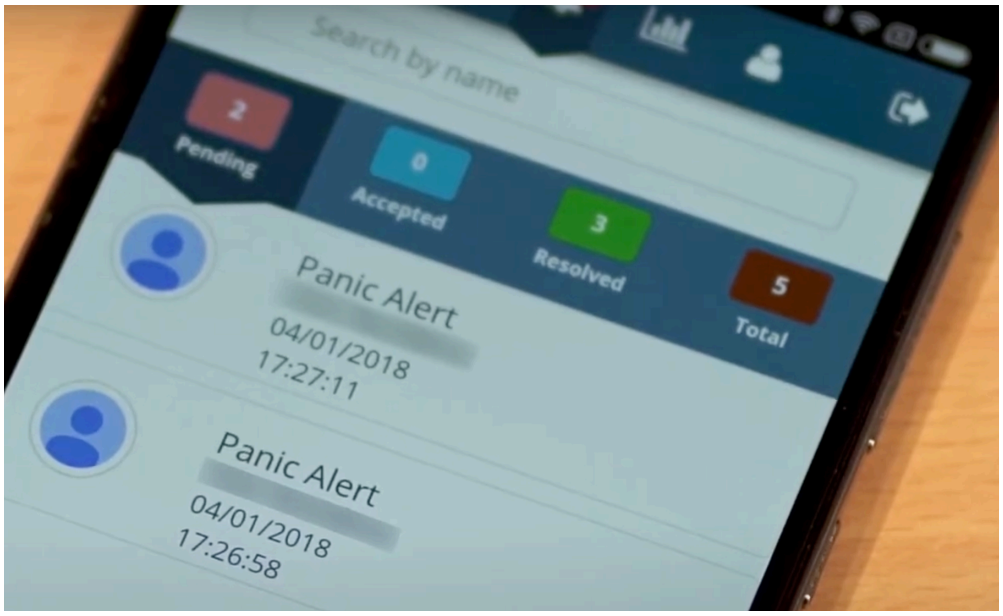


Figure 121: Alert System on Smartphone.

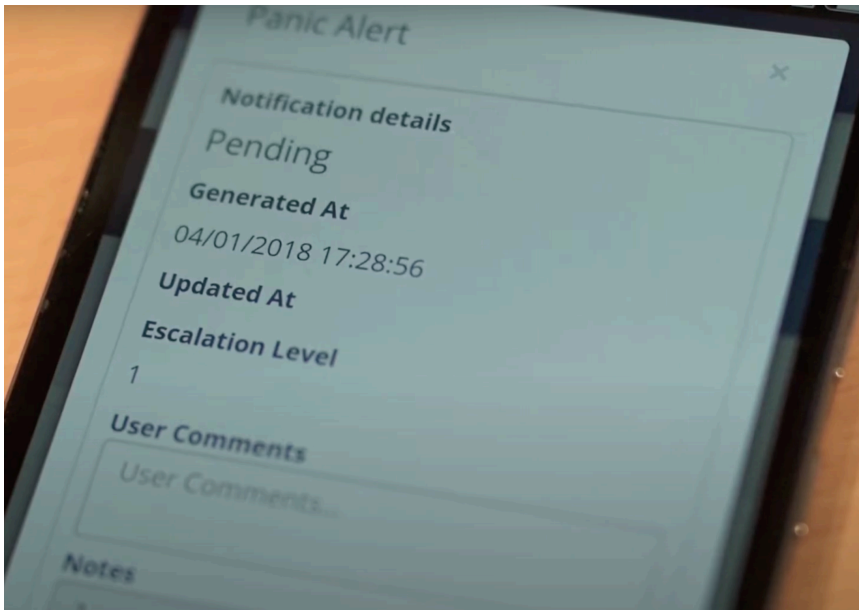


Figure 122: Details of Alert on Smartphone with User Comment section.

Esther explains the two kinds of alerts: first, the emergency alert, activated when the senior physically presses the button. This goes to the smartphones of the workers, the developers, and family members with the app. Second, the inactivity alert, which means "no motion has been detected, so you need to go check that the elderly did not fall or faint." These alerts go through Slack, she says, so you need to have the app downloaded and be on the right channel:

The system shows time at home and time not at home. Beacon confirms they aren't at home, so they should attach it to their keys. This way you can also tell where the inactivity occurs: so if they're in the toilet, for example, you can theorise that they might have fallen and go check on them. The last seen location gives an indication of what might have happened.



Figure 123: Emergency Button on Necklace.

To report you have responded to the alert, Esther continues, you need to input the alert, the alert number, press space, then the message. The workers become palpably uneasy as she adds steps. Esther instructs them to care for the elderly person but also reply so everyone knows the alert has been responded to: “It’s always good to put the number, otherwise it won’t be attached to the same alert and will be hard to track. We can’t tell what’s happening at the lab, so we need updates from you to tell us what’s going on. We have an activity chart, but we don’t know why it’s happening.”

It transpires that even existing care workers don’t know how to reply to an alert or even see alerts, other than tech-savvy Yishuan. Esther asks one worker to try on her phone. “Oh, mine is dying, forgot to charge,” she replies. “That’s a problem,” Esther replies, “make sure your device is fully charged, the app does take a lot of battery.”

Esther stresses: “You need to communicate to us when residents are away or at hospital, so we know why someone is inactive. The communication flow goes residents, VWO, iHome lab.” Care worker Iris asks about a resident in hospital: “He’s trying to come back; he wants to age in the community, but we are trying to get him to go to a nursing home because we cannot give him the level of support he needs.” The system is still in his house, she says, but it’s completely inactive and keeps sending inactivity alerts. “We don’t have information yet about whether he is coming back, his sister has the final say.” Esther sighs. “That’s ok, just let us know when you know.” She marks it in the comments field on the app. Iris asks: “but what if they don’t inform us when they are away?” “Do your best.” Esther replies.

Connie then shares qualitative survey results on resident happiness, social activities, and social connectivity. She displays residents who self-reported below-average social interactions. Iris laughs when she sees Mme Chong:

> When she says she has low social interaction, it's not true. She's always down at the centre. On the ground we know how often they come or don't come. When I see this graph, I'm shocked. They're very active, and here all the time. These are very active ones, the ones who say they are inactive. So much so that when we ask them to come for this or that thing they say, "I have an appointment, I can't." So take their words with a pinch of salt.

Esther pulls up the low activity graphs of several residents, based upon sensor data. Iris sees the low activity of Mr. Pillai. She says he may have low activity but that doesn’t correspond to low sociality:

> It's not possible for him to move, so he doesn't come down. It's not easy for him to move around. He likes to talk though. If you go up there for 30 minutes, he'll talk the whole time and you have to excuse yourself. And he’s always on the phone to someone, so lively that one.

Connie laughs and replies: “Yes! When I went up to give the survey, he took it out of my hands and wrote it by himself.”

Another resident appears on the monitor due to low SAC attendance and not leaving the house every two days. Iris says: “Go look at him, look at his house, it’s very clean. He cooks by himself. He is

not inactive; he just doesn't like to come down to the centre." Connie agrees that residents are very different:

> Many of them surprise you. The 83-year-old woman who gets up at 8 to help other people in the HDB. Everyone is different. One told me: 'I don't want you to come. If you keep visiting, I don't think I want this system.' She signed up because of the food vouchers we offered but says she didn't receive any. Then says she received five instead of fifteen dollars.

Iris replies: "She is like that with us too about everything, it's not just about the sensors."

Finally, Esther has Iris call a resident to test the emergency button. "Hi Auntie, it's Iris. We are here with the engineer, and she is asking if you can press the emergency button so we can test it." Esther waits for the alert to appear on the screen, but nothing happens. "Do you see the light?" Iris asks. "Can you press harder?" Another pause, and Iris hands Esther the phone. She discovers Auntie Jia-Xin is pressing the gateway, not the emergency button. "It's the black one, black in colour, on a string." Auntie Jia-Xin responds: "oh, yes, let me go find." A minute later, she says she has pressed the button. Nothing appears on the system, so Esther asks her to check if the gateway is on. She explains the difference between the sensors and the gateway: "Sensors have batteries inside, but gateway turned off means it won't work. Can you help us check? Is the power off or on?" She gives up. "OK, I'll come check later."



Figure 124: Gateway with Wi-Fi Stick, in HDB Flat.

Iris says: “See, they don’t make use of it. They don’t know what’s what.” She looks at the Slack app and asks: “what does the blue mean?” Esther explains that the colour changes from red to blue when someone responds to the alert. When the problem is resolved, the colour changes to green.

Connie gives a final project update. The funded period is ending, as the corporate funder only gave money for a limited timeframe, and the developers had not yet proven to HDB and URA that the project was worth continuing. Visits would continue “out of goodwill” until December and an external maintenance team would change the batteries instead of the developers. Connie handed out photos of the team. Her job today was to show as many residents as possible, so the residents would trust and let them in. It took developers time to build residents’ trust, as many were wary of letting strangers into their intimate space. She concludes: “This also means that we can’t respond to alerts anymore, you are the first responder now from 7am to 11pm.”

The workers look overwhelmed. Yishuan asks if there will be more funding. Connie says she doesn’t know. Yishuan is certain “the ministry will fund. Chi-ye pushed hard for these things and she is now at the MOH [Ministry of Health].”

Connie and Esther then split up to visit different residents and do sensor maintenance. They play rock-paper-scissors for Mr. Tuah, who answers naked and makes sexual comments when women developers visit. Connie loses, but Esther says they’ll do it together. “You shouldn’t go alone into the home with uncles ever, but we are understaffed,” Connie tells me.

Esther and I take the lift to the 17th floor to visit Auntie Jia-Xin, who always opens the grated door with a smile and a lemon green tea juicebox. Like many residents, she leaves the main wooden door open for air flow and closes the grated door, but (visible in Figure 126) the contact sensor sits on the main door, making it hard to track when residents actually go out. Esther enters and we observe the white, orb-like motion sensor, one of six in the flat, blink green behind the couch.



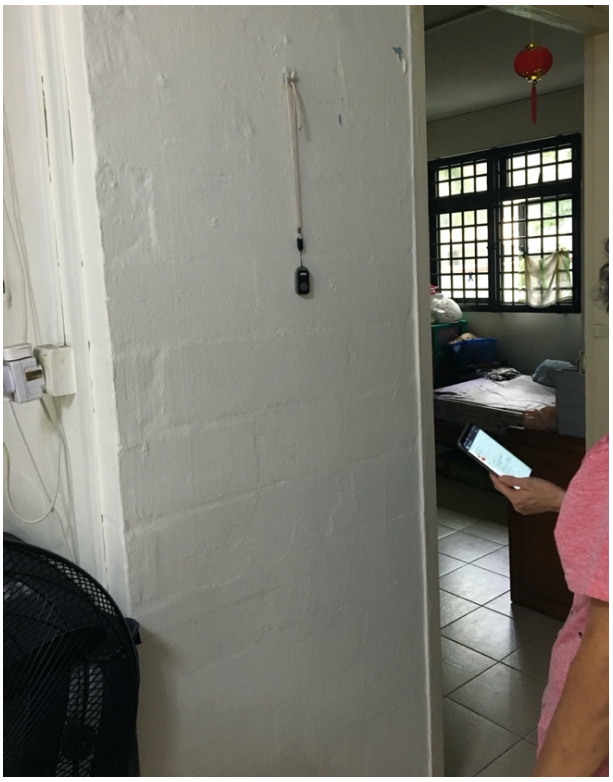


Figure 126: Motion Sensor behind the Door, Contact Sensor on Main Door (Left).
Figure 125: Testing Emergency Button Hanging on Hook with Smartphone App (Right)

After catching up with Auntie Jia-Xin, Esther checks the gateway. The power is connected, but no data transmits. Taking apart the gateway, she shows me: “Faulty SIM card again.” She sits cross-legged on the tile floor and pulls out her backpack full of replacement batteries, sensors, power sources, and SIMs. She takes a new SIM card out, swapping the old one and changing the gateway’s batteries just in case.

“It should work now, Auntie.” Esther asks her for the emergency button, which Auntie Jia-Xin has hung on the wall. “You should wear it, Auntie! What if you fall, how you reach up there?” Jia-Xin replies: "I leave there, I'm worried it will make noise and not stop." Esther tells her it won’t make noise,

and she nods, but we can tell she doesn't believe. "Auntie, we are going to test it. Press it hard for me, OK?" Jia-Xin awkwardly presses the button without unhooking it from the wall, only releasing the button when Esther tells her to.

While waiting for the care workers to respond to the alert, Esther looks at Jia-Xin's activity chart. "Auntie, I can see you haven't been going out much lately. All OK?"

"What? I go out regular. I don't bring keychain. I go do exercise lah and forget it. I don't spend much time here, I live alone!" Esther notes this in the comments field on the smartphone app and replaces all the sensor batteries. Each technology uses different batteries (the gateway, sensors, and emergency button) so this takes time. The workers never respond to the button press.

"Esther, can fix TV? And text my son?" Jia-Xin asks, handing her the remote. "Can. What's wrong?" "Text my son, he will tell." Her son lives in Australia, so Esther frequently helps her know when and how to communicate with him through the smartphone he gave her. After spending 30 minutes fixing the TV, we say goodbye. "OK, till next time" Jia-Xin says, beaming. As we walk to the next flat, Esther says sadly: "I don't want to tell her I probably won't be back unless the project gets more funding."



Figure 127: Wendy and Mum. Home Visits, Alecia Neo. 2010.

Next, we see Mme Chun and her daughter, Mei. Technically the seniors must live alone, to avoid the issues ICON faced, but in practice they often don't. Mme Chun's daughter fell on harder times and moved back in. Esther decided not to report it because the pair needed the food vouchers they got from participating. Mei told us how they came to this HDB, a path that should sound familiar from Alvin's story. They lived in a different HDB across town, but the state reclaimed that space for a new mall:

> You know the [MALL NAME] that I told you about? The government built that in the usual way. They parcel out the land, reclaim it, demolish the homes, build a new housing block, and move everyone. That's what this HDB is, it's the ones they built to replace the old ones. The woman who lives over there, she's 60, the couple over there are in their 70s, and the woman over there is in her 60s but her daughter lives with her. They were all in the same block in the old HDB, and they've just moved over here in the same way. A lot of people did that.

Residents of her former HDB were all evicted but relocated to this new HDB. Esther checks the home's sensors and notices that Mme Chun has again covered the sensors with face towels. "She thinks they are cameras", Mei says, "and I cannot convince her otherwise." Esther sighs and notes this down in the comments field in the smartphone app. The emergency button was in the washing machine, "a new one even for me," she tells me after. "She won't let me test it because she won't let me touch it," Mei says.

Mme Chun is not the only resident with a roommate, causing sensor data to read another persons' motion, without state agencies' knowledge. Esther giggles as she tells me about a resident with two mistresses, who he introduces as his "close friends". One comes from Indonesia for long visits, but he is ashamed to admit a woman is staying so he doesn't report it.

Next, we visit Mme Fong in a different block. Her HDB is one of the oldest ones. She lives in a tiny, one-bedroom HDB off a narrow, dark common corridor on the building's inside. It looks nothing like Auntie Jia-Xin's or Mme Chun's. But Mme Fong is always in good spirits and has chrysanthemum tea ready. She was a dancer and has old photos covering her walls, alongside pictures of her large family. She tells me her life history in our interviews, indifferent to the smart city or sensors. Her husband passed years ago, but she likes living alone to not "burden" her children. Her many grandchildren visit frequently: her son has three girls who gleefully dance in her old ballet shoes when they come over.

She teases me about when I'll get married and Esther about when she'll have children. "Shhh…now you need call GP this week? How are your pills?" Esther asks. Mme Fong nods, yes, she needs some help. Esther pulls the medicine box out and helps Mme Fong arrange her medication for the month, because she has difficulty opening bottles and cutting pills. Then Esther calls the GP for this month's appointments, writing them on a whiteboard on the fridge. Esther tells me that she has been doing this for two years and texts Mme Fong's son to ensure someone takes over if project funding runs out. Before she leaves, she fixes Mme Fong's nightlight.

We meet Connie for lunch at the HDB's hawker centre. I ask if the session with the care workers concerned them. Connie responds:

> The VWOs, other than Yishuan, you always train and retrain them. They forget to use the system. But this is not a tech job, not really. The seniors tell us things that they won't tell the VWO workers—they ask us first, are you a social worker? No? OK. And the VWOs know this too. When they went on a retreat, they asked us if we would be the ones monitoring the elderly. You are befriending elderly, and most of them like it when we visit. Although some of them will say 'eh you just survey me, why you back?' and get fussy. In the first year none of the seniors knew how

to use the tech, but because we visit, they say they feel safer. I sit down with them and show them their data and say: don't you want to contribute, to help other elderly? They come around when they see it. And when they hear through word of mouth that the button actually connects them to someone, they become more comfortable. It'll be ok if there are still people to come see them.

We finish our food and head back up the lift to visit more residents.



Figure 128: Uncle Au's Kitchen.

Next is Uncle Au. "He is nice so I can go in alone," Esther tells me. "His kids are so filial; they take him shopping once a week." His sleep activity data are non-existent, but she knows from sensors that he's still in the house. "Are you sleeping right, Uncle?" she asks. "Yes, yes! Sleep here or on floor. Room too hot." She notes that he is not sleeping in the bed, so the bedroom sensor cannot pick up any sleep data, in the comments field in the smartphone app.

We knock on other doors: a few where no one answers despite sensor data saying someone is inside, one where just the son is in sweeping, one where a Filipino maid is in but no other resident, and one where the uncle was sleeping naked on the living room floor. One woman allows just Esther in but then berates her, asking why Esther is so slow and repeating "I don't want this."



Figure 129: Home Visits, Alecia Neo. 2010.

Our last visit is with Robin, a trans woman and formerly famous singer. Robin is younger than other smart home residents but suffers from depression and suicidal thoughts. She often breaks sensors on purpose to be visited. She holds my hands in our interviews and tells long stories about past travels on tour. Esther often stays with her for an hour, playing guitar while she sings. "Robin, will you come to Makan Day this weekend?" Esther asks. The developers throw a big party in the SAC every month, making huge batches of chicken rice under the supervision of Jin, who moonlights as a chef.

"I don't think so," Robin says, sighing. "But there will be karaoke, you can sing for everyone!" Esther coaxes. Robin raises her eyebrows. "Live band or just recording?" Esther responds: "live, me, I play with my band!" Robin thinks and replies: "OK, but I will send you music to learn because I have special songs to sing. Deal?" Esther laughs. "OK, deal." As Esther leaves, Robin asks: "You're my friend, right? I can call you anytime?" Esther nods, telling me later: "it's hard to say no."

Connie also says the visits take an emotional toll:

> Many of them are active, they're always out and about. When you go see them they are cooking, or they are dressed to go out, and leave right after your appointment. But you also get sad, some of them have sad stories. One woman, when her husband passed, she worked as a

hostess. When the kids got older they learned, now they despise her and don't visit. She says, "better to die, lah."

It's 3pm and we need to return. Esther calls Connie and a Grab. Crossing the street to meet the driver, Esther notices LTA's crosswalk sensor, which seniors can tap their senior EZ-Link card on to get more crossing time. "They've added an icon indicating that it won't charge the seniors!" She tells me, amused. "Maybe it will work. At least they finally realised that elderly never tapped because they thought it would charge them money like the MRT." This means Alvin's system for determining elderly resident mobility in his interactive planning map described in Chapter 5, using crosswalk sensor data from LTA to plan the new HDB town, must have missed many daily resident activities. It also indicates that someone noticed the difference and planners changed the sensor design interface, possibly changing (even incrementally) flows of data from elderly residents to the smart city planning technologies, affecting the design of new HDB towns built based on their current walking patterns.



Figure 130: Crosswalk with Sensor to Tap for More Time.

The team assembles back in the lab. Project lead Hu, a computer science professor, summarises visitations and alerts. Total active homes are currently 86. September had 19 inactivity alerts, same as August (year to date, 271 inactivity alerts). All inactivity alerts in September were false, Hu announces.

"Is it because the door contact is down?" Hu asks. Feng, previously an A*STAR engineer, pulls up the alert logs and replies:

> The door contact is down in many cases, or the door is not in use. One resident does not close his wooden door at all. When we visited, there's no place on metal grate door to put sensor. We put it on wooden door and reminded him every day to open and close it. For another resident, the door system wasn't triggering because battery was out. Wasn't sending data.

Feng continues:

> And there is noisy motion sensor data. With humans there are a lot of other factors for sensing. They tend to have a lot of variation in behaviour. There is so much interpretation of movement on the ground either from our perspective or from the care worker. Based upon what we know about the person, about past actions that lead to certain sensor alerts, we flag it as a false report. The system doesn't do it automatically, but the care workers know or we know and we flag it.

"OK, we need to figure out how to stop so many false positives, we rely too much on the user notes rather than the data." Hu continues. "There have been 31 emergency button alerts for the year. 4 true alerts from one HDB site, all false from the other 2 sites."

Esther replies: "Two false alerts are from Li Na. She has had a lot of change and emotional distress. Her family reorganised the house, her maid took her jewellery and ran." Connie continues: "25 are from Mr. Hong. He presses when he wants to have a chat, because he knows that someone will come see him. But now he is pressing less, the trend says it will go down. So, one resident is affecting the overall data a lot." Hu instructs Esther:

> We don't want to just present numbers every month. The numbers don't mean anything unless we look further into what it means. Take away false alerts, calculate what are the indicators, who is triggering every month. With this data, we should go beyond tabulating. Try to find some reason or insights into this number.

Before Esther can answer, Feng says: “But we don’t have the resources, Esther is too busy.” Hu answers: “Doing what? What’s her primary responsibility? Don’t tell me its technology connectivity, because we have outsourced to an external company.”

I think about all the non-technological connectivity Esther does for residents, the care infrastructure she provides with the smart home infrastructure. She replies: “We were busy upgrading the SIM cards in the gateways because [corporate partner] changed provider. We had more active SIMs than residents, 20 dollars wasted on each unused, and there is no data till I go change the SIM.” Sensing his cue, Jin brings up commercialisation. He repeats what he told me many times:

> We need to avoid the business to consumer model, because no one would pay for this service alone. It’s the state agencies that want this data, because it is a part of their Ageing in Place Masterplan. There are 53,000 people in Singapore living alone, and they [the state] are not managing to incentivise children to take in their parents. The full smart home solution, with all the sensors…infrastructure and maintenance costs are high, and the data doesn’t tell us much.

We have to acknowledge the reality, he said in an interview, that “the ML [machine learning] application is out of reach. We originally installed in 500 homes but had to downsize because we couldn’t get it right. So many false positives. False alarms. And the old system was even a simple SMS system.” Less is more, he says in the meeting:

> The best solution just lets the VWO know if they are home or not. We cannot tell much from the rest. I know it is not what anybody wants to hear, but we have seen this system in use now on the ground. I suggest we forgo the possibility for more data analytics in exchange for more maintenance visits. When I talk to the care workers, more than the analytics portion, that's the feature that they value most.

Jin continues:

> We know it’s not the home that needs to be smart, it’s the people. The smart home alone won’t do anything without the response protocol, and that’s the VWOs connecting with residents, otherwise it doesn’t matter where the sensor data goes. We know from Yishuan that they use it to see if someone is home or not. And she uses it to check on toilet time. Only one person ever looks at the full data, and it’s her. The other care workers do not look at the data. We should take back the rest of the sensors and recycle them for better use. Realistically, our workflow is dependent on who links to the VWO. We need to connect the resident to a VWO in our system, that’s the value of the smart home platform. We have to ask: who is this for? Who are we projecting to? Because the agencies will ask me, if it is not the full flashy system, why they should fund it if it does not have R&D potential. It ends up being a marketing thing.

“OK, just say it. He business man!” says Hu, and everyone laughs.

Esther thinks Jin is right, because of a conference we attended the week prior. The Smart Nation and Digital Governance Office (SNDGO) presented a host of Smart Nation solutions, including the smart home project, to private industry and international public sector visitors. Most memorable was an AI called Viola, designed to matchmake young Singaporeans because the state fears the “alarmingly high percentage” of people 25-35 delaying marriage and lowering the national fertility rate. I stifled a laugh as Esther wiggled her eyebrows at me.

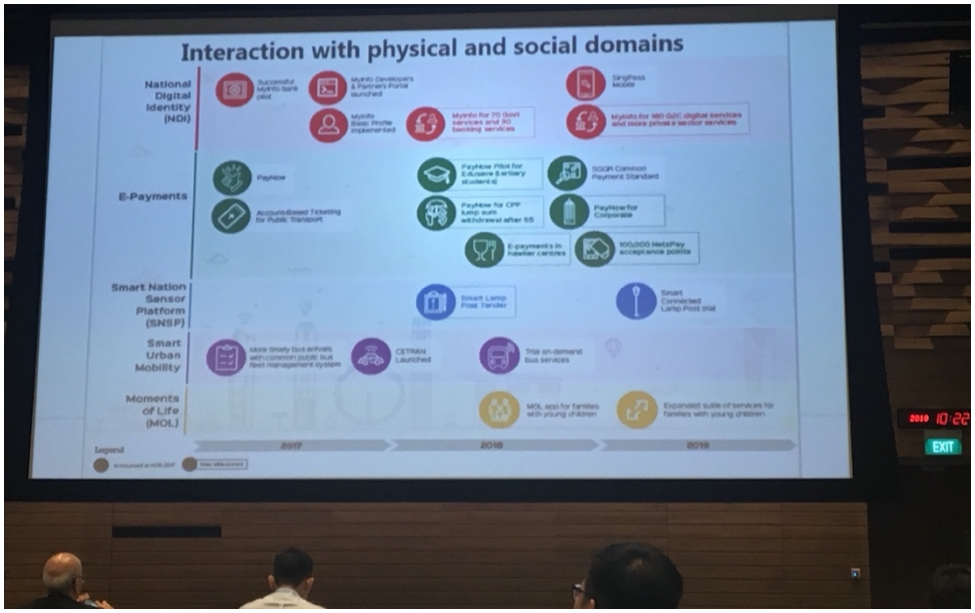


Figure 131: SNDGO Presentation Integrating the Social and Technical Systems of the Smart Nation.

The SNDGO Deputy Secretary said his goal was to “make data flow like water”, reducing the time it takes for agencies to ask other agencies for data, building “connective digital and social infrastructure that is invisible but allows for so many things to happen at a fast rate.” He continued: “I don’t serve as if I were five agencies, I serve as if I am one government. We want to give integrated services. We move people every four years to get them thinking beyond their sector, seeing the whole picture.” I noticed the connectivity imaginary repeated again, along with standardisation (one government, whole picture).

At lunch Esther ranted about how badly the "stupid" water metaphor misrepresented how data moves and what data is.

Her department head, a white American who had never worked on the project, announced that the smart home project was also a connector: bringing together international corporations, universities, and smart researchers from all over the world. He met me, a visiting Oxford student, right before the talk and incorporated it immediately: "an effort like this is attracting scholars from top universities around the globe like Oxford, connecting Singapore and showing that we are world leaders in this smart space." I became a symbolic resource used to replicate the sociotechnical imaginary of smartness-as-connectivity.

Hu ends our meeting: "Time to go home. App development session tomorrow, Jin will run." Esther packs up, logs out of her computer, and heads to band practice, falling asleep on the bus in the dark on her way home.

3.2 Breaking Domestic ICT, Connecting with Other Partners

Smart city residents, including developers, reimagine smart city sociotechnical imaginaries through material engagement with smart urban infrastructure. Residents do this by living in the HDB in unexpected ways and by *not* using digital connectivity in the social or material ways that state planners imagine. They do this all in their everyday embodied practice, generating unique technological everydays in the digitally mediated city. These are not grand acts of resistance against the smart city concept writ large or acts of speaking out against it. But in disrupting imaginaries of standardisation and connectivity in daily acts of differentiated repetition, they slowly reimagine the smart city itself by interrupting state planning agencies' metonymic processes, not neatly "standing in" for anything.

This reimagining is visible through Esther's technological everyday. While sensor connectivity often fails, other kinds of connectivity persist: those which connect residents to care workers and to the

different social connections they seek. Seeking connectivity becomes less about seamless data flow (data that "flows like water") or being a global node in a network of international partnerships. It becomes more about increasing the human contact that residents can make, with people in their neighbourhoods but also with friends and family in other places around the world. The smart home project is still about connectivity, but a reimagined connectivity.

For developers, reimagining connectivity comes from repeatedly experiencing what technology is actually used and useful for, in residents' diverse and differentiated daily practices, and trying to remake the technology and reimagine the smart city sociotechnical imaginary accordingly. These processes are both conscious and unconscious, as developers like Esther try to improve life for residents in small, everyday ways. The foundational imaginary of smart city connectivity shifts from seamless digital connectivity, data flowing like water, to a connectivity enabled through daily interactions with digital technologies that require human mediation, intervention, and interpretation.

Crucially, developers and residents rarely reject smart technology or the smart city wholesale. These developers are also not technologist elites out of touch with the lived experience of residents, imposing their abstract smart city imaginaries. Instead, developers look at residents' technological everyday, their interactions with a wide range of technologies, and try to understand what those engagements mean in practice. Interpreting that data, with residents and with care workers, moves them away from standardisation as a crucial material-symbolic resource for building smart city and towards contextualisation, the ability to account for resident differentiation. In their own daily practices, developers negotiate between the expectations of state agencies and the needs of residents and care workers, working through constraints to make changes and strategically using the material-symbolic resources given to them by state agencies to do so.

Their smart city, in turn, no longer seeks to standardise residents. Instead, it seeks to account for their difference and connect them with what they want. Not standardising their daily practices and seeking connectivity other than that imagined by the state, residents and developers make space for other futures. In Chapter 7, I show how their practices change the state's smart city sociotechnical imaginary. These practices create new smart city futures, making them critical forms of political participation invisible to scholars using limited frameworks of "active" resistance or participation.

In the next section, I turn to alternative temporalities that structure residents' technological everyday as they diverge from state-projected reproductive and productive futurity. I show how reimagining domestic space leads to imagining other futures than those planned and materialised by state agencies, disrupting the metonymic process projecting the heterosexual and youthful "national family" as the Smart Nation's future.

4 Reimagining the Future

In this section, I show how smart home residents reimagine state imaginaries of futurity, disrupting its attempts to enact reproductive futurity and productivity, by reimagining domestic space not designed for them and resisting queering surveillance. I show how queer residents live in HDBs in arrangements other than the state's imagined nuclear "national family", also disrupting its metonymic imaginary of reproductive futurity. I also show how residents reimagine the state's "Asian Values", including filial piety-based policies of younger residents caring for elderly residents no longer "productive" of futures. They do so by creating different domestic arrangements than HDB's 3Gen flats and reimagining the care relationships expressed through its smart home projects. The daily practices of residents existing outside the state's future imaginary—queer residents, elderly residents, single parents, foreign workers—and all residents who choose to reimagine what "Asian Values" and filial piety mean, show how the state's sociotechnical imaginary is reimagined through material engagement with smart urban infrastructure.

4.1 *Reimagining the National Family*



Figure 132: David, Red Party. Home Visits, Alecia Neo. 2010.

I sit in Colin's sparsely decorated HDB flat, which belongs to an older Chinese-Singaporean woman. Once she retired and her children moved out, she relocated to a smaller HDB flat and rents out her larger flat to Colin and his friend Clarissa to make money. Colin and Clarissa are in their late 20s and gay. Neither are married nor can afford private condos, so they rent the three-bedroom HDB, significantly larger than either could legally buy. Colin told me:

> To get a HDB you have to follow their rules. A lot of people get married to get an HDB. If you don't get married you can only get one once you're 35, and it'll be a one-bedroom or a two-bedroom one. So people get married in order to get the flats. And it's no wonder people stay living with their parents: it's a good deal.

As a gay man, he is excluded from these housing futures. The family norms underpinning HDB access and built into its infrastructure have changed little since the 1950s studies referenced in Chapter 4. One has to form a "proper family nucleus": be at least 21 years of age, married or engaged. One can have children, parents, and siblings in the home (HDB 1972). The only substantial change is unmarried individuals can buy after 35. As Colin expressed, unmarried-accessible flats are lower quality, resale flats (not new flats), and have a much smaller subsidy than for those married or married with children.

Clarissa and Colin often joked about getting married to buy a big HDB, but even if either found a long-term partner, they would be unable to buy one for their own families.

Colin often speaks about the trade-offs of smart city surveillance technologies. Like other residents, he decides every day (both consciously and unconsciously) when to accept trade-offs given by the state by replicating its imaginary, and when to literally make space for other futures by reimagining space. This morning he recounts his previous night's "sexcapades." He found a man on an online dating app, who he then messaged on Telegram. Colin texted his address and the man picked him up in an "expensive black car with dark tinted windows." They went back to his "landed" property (a standalone house, signifying serious wealth in high-rise Singapore: Colin calls it "atas", a Singlish word for expensive) where Colin spent the night.

Singapore is safe, he says suggestively: "I'll do *anything* here. I'm not scared to go to the house of someone I've never met, cannot in UK, could get robbed or hatecrimed. Here if some sado [Malay slang for hot] guy asks me, I say yes." His face becomes serious. "I don't feel safe as a brown person in the US or UK. A lot of Europe is so racist as well. The police and guns scare me. People here are harmless; they won't hurt you. They can't. They can see and sense everything, that's why there's no crime."

Because he is gay and a racial minority, the queering and racialising housing policies discussed in Chapter 4 make dwelling difficult, but he likes the safety and quality of life in Singapore. The trade-off, he says, is worth it for now: "You accept the Singapore deal a little bit every day: personal freedom for collective well-being."

Like many of my interlocutors, Colin ambivalently but selectively enables and refuses data flows. Colin lives in an HDB estate where smart home technologies are tested. He likes the smart security cameras in his estate but engages in very explicit practices to ensure certain kinds of his data are not

communicated to state agencies. Most people, he says, don't really care about their data being used. People give him data freely in his medical job, more than when he worked in the UK:

> People here think bad guys are being watched, that it's good. There's an ideological difference here. The US, UK, have a long history of liberalism. They will never be smart nations with their obsession with individual rights and privacy. In Singapore, we know how to trade-off.

While he seems to share the imaginary of being protected from "bad guys" by the state's all-seeing eye, he is particularly wary of data that would communicate his HIV status. He goes to a private GP clinic because they "aren't mandated to report these things" (which, he says, definitely throws off the state's statistics). "I happen to know there have been 9 HIV positive patients in the last month at my clinic", he says to me. "I saw the data. Caucasian, Chinese, Indian. Lots of people go private for this. You get deported if you are not Singaporean and test positive, discriminated against if Singaporean." If you test HIV-positive in a public clinic, you are automatically registered to a national HIV database (Ministry of Health Singapore 2021). The registry shares HIV data with insurers, healthcare providers, and employers, exposing HIV-positive residents to discrimination without legal protection. A large data breach in 2019—part of why Alvin can no longer see outside of the state's intranet—publicly exposed 14,200 Singapore residents.[35]

Colin also feels the state in his daily domestic life, drawing attention to how it shapes his daily eating practices:

> The Singaporean government wants its fingers in everything. They control the price of the hawker markets you see in every HDB, for example. Like that certain meals cannot be over a certain price, they have to be the same everywhere. If you notice, these kitchens aren't very big. They encourage people to eat out because the food is cheap and right there. So that way it's all monitored. Same with the social rooms in the HDB: they belong to the Party.

The Straits Times book on Colin's coffee table, *50 Things to Love about Singapore*, echoes his sentiment: "From stamping out obesity to stubbing out cigarette smoking, the Singaporean government is all over

[35] https://www.bbc.co.uk/news/world-asia-47288219

your kitchen cupboards, weighing scales, and supermarket shelves." (Khalik 2015:29). It adds that there is "almost no aspect of life that HDB does not have a hand in" (ibid).

Other queer interlocutors selectively subverted state futures in their daily practices by altering domestic data flows, disrupting HDB standardisation and the state's sociotechnical imaginary of reproductive futurity. Hannah and Ming are in a long-term relationship. Hannah's parents live in Shanghai, so they live in her parents' HDB and care for Hannah's grandmother who lives with them. In state databases, Hannah and her grandmother live together with Hannah's grandmother's carer, Ming. Ming passes for male to neighbours, who assume Hannah and Ming are married and caring for Hannah's elderly grandmother. Nurul officially lives with her Malay-Singaporean parents, but actually lives in her Chinese-Singaporean 36-year-old girlfriend's single-occupancy HDB. They plan to live there permanently and have no children, eliding racial quotas and heteronormative policies.

Queer residents are not the only residents excluded from the state's "national family" imaginary of reproductive and productive futurity. Less well-off residents, more likely to be elderly or minority ethnic, face difficulties buying into the nation's future, as do single parents. Dayana is one such resident, divorced with a daughter. They recently moved from her mother's flat to a new HDB development in the north. "We could only get it because the government is really encouraging people to move out of the city centre." Thinking of her previous flats, she sighs. "Old HDBs are really bad" she says. "it's really sad. They face each other so it's really dark. They are these small studio flats. And many of the elderly, since they are poorer, they have to live there." This difference in living standards based upon class also disrupts the imaginary of standardisation, since HDBs are not uniform in quality. When I asked a former HDB board member about HDB standardisation, he shook his head:

> Quotas only apply to race, so there are differences from HDB to HDB. Some places are poorer than others, and usually those are the ones closer to the city, like Bukit Merah. The way to tell is to go to the wet market, hawker centre. Newer HDBs are younger and richer.

The differences are hard to determine from indicators like age of estate, because new people who move into old estates are usually wealthy, as those estates are nearer to the centre. Age of occupants is more enlightening, he says: "In Singapore, the wealth distribution is more observable though age difference rather than estate difference. Everyone over 60 years old is unlikely to be wealthy, because their most active working years were spent in a developing country." These less-wealthy citizens are also those the state deems to be less "productive" of national futures since their working days are over.

As a single person with mental health issues, Mei (who lives with her mother in a smart home, as discussed above), also lives outside the national family. Mei explains:

> I think Singapore is a really particular case. You couldn't have any of this stuff [gestures to the flat] without this autocratic form of government. People are only okay with being evicted because they know they'll have a shiny new place to live. But how can we complain, when everything is so nice? I could never afford this upgrade on my own.

But buying into Singapore's future is becoming less possible, and not only for those traditionally left out of the national family. Nadia, who worked in the SNDGO, tells me I've come at a "hot button time" to study housing, because the material resources upholding residents' buy-in to state futures for the last 50 years are eroding. "Everyone is talking about how we can't afford HDBs anymore," she says:

> The government has broken a promise to its people because housing is unaffordable. In Singapore it's supposed to be regulated, but now the youth feel angry because they can't afford to buy. In Hong Kong, it was always left to private enterprise, so the situation is worse, but citizens also don't expect the government to behave any differently because they never have. Here it's different because the promise that was made is being broken.

Nadia uses the same trade-off language as Mei and Colin, but with the state's half of the deal eroding. Chua (1997:xi) calls housing a "covenant between the people and the government in Singapore," a "promise of continually upgraded housing units and environment in exchange for political support." But when the material-symbolic resource fails to project the promised future, what happens? I ask Nadia what changed, and she says that prices keep rising:

> An HDB costs 1 million dollars now, and to go private it's at least 1.8-2 million. I have no hope of buying an HDB, and I am doing pretty well for myself. So we are stuck living with our parents, or we have to leave Singapore. And no one really 'owns' property here anyway even though

> that's what the government promises—it's a 99 year lease. That was OK before when you could afford it, but people are getting angry now.

The state's political relationship with its residents and their imagined futures is repeatedly replicated and reimagined through the HDB. The state makes its national sociotechnical imaginaries collectively held by using technological advances to create a unified sense of nationhood through a "sense of being well-ruled" (Jasanoff 2015:4) The Singapore state materially and symbolically projects that sense to justify its control over urban infrastructure and domestic life, described in previous chapters.

In this section, I explained the continually rearticulated imaginary of futures trade-offs, where residents conform to state future imaginaries in exchange for guaranteed future material well-being. Residents explain these trade-offs as choices they make every day, both consciously and unconsciously, through the embodied practice of HDB living. This foundational trade-off imaginary means that the material-symbolic resource of the HDB and the smart home, if it shifts in meaning, destabilises the entire trade-off, making state futures increasingly likely to be reimagined by residents. It also means that state futures can be reimagined through the material-symbolic resources it uses to project them, like the home. In the next section, I explain how smart home residents reimagine filial piety, also reimagining state imaginaries of productive futurity, resulting in material changes to the Smart Nation.

4.2 Reimagining Filial Piety

I am in a Grab back to the lab after home visits with Connie. New residences under construction appear on our left. I try to figure out if they're HDBs or private condos, but they don't look like either. I ask Connie, and she answers:

> Those are some of the new HDBs purpose-built for the elderly. The government has given up on the 3Gen idea…kids just don't want to live with their elderly parents anymore, and seniors want their autonomy too but don't want to live in nursing homes. So HDB are coming up with new housing plans to take care of the elderly. And not like nursing homes, they're independent. They are one-bed flats purpose-built with elderly stuff—toilet big enough for a wheelchair, kitchen purpose-built, emergency pulls, hold bars. And SACs in every bottom. They'll be integrated into existing HDB estates, my parents are even getting one.

This, she says, indicates that both material living arrangements and the symbolic cultural values the state has pushed for decades are shifting.



Figure 133: Home Visits, Alecia Neo, 2010.

The head of Gerontology at a large Singapore hospital, who I talked to at a Design for Silver Generation event, said about this material-symbolic shift:

> In the past, filial piety meant respect, obedience, and a responsibility to care for the older generation even behind our parents. Today it refers to being respectful and courteous and willing to make care arrangements for them, whether personally or outsourced.

This shift in both the material infrastructure of the HDB and the symbolic resource of filial piety is also visible through the failure of smart home projects, as Jin details, that seek to make adult children the main consumer of smart home solutions for the elderly rather than the state. HDB initially imagined elderly residents' children as primary users of the smart home app, responding to alerts.



Figure 134: Illustration of Smartphone App Connected to Smart Home System created by HDB. Daughter checking on Mother.

But in iHome developers' experience, adult children quickly deleted the smartphone apps. Too many false positives caused too much anxiety. They were not present enough in the HDB daily, lacking care workers' contextual knowledge to interpret the data. Additionally, elderly residents felt more comfortable with care workers accessing their data (especially toilet sensor data) than their children. This relationship with the smart home and the data it produces caused a marked shift in HDB's policy and how it imagined housing futures, including its imagining of the ideal family organisation.

The first HDB smart home project, in Yuhua estate, was widely advertised and projected as a futuristic model for smart living, particularly at international events like the World Expo. Ivin, during his NUS senior thesis project, knocked on a thousand doors in Yuhua estate over five months to see how many people were participating in this smart home project. He initially planned to interview those

residents in depth, but of the 1,080 houses across 38 housing blocks, not one had opted to participate in HDB's smart home project.

This lack of uptake caused HDB to abandon their model of children as primary consumers of smart home technologies for their elderly parents, shifting their attempts to materialise certain relationships and futures through the smart home. Reimagining space leads to making space for other futures, both materially and symbolically, socially and technically.

5 Discussion

Browne (2015:16) defines racialising surveillance as signalling "those moments when enactments of surveillance reify racial boundaries, borders, and bodies along racial lines, and where the outcome is often discriminatory treatment of those who are negatively racialized by such surveillance." Drawing from Black feminist analysis, she pays special attention to "intersecting surveillances", in which interlocking oppressions work together to produce injustice using similarly interlocking technologies, practices, performances, and policies of surveillance. Singapore state surveillance practices control the access of queer residents, racial minorities, elderly people, and non-citizens in differentiated and differentiating ways by marking them as outside of its national smart futures. State agencies recursively spatialise those exclusions through housing infrastructure shaped by the citizenship categories that historically continuous forms of domestic surveillance replicate.

Living in HDB flats with other queer residents, while not a form of public demonstration, subverts the metonymic "national family" imaginary so central to state future-making, as described in Chapter 4. Many Singaporean LGBT people engage in "pragmatic resistance" in which they "often do not deploy strategies and tactics familiar to activists in liberal democracies, especially street demonstrations" (Chua 2014:5; Yue and Zubillaga-Pow 2012). Intense restrictions on public political expression create an environment in which "basic civil-political liberties are seen as trade-offs for

engineering a particular vision of social stability and its fruits of economic progress" (Chua 2014:34). I argue that resisting heteronormative futurity is a form of temporal and spatial divergence from state-imagined futures (Singapore's "heteronormative time and place"), through refusing regulatory structures of heteronormative time: the time of reproduction, ruled by the biological clock; intergenerational time, a chronological timeline in which parents pass down inheritance to their children, so on ad infinitum; and an imagined pristine historical time of the nation, which relies on heterosexual familial relations to assure its future (Halberstam 2005; Oswin 2019).

The "incommensurate geographies" of queerness disrupt the state's imaginary of standardisation, as many queer Singaporeans diverge from the state's imagined domestic sphere and by extension its productive and reproductive futures (Berlant and Warner 1995:58). Queerness involves "strange temporalities, imaginative life schedules, and eccentric economic practices" that resist standardisation into one future path (Halberstam 2005:1; Edelman 2004; Muñoz 2009). It does not do so inevitably, however: queer residents also replicate state sociotechnical imaginaries, as Colin does by supporting Smart Nation surveillance technologies like smart security cameras and making trade-offs.

Other residents fall outside these temporal and spatial boundaries imposed by the state through smart urban infrastructure and its queering surveillance: single parents like Dayana; those who do not want to get married or want to live alone; non-citizens, like foreign workers, who cannot access public housing and often live in poor conditions (Tan and Lee 2007); elderly residents past their "productive" working age who do not want to live with their children; and anyone who imagines living outside of reproductive futurity or capitalist economic productivity. These subjects are "queered" and infrastructurally excluded from participation in Singapore's imagined future (Halberstam 2005).

In their case, however, refusing exclusion is often more about *decreasing* their visibility to the state, not increasing it. Residents refuse some discriminating data flows using "dark sousveillance"

practices where they evade visibility rather than trying to increase it through public protest (Browne 2015): information about where and with whom they live, like Mei, Hannah, and Ming; preventing data transmission of HIV status, like Colin; and refusing to participate in smart city projects (like accepting domestic sensors) or trade-offs that previously maintained state futures. Resident abilities to refuse rely on social and economic resources: family that allow you to live with them; money to afford private practice, private condos unrestricted by racial quotas, or to not rely on experimental state projects for income; a citizenship status that does not subject you to constant state surveillance in dormitories. Refusing sensors inside the home is also easier than knowing the location of sensors in the urban fabric as you go about your daily life in the smart city. I expand on these differentiated forms of resistance and reimagining in my discussion of smart citizenship in Chapter 7.

6 Conclusion

Smart cities are lively "relational fields of action" (Massey 2005; Cresswell 2004; Mitchell 2000), requiring analysis of the "many intimate ways we negotiate the diverse affective and social registers of urban places and the performativity of our entanglements of these spaces" (Barns 2019:7). In Chapters 4 and 5, I showed how the Smart Nation is projected through continuously re-enacted, often metonymic sociotechnical imaginaries of standardisation, connectivity, and futurity, based upon historically continuous forms of domestic surveillance. I explained these imaginaries as both social and technical, enacted through material smart urban infrastructures with the aim of structuring resident behaviour and imagined futures. I argued that by extension, people replicate and reimagine the smart city sociotechnical imaginary through everyday material engagement with smart urban infrastructure. Planners replicate the state's Smart Nation imaginary through GIS maps and Master Plans, replicating these planning practices through training and through agency structure. These maps and plans continuously co-produce the infrastructure of the smart city itself.

In this chapter, I showed that developers are given these maps and plans to build smart homes, and with them the imaginaries of standardisation, connectivity, and futurity they project. But along with residents, developers often end up reimagining them. They have to reimagine because residents disrupt the metonymic imaginaries expressed through these maps, plans and domestic infrastructures: standardisation, by living in the smart home in diverse and differentiated ways; connectivity, by disrupting seamless data transfer and seeking other forms of sociotechnical connectivity than those prioritised by the state; and futurity, by reimagining the reproductive and productive futurity expressed through smart home infrastructure, requiring the state to create other kinds of living spaces which make space for other futures.

I showed that resident and developer everyday practices are distributed and diverse, engaging with the smart city through digital devices, their homes, and their daily movements through it. Residents engage the smart city through a "situated urbanism", *producing* it through their mutually constitutive interactions with digital technology, requiring attention to "how people use space and what the constraints are" (Odendaal 2015:32). This is the attention that the local developers realise they need to co-produce a smart city that works for residents, and these are the practices through which smart city sociotechnical imaginary co-production happens.

Through everyday practices of dwelling in the (smart) HDB, residents create a different relationship between the smart city and Singapore's future than that imagined by the state, leading to material and symbolic changes in the smart city. These changes to the smart city emerge from resident and developer everyday embodied practices of differentiated repetition and dark sousveillance, using smart city space in ways that make space for other futures. I argue that these practices are forms of political participation, causing shifts in state smart city sociotechnical imaginaries and people's own imaginaries of smart citizenship, often left out of smart city analyses. However, some data flows are

more difficult to refuse than others, and some data flows are required to access citizenship rights, perpetuating the difficulties that differentiating surveillance unequally creates for those outside of the state's imagined national futures.

In the next chapter, I argue that attention to resident everyday embodied practices of replicating and reimagining state-imagined smart city futures mandates a change in how we theorise smart citizenship. Attention to smart citizenship as practice, the ways that residents spatialise diverse and differentiated forms of smart citizenship, shows how these everyday actions are political and have sociomaterial effects. Residents resist being standardised out of existence through technologies of state future-making, seek other affective modes and forms of connectivity, and live lives according to other temporalities than the futurity imagined and enacted by the state. And rather than continuing to "knock off useless blocks with dental dexterity" to make space for the state's imagined futures (Boey, *The Planners)*, planners and developers sometimes make space for these resident reimaginings instead.

CHAPTER 7: PRACTICING SMART CITIZENSHIP

1 INTRODUCTION

In Chapters 4 and 5, I addressed my first research question:

> *RQ1: How does the state project its future imaginaries through the digital and urban space of the smart city?*

In Chapter 6 and Chapter 7, I address my second research question:

> *RQ2: How do smart city residents replicate and reimagine state future imaginaries through these same digital and urban forms?*

In previous chapters, I detailed the history of the Smart Nation's smart urban infrastructure and the imaginaries of standardisation, connectivity, and futurity expressed through it. I showed state and resident agency repeatedly enacted through everyday embodied practices of differentiated repetition in the digitally mediated city. In this chapter, I argue that rather than asking residents to *become* active citizens by adopting a republican citizenship model, scholarship on smart citizenship must recognise that residents already actively participate in the political life of the smart city. People's everyday practices and affective engagements in quotidian spaces like homes, schools, and community centres are themselves political expressions of citizenship (Campt 2014; Berlant 1997). Citizenship is mediated through and by the intimate public sphere: the state uses housing access and data-gathering technologies in domestic space to control who gets to belong in, represent and reproduce the nation's future. Hence, intimate spaces are also key sites where (smart) citizenship can be negotiated. State interventions target "mundane" domestic practices and can therefore be reimagined through those same practices, in those same spaces.

Conceptualising smart citizenship, like the nation to which citizens belong, as enacted through stories, made in social and material practice, I collapse theoretical distinction between discursive,

affective, metaphorical practice and material, embodied, enacted practice. Citizenship is both an imaginal affective identification with the nation and materially spatialised through being "in place" with the "right" documents and data. It is both about an affective sense of belonging and being able to materially access one's right to belong, to be able to be in the place of one's choosing. By extension, citizenship is mediated by a relationship between the state and residents, through which who can signify themselves as part of the nation and produce and reproduce its future is negotiated.

I argue that this relationship (mediated by data-gathering technologies in and of domestic life) means that practicing smart citizenship involves asserting one's belonging-in-place, making space for one's futures. As a result, attending to what residents do and feel, not just what they say, surfaces smart citizenship practices enacted by those often left out of academic smart city discourses and illuminates how the Smart Nation evolves through everyday resident material engagement and shifting affective identifications with it. It also shows the limitations of spatialising one's belonging in-place as part of the nation's future, as some components of (smart) citizenship are more easily reinvented through daily practices of facilitating and interrupting data flows than others, by some residents more than others.

In this chapter's sections, I consecutively argue for the importance of space, materiality, and difference in theorising smart citizenship. I first argue that a theory of smart citizenship as practice (Isin and Ruppert 2015; Datta 2018) produces a differentiated understanding of citizen participation *spaces*. Residents participate in co-producing the smart city, but usually in spaces they already frequent daily. Looking for smart citizenship in state spaces like urban planning offices or an imagined public agora misses a wide range of material and affective resident engagements generative of smart city futures. I show this by describing a consultation session in the planners' offices and lack of resident interest in the first state-run smart home project, contrasting it with the technological everyday of Subhatra, a composite of my elderly resident interlocutors.

Second, I argue that residents practice politics by affectively and *materially* engaging with the Smart Nation in their daily lives, in part through play with biometric and other data flows. For many residents, such material engagements *are* political rights claims, because they build themselves into a future they were built out of. The state also needs such affective engagement to successfully replicate its imagined futures and to get residents to "buy in" to its imaginaries, as illustrated in Chapters 4 and 6. I describe 14-year-old Ying's technological everyday: a schoolchild who largely cannot exercise rights claims in a traditional democratic sense but still materialises her future through active engagement with the Smart Nation in myriad daily digital entanglements. I draw Ying and her brother Justin's experiences directly from interlocutors' children and grandchildren, children I worked with when volunteering for the programme Participate in Design (P!D), and personal details of *Balik Kampung* characters.

Third, I argue that theories of smart citizenship should include residents' own understandings of *difference*, including those between smart city contexts, civil services, public works, and governance processes, to avoid overly generic or vertical analyses. I share NUS geography students' articulations of difference to illustrate how residents practice smart citizenship differently based on situated understandings of political-geographic context, self, and nation. This specified analysis shows what materials residents can access to imagine futures with and how they are differentially able to use smart city resources to practice smart citizenship. Finally, I show how young planners learn how to reimagine rather than replicate Smart Nation imaginaries by mapping the diverse and differentiated daily practices of elderly residents instead of using the existing planning maps described in Chapter 5. In doing so, they disrupt state metonymic processes and reimagine connectivity, standardisation, and futurity in ways that slowly change the state's Smart Nation sociotechnical imaginary. My analysis shows how changing the materials that project the smart city changes the imaginaries projected through it, illustrating the fundamentally political nature of residents' everyday material engagements with the Smart Nation.

In conclusion, I advocate a shift from a standardised republican smart citizen archetype towards specific analyses of how differently embodied residents want to or already participate in the everyday production of smart citizenship. As Larry, a P!D planner, said: "Stop talking, stop asking people to talk. Watch what they do, do it with them, let them surprise you." Responding to Zandbergen and Uitermark (2020:1735) call to move beyond a "dichotomous framework" in which some cities "empower" citizens through "bottom-up" technology, while others "control" citizens through "top-down" technology, I show how understanding smart citizenship as affective, material practice makes modes of citizen (and non-citizen) participation visible. It explains why cities' current attempts to engage residents according to ideals of bottom-up, active, vocal participation in a democratic public sphere outlined in smart citizenship literature might be unsuccessful. It also specifies where and for whom everyday practice *cannot* produce access to forms of (smart) citizenship.

2 Spatialising Smart Citizenship

In this section, I argue that characterising smart citizen participation as that which takes place in "public" city-space re-enacts exclusions of historically disenfranchised groups. It ignores histories of differentiated and differentiating surveillance and groups' meaningful resistance to it through avoiding, not increasing, visibility (Browne 2015). I critique hierarchical distinction between affective, everyday concerns and political rights concerns, arguing that engaging in practical, personal daily activities in domestic and semi-private space can be as political as vocalising rights claims in high-visibility public spaces. Driven by feminist scholars' attention to political practice in homes and communities (Campt 2014) and Berlant's (1997) understanding of the "intimate public sphere", the nation as an affectively experienced entity co-produced by a state that enacts (often coercive) political control in domestic space and intimate relations, I look beyond the "public sphere" to residents spatialising diverse forms of smart citizenship. I attend to "everyday practices that confound the public-private and work-home

boundaries," showing how residents replicate and reimagine the Smart Nation across digitally mediated city-spaces (England and Lawson 2005:80).

First, I describe how planner attempts to bring residents to "civic" spaces for consultation sessions found limited success in eliciting smart citizen participation in smart city design, because they lacked the affective dimensions of everyday resident spatial engagements with the city. Second, I explain why the first state-run smart home project failed to create the smart citizens state planners imagined, due to different definitions of active participation. Finally, I describe elderly smart home resident Subhatra's technological everyday to show how daily affective, material interactions with Smart Nation technology in domestic and community space constitute more generative, accessible modes of political engagement for some residents than expressing rights claims in an imagined democratic public sphere.

2.1 "Participatory Design" Workshops in State Spaces

Lily, a doctor and single mother of two, lives in a smart home in a new HDB estate outside the city centre. Hers is an eco-friendly smart home rather than one fitted for the elderly, equipped with a pneumatic waste disposal system and devices that monitor household energy usage. I asked her if the smart home motivated her move, and she laughs: "Not at all. We moved here because there's more space. Ying and Justin love it because they can have their friends over, which we could never do before." When I asked about her participation in the Smart Nation, she responded: "Isn't the point of the smart city that I don't have to participate?"

In their study of UK smart citizens, Cowley et al. (2017) found a lack of public enthusiasm for or counter-discourse against the smart city. Encouraging critics to assume that governments want to engage citizens, they argue engagement is difficult and citizen apathy requires further study. I propose a perceived absence of active citizen participation indicates more than a failure of top-down planning initiatives to give citizens voice, suggesting a need to reimagine the "active" smart citizen concept itself.

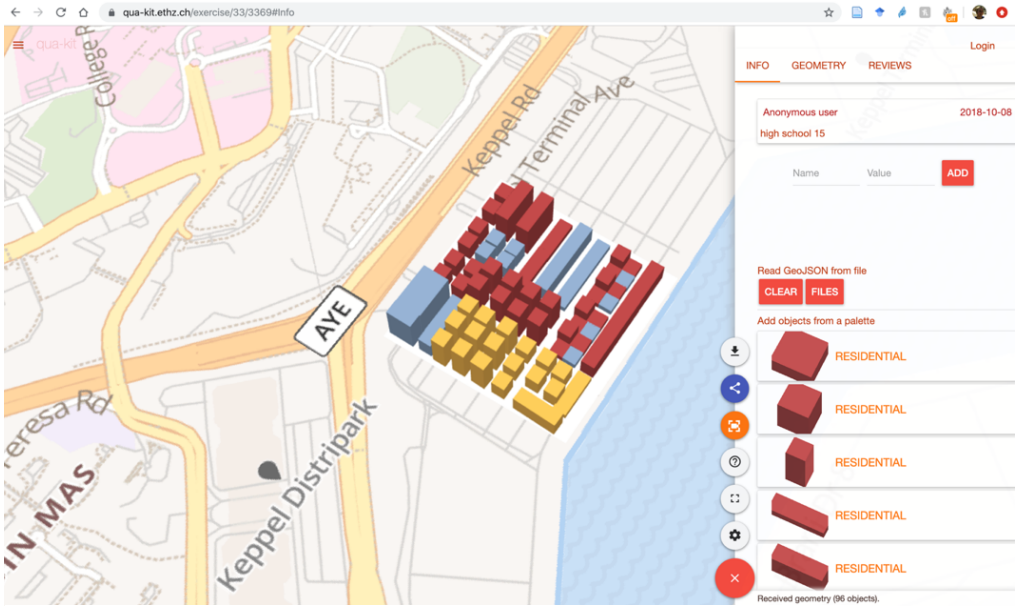


Figure 135: Qua-Kit Resident Design. https://qua-kit.ethz.ch.

My state planner interlocutors lamented that they tried to engage citizens but "no one cares." Planners held citizen design workshops at their offices, setting up a digital city rendering and inviting residents in the afternoon during their workday. In one, residents sat around a meeting room table while planners explained participatory design processes—showing residents how to position residential blocks in open space to design new housing complexes. Arnie, a visiting Swiss planner, asked residents to build the future housing they'd like to see using the digital planning tool, a "Quick Urban Analysis Kit" ("QUA-KIT") (Figure 135). It was designed in international partnership between the URA and ETH Zurich Future Cities Lab (FCL), René's employer after ICON and A*STAR. Planners consider this session a textbook case of hands-on, participatory design: something that might rank highly on Cardullo and Kitchin's (2018) scaffold of smart citizen participation. Most of the ten residents looked uninterested after a few minutes.

On temporarily set-up laptops, older residents largely created uniform blocks and stacked them in neat rows. I asked one woman what she was building, and she shrugged: "just putting things in a line, not actually making anything." A group of high school boys giggled as they built the tallest, most absurd towers possible. I caught up with Arnie after. He sighed: "the public build these crazy structures, that surely they don't actually want to see in practice, or they place a few blocks and lose interest. And it's poorly attended. It's hard to do citizen engagement here, but it's hard in Switzerland, too."

Planners' most elaborate participatory design tool was a "smartbike" connected to a VR map of Singapore, to understand obstacles to cycling. I asked: why use an expensive virtual tool instead of cycling with residents in the actual city? They replied that they had gotten state and corporate funding for the smart technology and that it displayed the future, not the present. It was featured in the internationally televised programme Smart Cities 2.0[36], asking people to "spend a few minutes living in the future": saturated with imaginaries of standardisation, connectivity, and futurity. Like the developers



Figure 136: "Focus Group for the Future", Smart Cities 2.0. Channel News Asia 2018.

[36] https://www.channelnewsasia.com/news/video-on-demand/smart-cities

in Chapter 6, planners had to mediate their smart city planning with funders' desire for flashy smart technology.

The URA and FCL's approach, while actively engaging residents with a smart technology and asking for their opinions, does not model an emplaced understanding of transport and its affective relationship to imagining and "buying in to" the future for Singapore residents. The state has long tried to decrease driving by making cars expensive, creating smart traffic toll systems and mandatory in-vehicle sensors, and creating initiatives like this smartbike partnership. But in practice, getting Singaporeans to stop driving has been difficult because of cars' affective, material-symbolic significance. As smart home resident Aminah explained:

> No matter what the government does, it's hard to escape the cultural significance of the 5Cs[37] [credit card, cash, condo, car, country club]. No matter how nice an HDB is, or how much more expensive private housing is, or how good public transportation is, or how bad traffic gets, people still want condos and cars. These are very hard to eclipse, because it's about the cultural significance of those values of the luxury goods, the way they signify the good life.

This significance affects Smart Nation imaginaries, as attempts to detach people from cars are attempts to reimagine symbolic value embedded in material objects, originally created by the state. The 5Cs are continuously replicated affective identifications forged through Singapore's early stories of nationhood described in Chapter 4: that increases in material wealth and technological advancement are a way of buying into the nation's future. These affective identifications are hard to see or reimagine in a lab-based simulation missing those material-symbolic resources.

Many state planners also cited lack of smart citizen participation as evidence that Singapore citizens expected the government to take care of everything. Alvin said he and other planners try to engage regularly with residents, but with limited success. They put the Master Plan online for 90 days so that people can comment on it, he explained, but "people only care when it becomes clear that it will

[37] http://www.uniquelysingapore.org/5cs

directly affect them, which is after that period." Planner James cited under-construction building sites as an example: "we let people use the land before we build on it, and they play football on it and get attached." James encountered resident resistance to some new HDBs for sociocultural reasons: no one wants to live near nursing homes, for example, so people protest but only after it's "too late." James said they mostly actively complain on social media like Facebook, where they can easily give feedback to state officials due to Singapore's small population.

From Lily and the planners' reflections, one might conclude that residents do not want to participate, despite planners' best efforts. But James' and Aminah's experience suggests that residents do participate and express strong preferences, in part through consumption choices and affective identifications, but often not in planners' consultation, feedback, or participatory design spaces. In the next section, I elaborate on why attention to non-state spaces generates a theory of smart citizenship as practice.

2.2 Theorising Non-Participation in Smart Home Projects

During five months of senior thesis research, Ivin knocked on over a thousand doors in Yuhua estate to discover how many residents participated in HDB's much-lauded flagship smart home project. But of 1,080 homes across 38 housing blocks, not one had opted to participate.

"Most people had never heard of the project," Ivin told me. 94 people agreed to talk, and with pressing some remembered HDB's initial roadshow. Ivin recounted: "The planner comes by and explains everything in a large package, lots of information, all at once so it's really easy to miss something. I don't think they connect that with the project itself." Planners like Alvin make brief HDB estate visits to present projects. One resident said she was too busy to attend due to work. More than half of the 94 residents (65) had never heard of the project. Of the rest, many knew only from state advertisements and did not realise the programme was being deployed in their own estate.

HDB refused to give Ivin the number of participating residents, calling it "sensitive" data. For Ivin, data from state agencies did not flow like water, similar to Esther. Despite the wealth of publicised information on the smart home programme across media sources, presented as cutting-edge by HDB, he could not find any information on residents or the project's findings.

Ivin could have concluded that there was no smart citizenship in the Smart Nation due to a lack of explicit resident participation in or opinions on the state's smart home project. He instead explored other smart technologies used by the mostly elderly residents populating the small, old estate. He noticed digital technologies like smart TVs and smart locks in many flats, as well as smart surveillance cameras and sensors scattered throughout the estate by the HDB. Most residents felt the technologies rapidly fade into the fabric of daily life. Sensors existed for what they saw as "mundane" public services like waste collection and energy usage, were added slowly, and residents were used to Singapore's ubiquitous security cameras. Ivin concluded that residents rework the notion of smart urban living "from below" through lived practices (though he theorised this as a gap between "rhetoric" and "reality", "top-down" and "bottom-up" modes of participation, which I trouble). Using a "smart void deck" as a case study, he found residents use it "in their own terms and with their own agendas, and not in exact accordance to what was prescribed by the HDB."

Over more than two years, I found lots of resident engagement with the Smart Nation project as residents practiced smart citizenship in myriad ways, but in spaces that did not adhere to traditional democratic participation as "having your say" in an agora or the "participatory design" in state agencies imagined by planners. In the next section, I show quotidian use of home space *as* political through the technological everyday of Subhatra, a composite of older smart home resident interlocutors' practices and reflections, as she makes space for her futures. I draw analytical attention to political expression in

spaces and practices of everyday encounter while showing how spatialised power relations shape the smart citizenship options available to differently embodied residents.

2.3 *Imagining with Other Maps: The Technological Everyday of an Elderly Resident*

Subhatra wakes at 6am. The white motion sensor on her bedframe flashes green, registering her first morning movement as it has daily for the past year. She doesn't notice it anymore and walks into the kitchen to place a coffeepot on the stove, where another sensor blinks into life. She goes into the bathroom, the sensor there covered in a towel because it makes her uncomfortable.

As the coffee releases its aroma into the flat, she fills a water jug and goes outside to water her plants, overgrowing into the common corridor. A nurse who visits daily cares for her bed-bound neighbour. He never complains about the plants as his religious icons and miscellaneous objects also spill into the common corridor, framed by smart security cameras and electricity meters detecting energy use.



Figure 137: Sidewalk Easement, Ang Sian Nian. 2010.

Subhatra performs her morning prayers, having re-arranged her standardised HDB flat to suit the practice. She has painted her walls bright yellow, decorating the space with statues of Hindu deities. These gods share space with Buddhist and Chinese gods in the grass outside (Figure 138).

In Chapter 4, I showed how Malay-, Indian-, and Chinese-Singaporeans were forced to collapse their socio-spatial worlds, which reflected important cultural and religious differences, as well as extended kinship networks, into standardised HDB flats when forcibly relocated from kampungs. Residents resist standardisation by reshaping residential space to reimagine and re-specify generic "Asian Values", spatialising cultural and religious difference through the HDB. These practices spill out and disrupt the HDB's strictly structured division of private/public space.[38]



Figure 138: Tanglin Halt Road, Block 37. Sidewalk Easement, Ang Sian Nian.

After prayer, Subhatra WhatsApps her son about her afternoon art exhibition. She cleans her house and chats on her smartphone (which Esther recently fixed) with her daughter in Australia until her 10am hospital appointment. At 9:45 she takes the lift to the ground floor where I meet her. We walk

[38] Chua (1997) elaborates in detail the ways that residents extensively reshaped the HDB flats as best they could to replicate cultural and religious life in the kampong in his chapter "Adjusting religious practices to different house-forms".

across the 3Gen playground to the mall across the street, as she taps into the crosswalk for more time (since Connie convinced her it didn't charge her any money). Entering through the automatic doors, we walk along a travelator to her hospital wing, tucked between two malls. She checks in with her NRIC [National ID] number on the touchscreen iPad. In remission from cancer, she tells me while we wait how data from her last scan is automatically sent to her GP.



Figure 139: Hospital wing in a Jurong East Mall, 2018.

After her appointment, we walk to the library to return books. To enter the library barriers, she scans her library card, connected to the same NRIC number. I ask the librarian for access: since I do not have a permanent resident ID, I cannot tap in or check out books. After she checks out a new book using the same card, we walk back, passing a mall shop advertising sign-ups to local smart home initiatives (Figure 140).

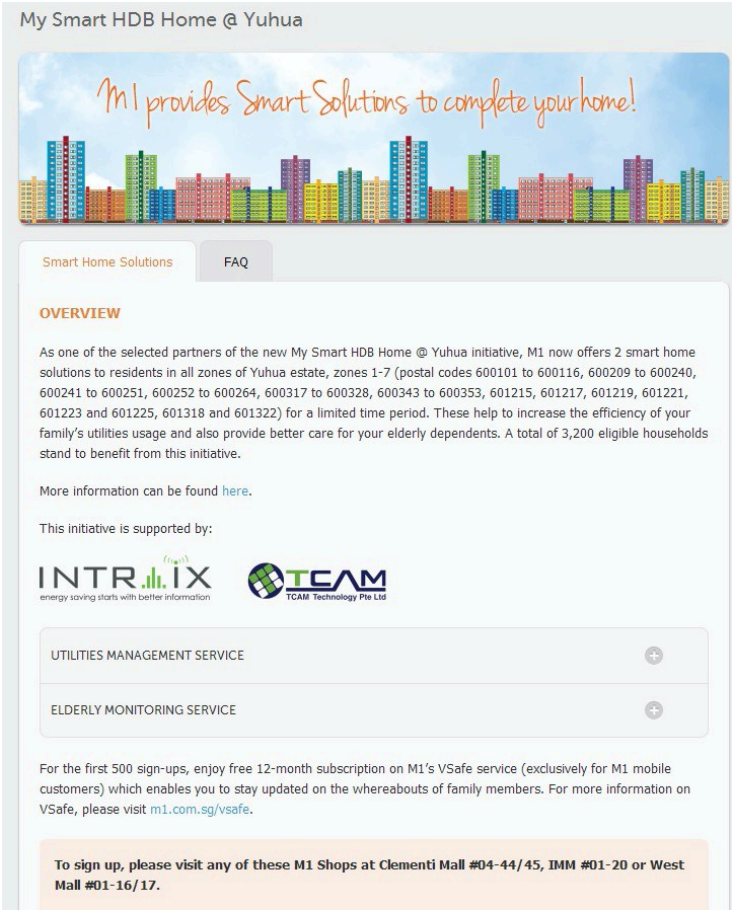


Figure 140: My Smart HDB Home at Yuhua, Housing and Development Board. https://www.hdb.gov.sg/cs/infoweb/about-us/news-and-publications/press-releases/yuhua-the-first-existing-hdb-estate-to-go-smart.

Normally Subhatra goes to the SAC to play cards, but today the iHome developers and care workers are there. We enter to the smell of chicken rice and a flurry of activity. Esther plays guitar and Subhatra adds her name for karaoke. She requests Christmas songs (I ask her why, as it is August and she is Hindu, and she just says "I like them!") and sings a cheery duet with Mme Fong. I help developers serve food as we chat with residents. Subhatra's friend Liyana gives Feng an earful about a senior who recently died. "A life was lost. And it falls on the VWO and on the university. You have to be careful with sensors, it can be dangerous. A senior died because one didn't work." Jin comes over with food and the topic is dropped when he sings a children's Mandarin song everyone knows.

Subhatra brags to me about the SAC's brightly painted walls and brand-new kitchen. She did a design workshop in the SAC with Participate in Design (P!D), founded by former URA planner Larry, who

I volunteered with. In an interview, he told me: "even though our architecture course teaches us how to design buildings, it doesn't really teach us how to work with communities." He discovered URA planners like Alvin usually "engage" citizens through long surveys and meetings where the planner explains the project, then asks for feedback on the already fully-conceptualised plan. In the workshop, Larry asked the seniors:

> Has the planner approached you to ask what you'd like to see in the neighbourhood? Not really, right? This is the problem: in any neighbourhood upgrading process, we realised that engagement from community is weak, and outreach is poor. We were approached by your local MP. They mailed survey forms to households hoping to get feedback, but they said they got poor response rate, nobody wants to be engaged. Of 2000 households, how many mailed back the forms? 24. Why is there so little people? Because they don't care? No. Because the survey form was very wordy, doesn't look attractive enough for you residents to want to be engaged in the process.

Subhatra and other seniors said they received many surveys and saw many roadshows come through the HDB, none really engaging with them. When Subhatra's children were younger, she explained, she never had time. "Now I do not have interest", she said, waving her hand and laughing.

Larry instead started with no designs mapped. He began with a blank community noticeboard with a marker at the bus stop, to reach the "busy and working crowd." The HDB worried about vandalism, but the only bad feedback he got was: *why did you give me so little space to write?* Larry said:

> We started off just talking to residents. We spent 3-months long social media campaign, talk to shop owners, kids, people from all walks of life about their stories in this estate. To add a human touch to the renewal process. Some people say: yeah, I've stayed here for 3 years but no one has ever talked to me about the process. We put posters along all the lift lobbies, got people talking about it. We do not want to wait for people to come to us, want to go where people are. One Sunday we just popped up in the marketplace, where people were, and asked them: what do you want to see in the neighbourhood and why? Aunties, uncles, started contributing ideas. It's a really simple idea, right? But it isn't happening often.

Larry then brought state planners for residents to show around: the residents became the experts, advising the planners. I couldn't contain my laughter when I saw Liyana taking a timid young planner on a tour: "This blank space here: why your architect never design something there? No brains!"

Larry also asked Subhatra and other seniors, the main SAC users, to share stories about how they use the centre and ideas for improvement, in multimedia forms and languages so different people had access. We then interviewed 28 people, including Subhatra. She told us how she came to the HDB after her husband passed, moving to a new neighbourhood where she knew no one at 82, and how she felt like a child trying to make friends again. Planners then spent time in the SAC and watched what the seniors did during their day. Subhatra and 22 other seniors then participated in a design workshop, in the future SAC space.

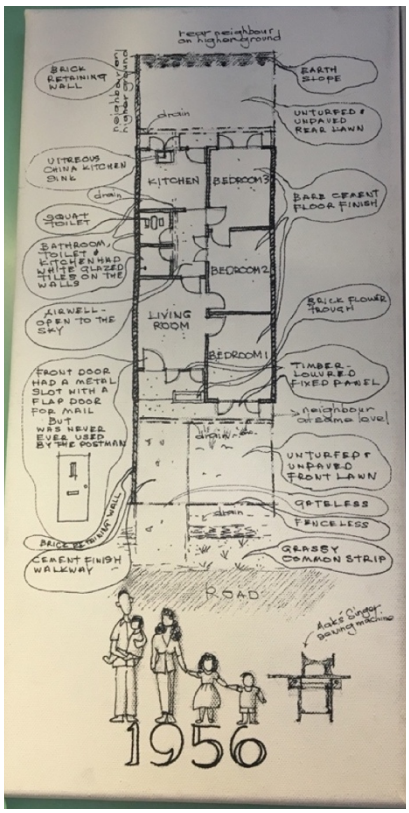
When we started a woman said: "I'm just an 80-year-old grandmother, you shouldn't ask me about design, what do I know?" But Larry replied: "We are volunteers to work for you. You live here, you are the expert." With encouragement seniors started moving light foam blocks shaped like stoves and tables around the centre. We taped out the area to show how much space things would take up and used cardboard to model cabinet heights. Seniors said things like "maybe we could lower the table so it's more elderly-friendly. And make chairs light so we can easily move them for dance or tai-chi classes." Larry said he would have left many small but significant things like that out. Subhatra told me when it was completed, she showed it off to her friends: "come down and see the kitchen I designed!" Subhatra described how she brought friends to come cook there and made a shared recipe box for older residents:

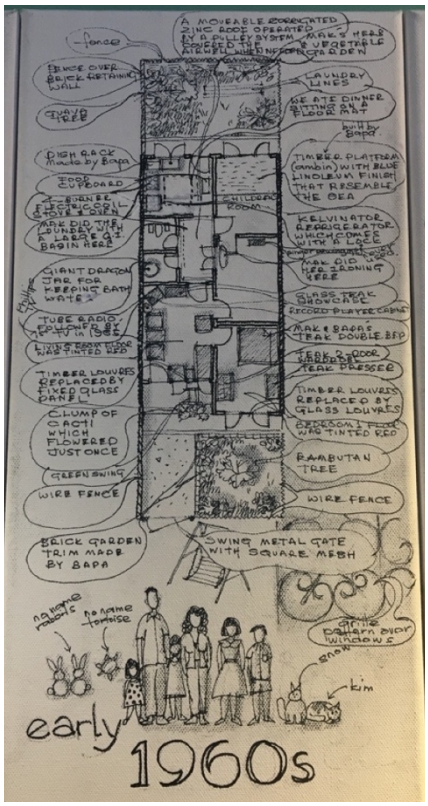
> I asked my friends to all come, to cook things as well. Then we cooked sometime together and shared the recipe. Many people now come to the centre. They do everything, they got many programs. Sometimes people come and share recipes, help with recipes. Before the seniors are so sad because they have no friends, don't know where to go. Now they know where to go, to the centre, now so many activity, can talk, enjoy. Some people come and teach me to plant flowers, to grow the tea. Now all happy. Lonely because not come down to the centre, always at home, alone. Now they every morning can come down, come follow me, go to recipe centre, enjoy breakfast, talk to other people. Don't so sad, don't think you are lonely, you've got many friends. You can come here and enjoy and not worry. Now my friends are all very happy, not so sad. Sometimes I ask my friends 'come we all cook' and then they say 'ok can!' When I pick the day and they all come, eat together, then happy, after that enjoy.

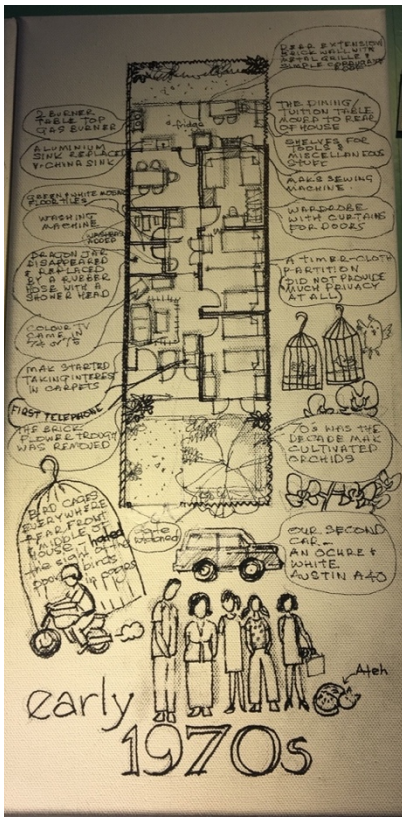
She says that more seniors come down to the centre and the kitchen stays cleaner. Larry says: "It's because people feel like they belong there, have a sense of ownership, because they helped make it."

After lunch, I go with Subhatra to art class in a neighbouring HDB's SAC. She is excited because it is exhibition day. For the last two months she participated in a workshop on mapping her history, inspired by her life and group trips to the National Museum and the National Art Museum. Teachers taught them methods and helped them imagine their past and present spaces through drawing.

When she presents her project, she reads a statement to the class and visitors (including me, her son, and grandchildren): "Everyone has a story to tell. I share mine through a floor plan. Working on this brought back fond memories." Her project is a map of her house from the 1960s to 2017, when she moved in to the small HDB flat she currently lives in after her husband died (seen through the X on the 2017 panel, and the house's emptiness). The floor plans, two for each decade, tell the story of her life and family, materialising her memories and affective identifications: through cars, household objects, pets.







After explaining each panel, she concludes: “The house will forever remain significant in my imagined sense of self—where I began and who I am connected to.”

Her classmates’ art projects explore different themes through spatio-temporal maps and their own domestic data-gathering: Florence maps her weekly activities and happiness in drawing and felt, Benny keeps a detailed calendar of his daily activities, and Nazeera tells the story of her childhood abandonment and move from kampung to HDB home in a pop-up drawing. Florence told me after the exhibition, with amusement, that the show-and-tell made her feel like she was back in school. But the stories they tell have unfolded over the many years since, in intimate daily material entanglements with their living spaces and everyday objects.

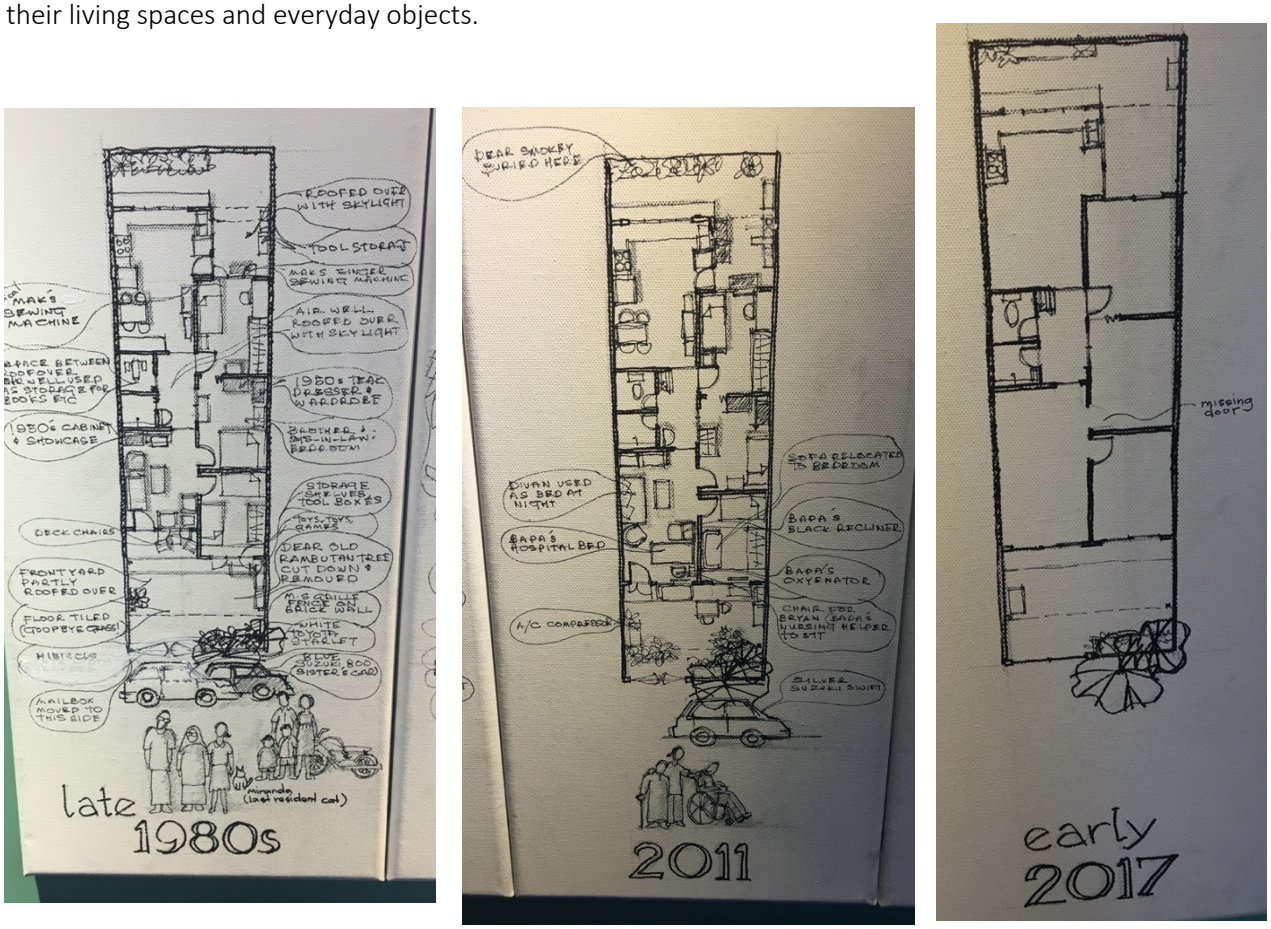


Figure 141: Subhatra's Home Storytelling Project (selected panels).

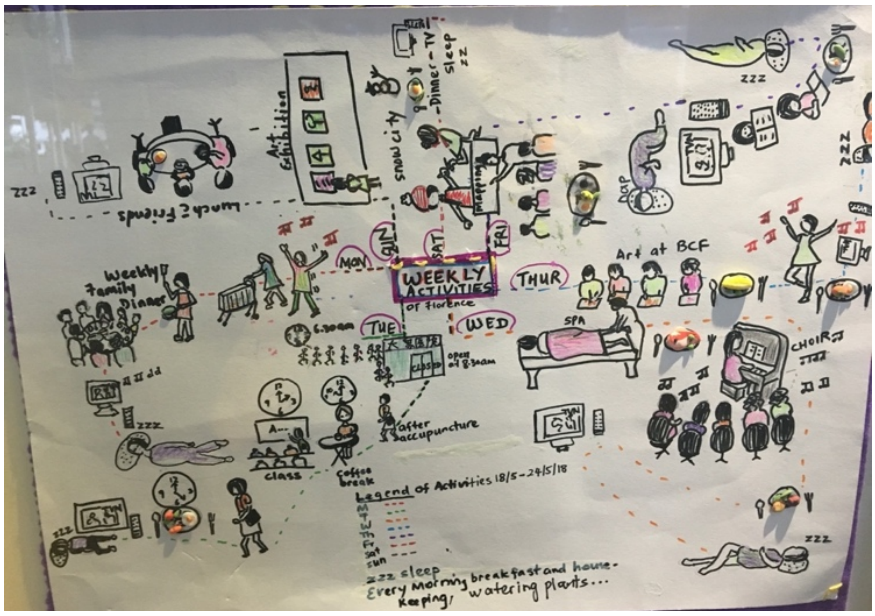


Figure 142: Florence's Weekly Activities Map.

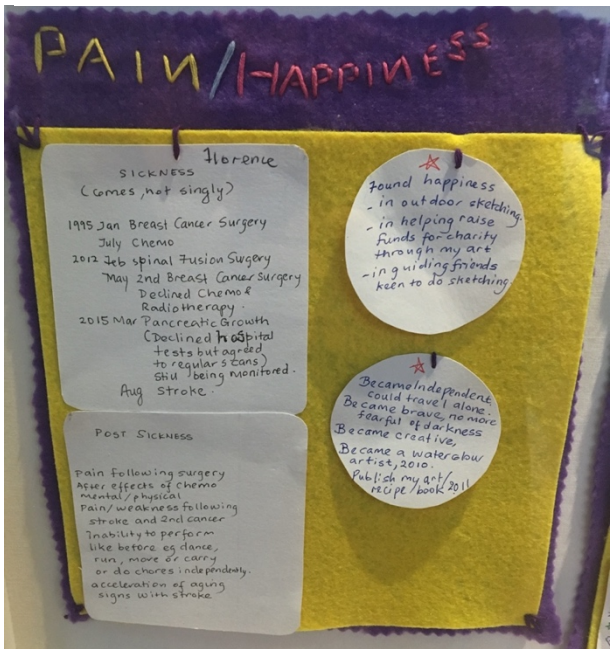


Figure 143: Florence Mapping Happiness and Pain.

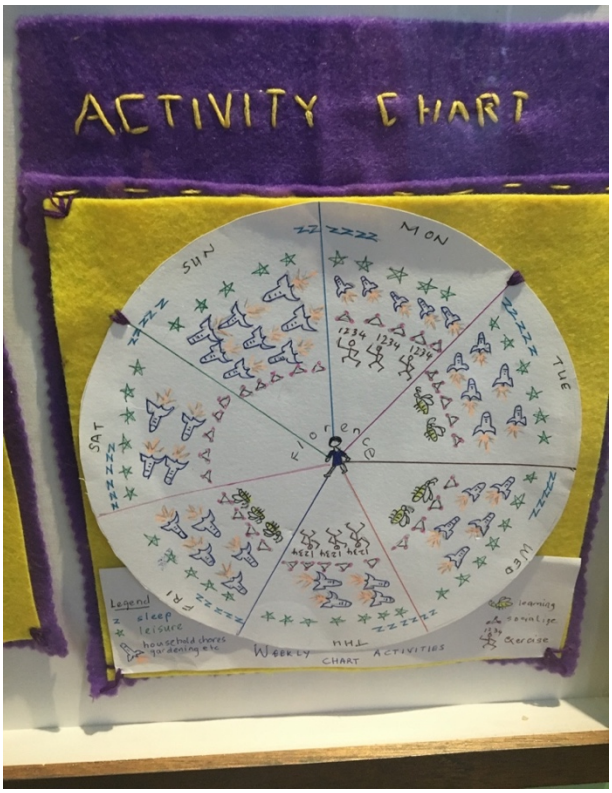


Figure 144: Florence's Activity Data Chart.

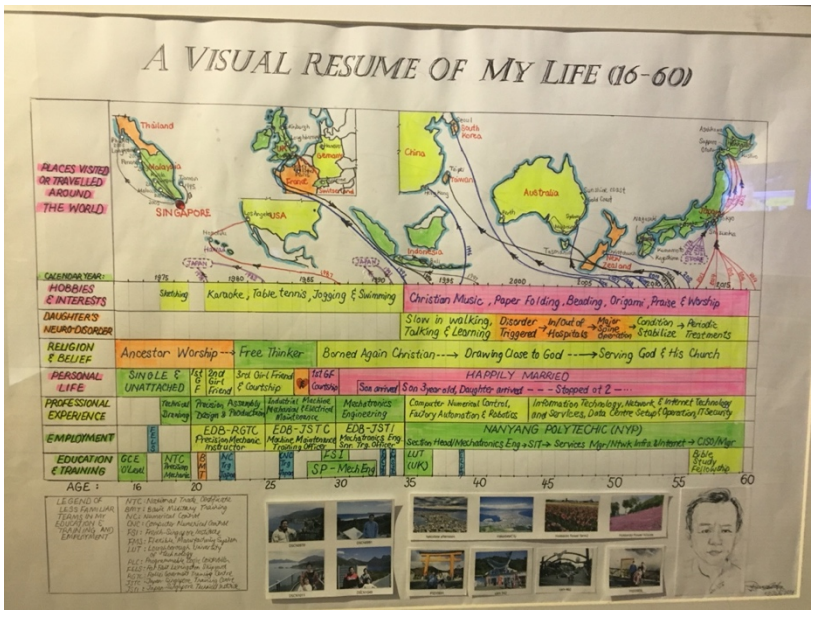


Figure 145: Temporality and Spatiality of Life.



Figure 146: Nazeera's Material-Symbolic Home.

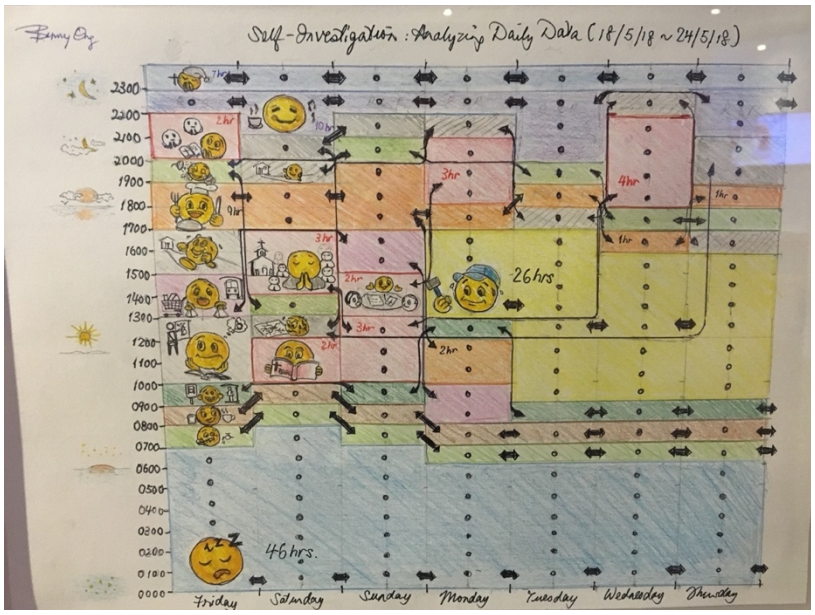


Figure 147: Benny's Activity Data Log.



Figure 148: Life through the Home.

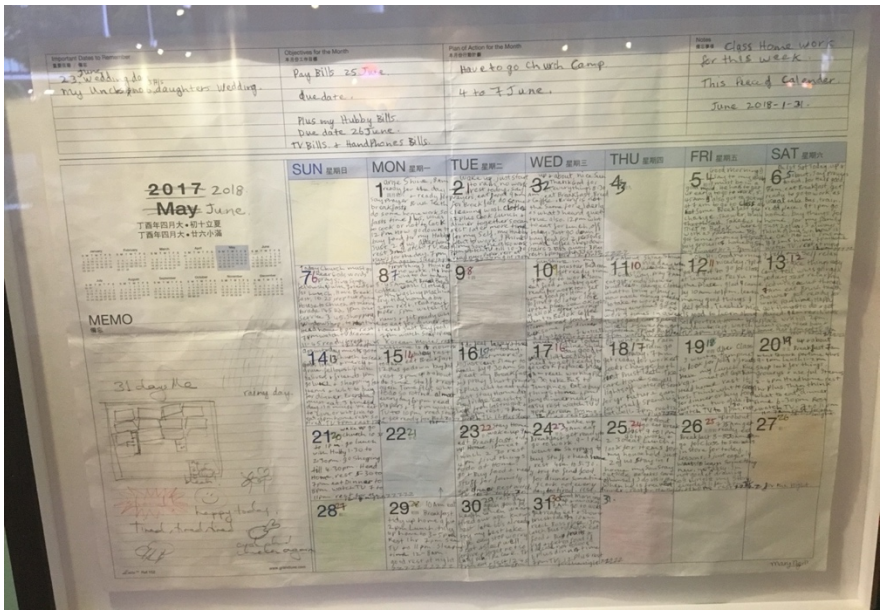


Figure 149: Daily Data.

After the exhibition I go out with the seniors and their families to celebrate, eating roti prata in the warm glow of the lights on Serangoon Road.

2.4 *Making Space for the Past in the City of Forgetting*

As Michael Fischer (2015: 218) argues:

> Stories are not just stories of, but stories for. They are ways of thinking about how we want to build communities of the future, for ourselves as well as others, as we all pass through the phases of aging; they provide the mental tools as well for sur-vie.

Subhatra's stories matter as she makes them come to matter every day. So do her daily engagements with the Smart Nation, in her own domestic space, as she affectively and materially practices smart citizenship. Limiting the scope of political participation in the smart city to civic public spaces like the agora risks invisiblising the meaningful participation of those less able or willing to frequent "political" spaces. "Civic and political publicness" may therefore not be the appropriate concepts to privilege in "local techno-public smart assemblages" (Cowley et al. 2017:70). Moving beyond "traditional fora as spaces of public engagement" helps us develop a more imaginative understanding of smart citizen spatialities (ibid:72). Putting poor, female and/or minority bodies in political spaces or increasing the number of democratic spaces in a city, as feminist scholars argue, is only "partially sufficient to address historically and culturally embedded forms of disadvantage" (Cornwall and Goetz 2005:783). Subhatra engages with the smart city in myriad ways in her own spaces, building herself into its future despite having "aged out" of it in the eyes of the state.

Browne (2015:8) argues that "with certain acts of cultural production, we can find performances of freedom and suggestions to alternatives to ways of living under a routinised surveillance." Subhatra has long been subjected to a range of differentiating data-gathering technologies, visible in her technological everyday as she gives various biometric data in exchange for access to resources. In her practice, she refuses certain kinds of surveillance (the toilet sensor) while accepting others (using her identity card to access healthcare and library services), and creates new kinds of data flows, mapping, and tracking (in communications with her family, through artistic mapping of her life, and her peers' re-

visualisation of their daily movements and temporalities in ways meaningful to them). Some of these she considers consciously, others fade into her subconscious routine.

Subhatra reshapes her future by reshaping the spaces she frequents daily. Changing her home to suit her specific religious practices and her SAC to enable connection with other residents is arguably more meaningful to her sense of belonging than speaking out in public against the standardisation and connectivity foundational to the state's Smart Nation plan. She also spatialises the past, rather than ceding to the state's relentless future progress narrative, by mapping and affectively identifying with past rather than future space. These practices, of course, can only reimagine certain parts of the state's Smart Nation imaginary as expressed through the HDB: her experiences of being a racial minority in her HDB, data recorded at her birth and sanctioned by the racial quotas imposed by the government, are less easy for her to reimagine through these acts of living space otherwise.

Finally, state planners' understandings of her needs and contributions evolve when they come to her space rather than staying in their own state spaces. Rather than conforming to the existing narrative of HDBs and their residents as standardised, planners like Larry think beyond the living lab. Larry does not see his project as a "test" in a laboratory-like setting: "Test what? To be honest, we didn't know what might happen. We just unlocked the space and opened it up to see what seniors would do with it." By changing HDB design methods to incorporate resident difference and non-standard behaviour, like local smart home developers do, these planners make standardisation less foundational to the Smart Nation, making space for difference. Thus Subhatra's lived experience becomes a part of the Smart Nation and changes it: but in ways also limited by planners' ability to translate her experience into their maps and into the HDB's smart urban infrastructure, which I analyse further in the final section. Changing the smart city's standardising logics thus happens through everyday practices of disrupting,

re-routing, and creating new data flows, reimagining parts of the Smart Nation while others remain difficult to change.

Since states project political power through smart urban infrastructure via smart city planning practices, everyday material engagement with the city, despite seeming practical and mundane, is political engagement (Leszczynski 2020; Billig 1995). By attending how residents co-produce the Smart Nation's technological everyday, I foreground quotidian practices as political, as residents' material engagements in homes and communities spatialise smart citizenship. Retheorising smart citizenship as practice requires linking "structural transformation to embodiment and lived experience" and "exploring place-based passions that arise in one's household, neighbourhood, workplace, or other well-travelled circuits of daily life, passions that have a potential to simultaneously ignite new ideas and new ways of living" instead of suggesting that residents increase their visibility in state spaces (Cravey 2005:110).

Having expanded spaces of political engagement with the smart city beyond the public sphere, in the next section I shift analytical attention from voice as a primary means of political action in the smart city towards material and affective engagement with smart urban infrastructure.

3 Materialising Smart Citizenship

Smart citizen literatures consistently reference the Greek "agora", a democratic public space for "political debate" in which "every citizen will have the possibility of having a voice" (Cardullo and Kitchin 2017; Vanolo 2016:31; Hollands 2008:314). The republican ideal of the agora has been critiqued for projecting an imaginary of "flattened connection" overlooking differentiated citizen "constraints, tangles, and disconnects" and "the plurality and flux of social and political formations" (Postill 2012:170; Dean 2009). I argue that theorising the personal as political, everyday existence as resistance, and citizenship as affective identification negotiated through the "intimate public sphere" widens what counts as smart citizenship beyond this limiting archetype (Campt 2014; Crenshaw 1991; Hanisch 1970;

Tawil-Souri and Aouragh 2014; Berlant 1997). For example, for citizens in the environmental sensing project Zandbergen and Uitermark (2020:1741) studied, empowerment

> was not merely and only imagined through the republican tropes of public debate, objective data, and collective action. It was also rooted in local and ad-hoc forms of negotiation based on individualised and affective forms of sense-making…as part of an urban environment consisting of information flows to which they could attune their senses.

Smart citizenship, (re)defined through its material and affective dimensions, is "rooted in a composite, paradoxical form of subjectivity" based upon "specific situated interests and forms of engagement" (Zandbergen and Uitermark 2020:1743). Instead of expanding republican citizen participation tropes widely met with apathy (like in section 2.1), Dunagan (2013:71) encourages platforms for "civic imagination" which widely engage citizen participation through affective modalities:

> We need Smart Citizens, but we also need absurd, playful, angry, emotional, intellectual, poetic, and kinetic citizens. If we want "every citizen" to contribute, we must create compelling engagement opportunities. Making the absurd, the fun, the visionary, or the poetic part of "official" civic life may sound paradoxical, but if done properly, we could see our communities and our lives improve in measurable and immeasurable ways.

In this section, I imagine "compelling engagement opportunities" tailored to diverse and differentiated smart citizens materialising smart citizenship. I describe the technological everydays of Ying and Justin, showing how extensively they engage with the Smart Nation in their daily lives. They replicate and reimagine it through material practice, in part as "cybernetic" smart citizens individuating and exteriorising based upon affective engagements with sensor technologies. They participate in compelling material and affective engagement opportunities which take place in their own spaces, while also being surveilled by the range of technologies detailed in previous chapters.

3.1 Actions Speak Louder than Words: The Technological Everyday of a Schoolchild

Lily wakes Ying at 8am. Like every day of the last two months, Ying groggily dresses and puts on her lanyard, upon which hangs a small, colourful sensor called SENSg (Figure 150).



Figure 150: SENSg (pronounced "Sense SG") sensors for National Science Project. National Science Experiment (NSE) 2016.

After breakfast she takes the lift with Lily and her younger brother Justin. The bus picks her up every weekday morning in front of her HDB block. She hangs out on the "3Gen" playground with other kids in the estate, while Justin plays and Lily talks to other parents (and sometimes me) before work.



Figure 151: Toa Payoh playground, 2015. Photograph by Stephanie Yeow.

Ying boards the bus, and the sensor registers her as it connects to a sensor on the school bus. If she missed the bus, Lily would get a smartphone notification.

Ying told Lily and I she was excited for her school trip today. Her class participated in the Singapore National Science Experiment (NSE), the reason for her sensor necklace which collects a range of biometric data throughout her day. It tracks her body's motion and her environment's light, sound, air temperature, humidity, and atmospheric pressure. It knows how many steps she walks, how long

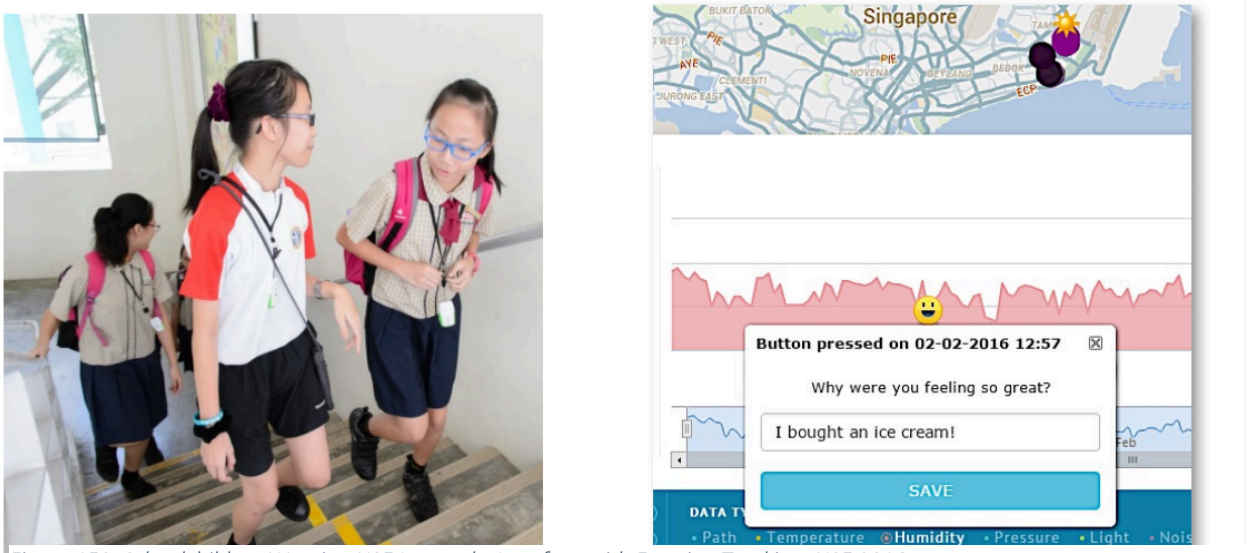


Figure 152: Schoolchildren Wearing NSE Lanyards. Interface with Emotion Tracking. NSE 2016.

she's been outside, and how much time she spends on the bus and in cars. It knows how many unique Wi-Fi networks it connects to over her day and where she likes to hang out after school. She presses the button each time she feels happy, inputting why to add more data (Figure 152). She also uses its camera to photograph her "fav hangout spots", like Toa Payoh playground (Figure 155). A*STAR nicknamed this project, tracking schoolchildren's' everyday movements, "Lab on a Lanyard" (Figure 153): materialising the imaginary of Singapore as a "living lab" through children (the "building block of the nation's future" according to Balakrishnan, cited in Chapter 4).

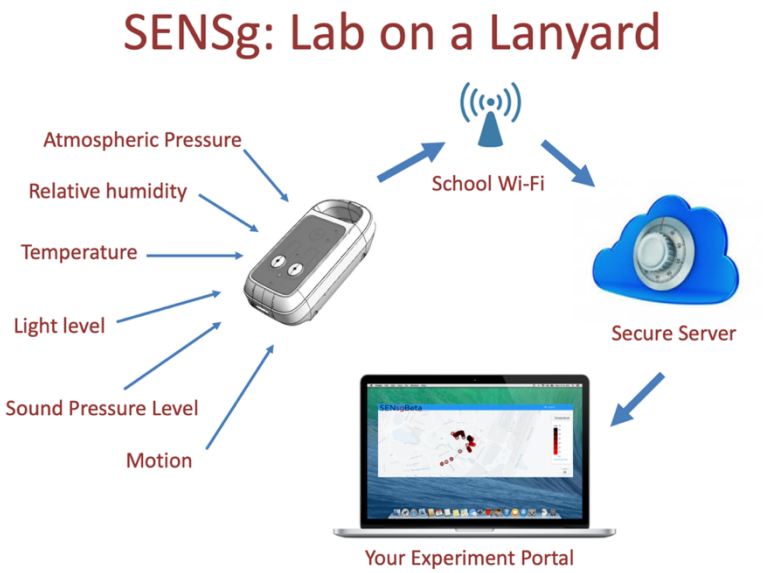


Figure 153: "Lab on a Lanyard". Sensor Data for NSE. NSE 2016.

At school, Ying and other students visualise their data. The application on the school computer's desktop opens to a full map of Singapore, like Alvin's. Ying inputs her sensor ID and PIN to log into the student experiment portal. She can view her sensor data in several ways, most geospatial. Hers and 50,000 other student participants' biometric data feeds into GEMMA, the large-scale geospatial map of Singapore that Alvin uses to replicate the Smart Nation in Chapter 5, using QGIS plugins.

The NSE map, called "Singapore Views", was created by the same state agencies that designed GEMMA, in a state-international university partnership with ETH Zurich's Future Cities Lab (René's employer after A*STAR via ICON, designers of the smartbike). Its map interface is based upon the 2014 Master Plan created by the sociotechnical planning practices detailed in Chapter 5. Questions on the platform ask students to actively fill in data gaps the sensor missed, like what HDB floor they were on at a certain time.

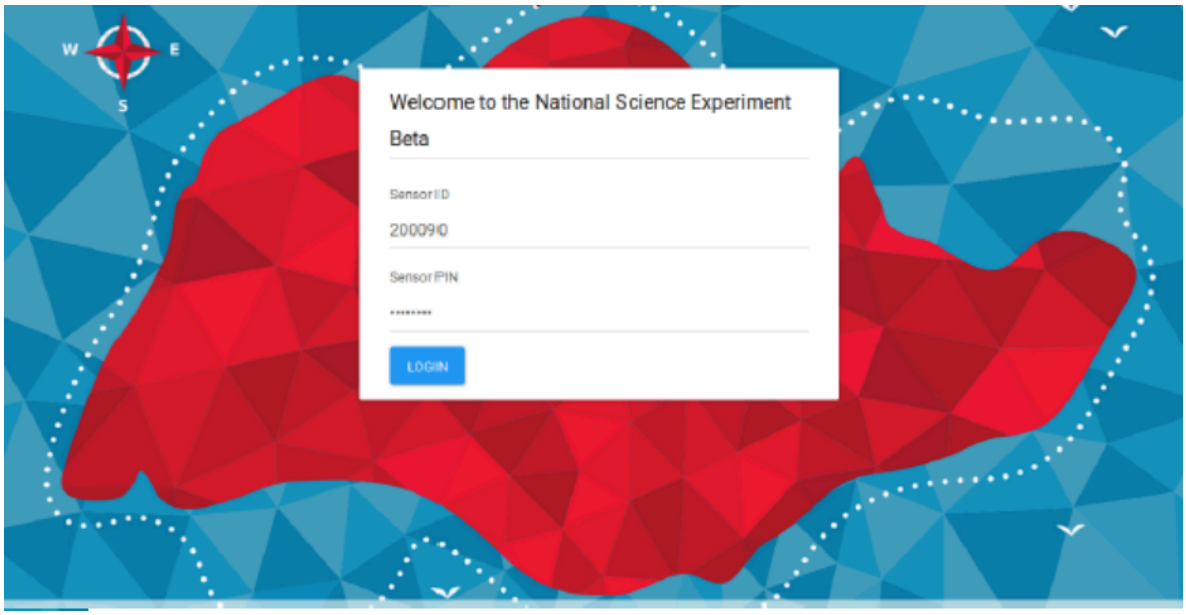


Figure 154: NSE Login Page. NSE 2016.

Students like Ying do not just provide data to the map: they learn how to visualise their data, with other students' data, to see themselves as belonging to and constitutive of Singapore's population. This data visualisation is part of their school lessons during the project, as they too are taught to imagine their futures like the state.

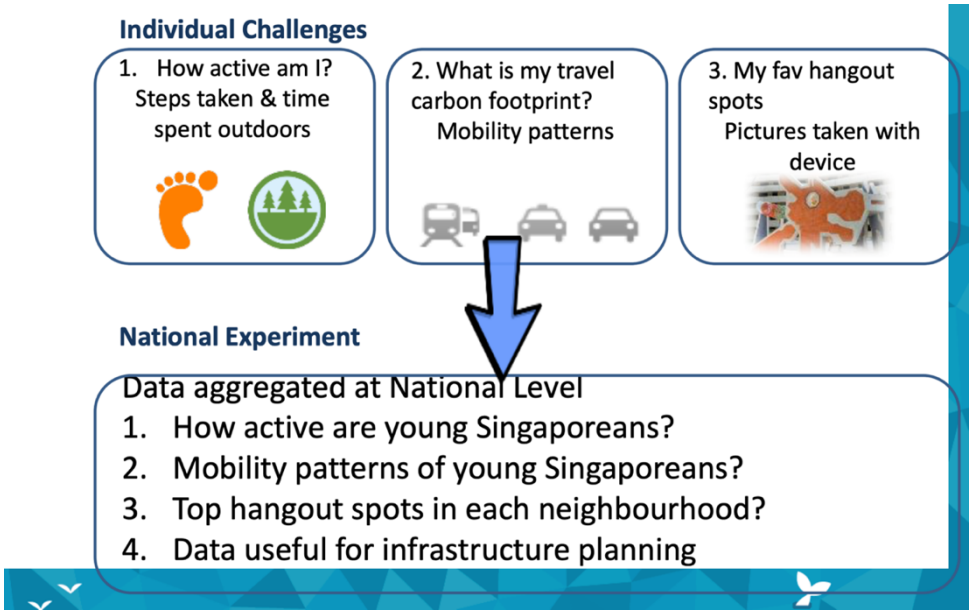


Figure 155: NSE Research Questions, presented in School Lesson. NSE 2016.

Ying studies her activity report, which tells her how many stairs she's climbed, how long she's spent outdoors, her carbon footprint based on her transportation usage, and her device battery. This activity report looks similar to the activity report generated by the seniors' smart home sensors in Chapter 6, but it comes from a single sensor attached to the schoolchild's moving body connecting to sensors embedded in smart urban infrastructure. This interactive mobile form of sensing, as René told the seniors in Chapter 6, is a key future goal of the smart home projects since it allows for "continuous and ubiquitous" data connection, data that "flows like water."

Xinyuan from the URA shows Ying how to read temperature data from her sensor data dashboard (Xinyuan walked me through the interface and process she takes with the students as I asked her questions about it). Students learn how visualise data with guidance from a partner state agency mentor like Xinyuan, including GovTech and the URA. Older students learn more detailed analysis, while younger ones learn science lessons about temperature and transport, using Smart Nation data. Xinyuan uses the same teaching model for the students as for the young planners described in Chapter 5, teaching them practice-based applications of sensor data and mapping technologies to think about the Smart Nation rather than just abstract or general uses of data or GIS. In the app, students play games

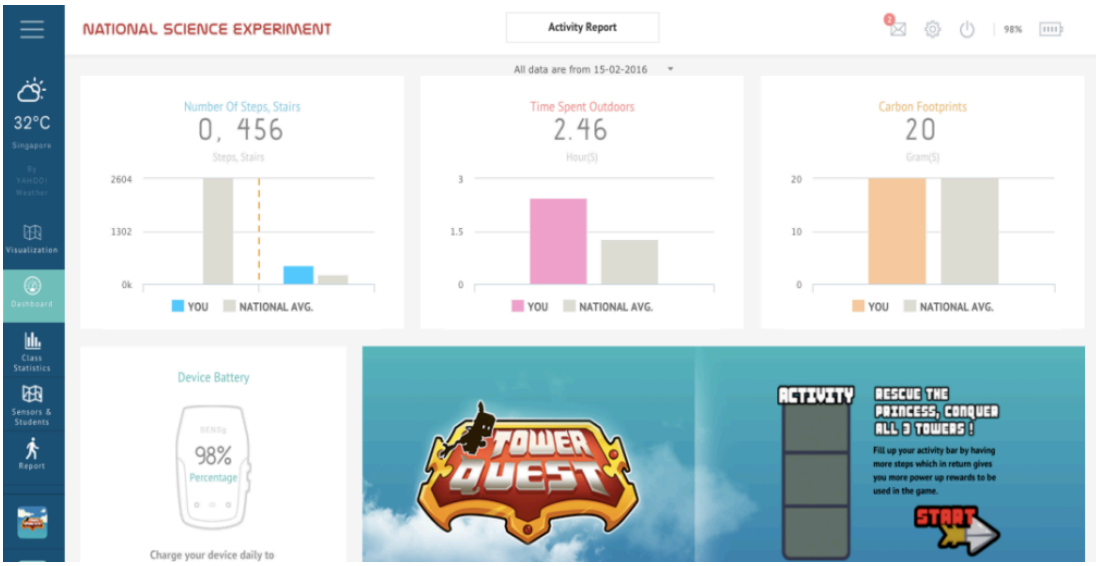


Figure 156: Activity report, NSE Dashboard. NSE 2016.

about smart city design and do educational modules that tell them whether they correctly interpret the Smart Nation geospatial data according to URA models.

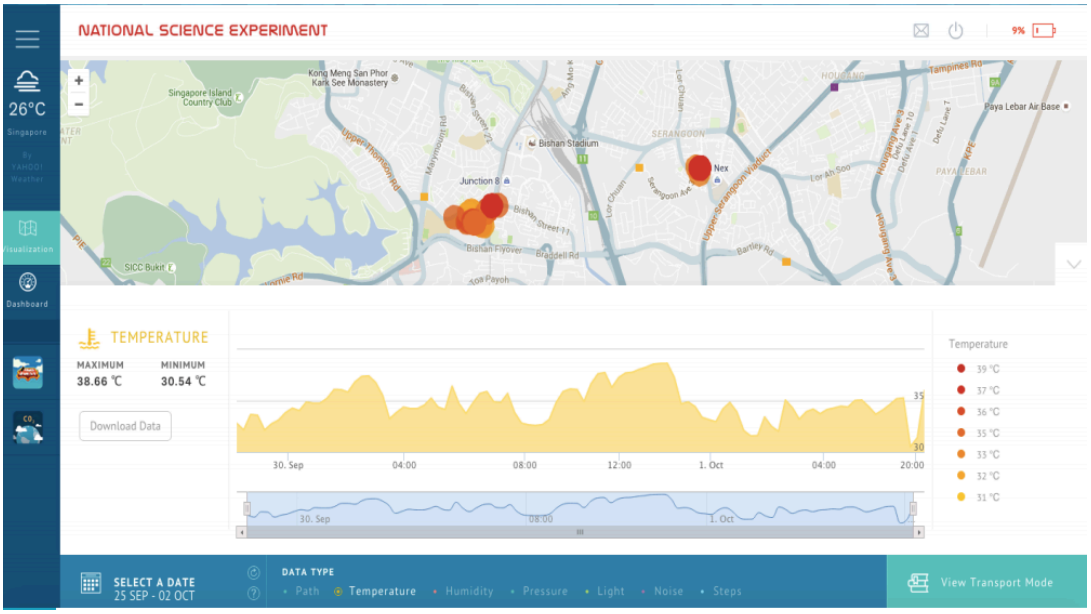


Figure 157: Temperature Data, NSE Sensor Dashboard. NSE 2016.

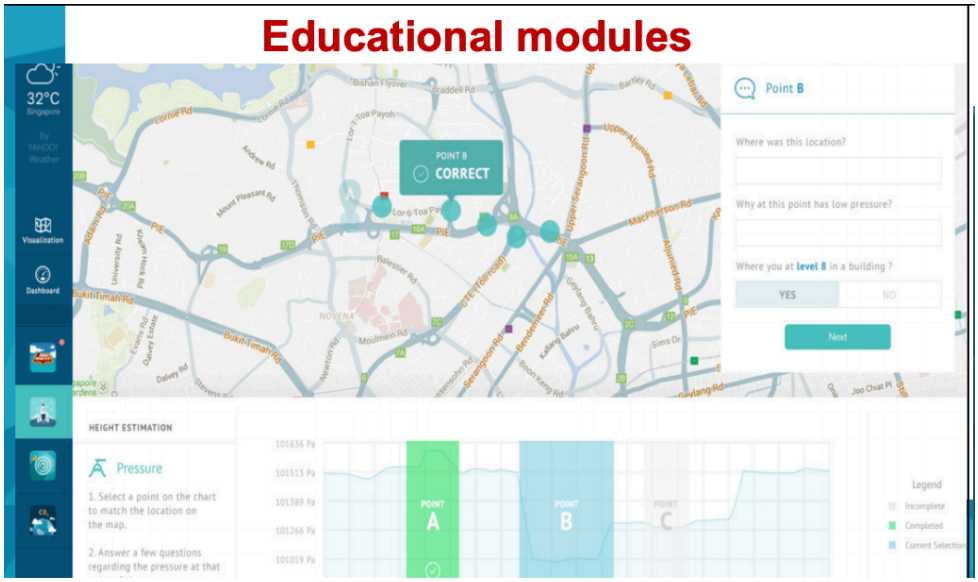


Figure 158: Educational Modules, NSE Sensor Dashboard. NSE 2016.

Today's trip is to the URA Singapore City Gallery. One of Xinyuan's colleagues at the Digital Planning Lab will show them the gallery to teach them how their biometric data, and their (data)body,

is part of Singapore's larger Smart Nation plan. Then they will participate in an interactive playground design challenge, which excited Justin and his primary school friends.

Hopping off the bus (the sensor registers), Ying walks through the same URA doors into the same glass atrium as Alvin does every day. On the back wall by the large-scale models of the city-state, she sees the "Connecting People and Places" display. She reads about Future Mobility Sensing, a smartphone app by SMART-MIT in partnership with the URA, which gathers the same kinds of data as her sensor. She sees the National Science Experiment displayed next to a description of the URA's GEMMA map, which she excitedly told Lily about later ("we were part of it, Mama!").

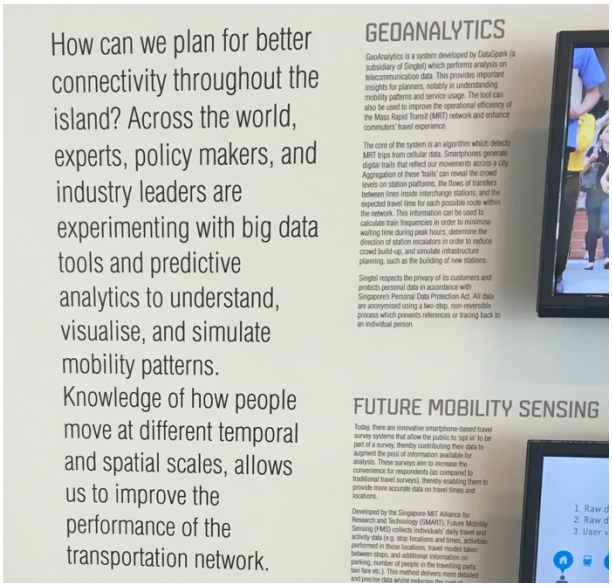
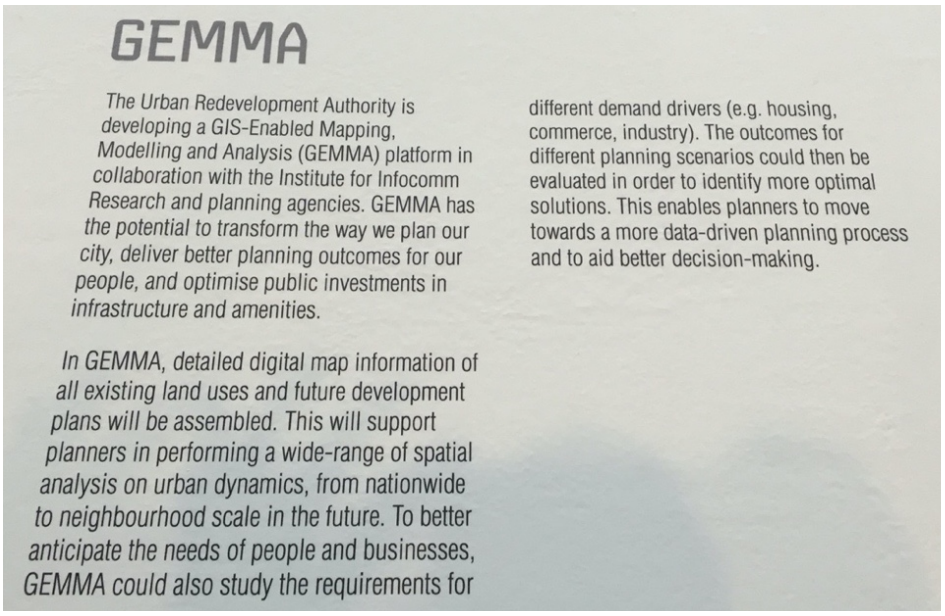


Figure 159: Connectivity at the URA Singapore City Gallery, 2018.

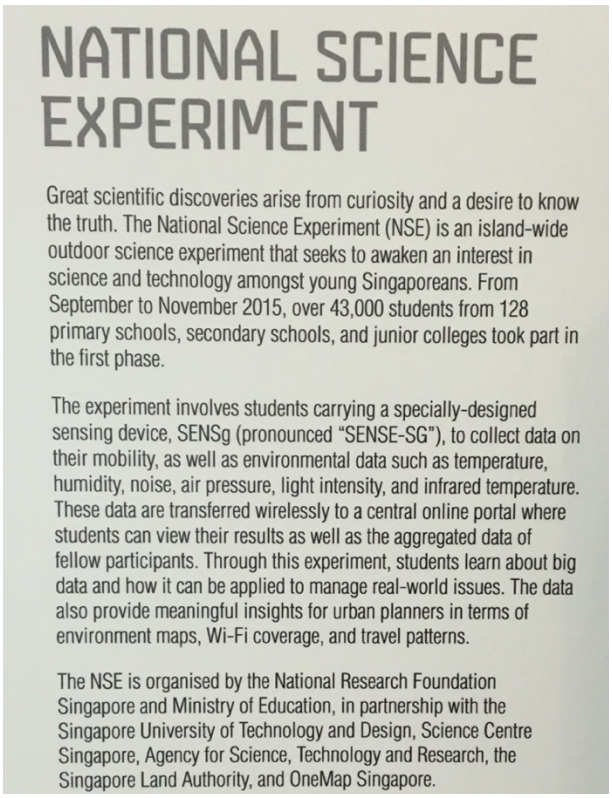


GEMMA

The Urban Redevelopment Authority is developing a GIS-Enabled Mapping, Modelling and Analysis (GEMMA) platform in collaboration with the Institute for Infocomm Research and planning agencies. GEMMA has the potential to transform the way we plan our city, deliver better planning outcomes for our people, and optimise public investments in infrastructure and amenities.

In GEMMA, detailed digital map information of all existing land uses and future development plans will be assembled. This will support planners in performing a wide-range of spatial analysis on urban dynamics, from nationwide to neighbourhood scale in the future. To better anticipate the needs of people and businesses, GEMMA could also study the requirements for different demand drivers (e.g. housing, commerce, industry). The outcomes for different planning scenarios could then be evaluated in order to identify more optimal solutions. This enables planners to move towards a more data-driven planning process and to aid better decision-making.

Figure 160: Description of GEMMA at the URA Singapore City Gallery, 2018.



NATIONAL SCIENCE EXPERIMENT

Great scientific discoveries arise from curiosity and a desire to know the truth. The National Science Experiment (NSE) is an island-wide outdoor science experiment that seeks to awaken an interest in science and technology amongst young Singaporeans. From September to November 2015, over 43,000 students from 128 primary schools, secondary schools, and junior colleges took part in the first phase.

The experiment involves students carrying a specially-designed sensing device, SENSg (pronounced "SENSE-SG"), to collect data on their mobility, as well as environmental data such as temperature, humidity, noise, air pressure, light intensity, and infrared temperature. These data are transferred wirelessly to a central online portal where students can view their results as well as the aggregated data of fellow participants. Through this experiment, students learn about big data and how it can be applied to manage real-world issues. The data also provide meaningful insights for urban planners in terms of environment maps, Wi-Fi coverage, and travel patterns.

The NSE is organised by the National Research Foundation Singapore and Ministry of Education, in partnership with the Singapore University of Technology and Design, Science Centre Singapore, Agency for Science, Technology and Research, the Singapore Land Authority, and OneMap Singapore.

Figure 161: Description of NSE at the URA Singapore City Gallery, 2018.

Justin runs to the interactive exhibitions, pressing buttons asking him to imagine his ideal future playground. Hands on the large touchscreens, he watches the application change colours in response to

his answers. The whole exhibition explicitly asks him to make his future play space by touching the digital screens, playing with the sensor-enabled blocks in the exhibition, and drawing pictures.

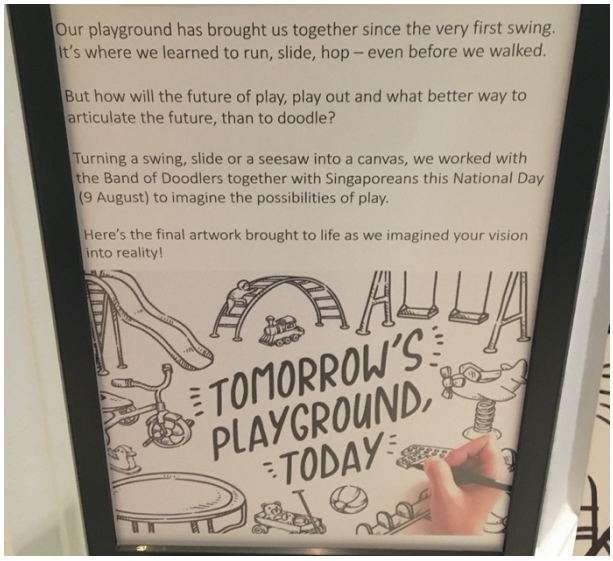
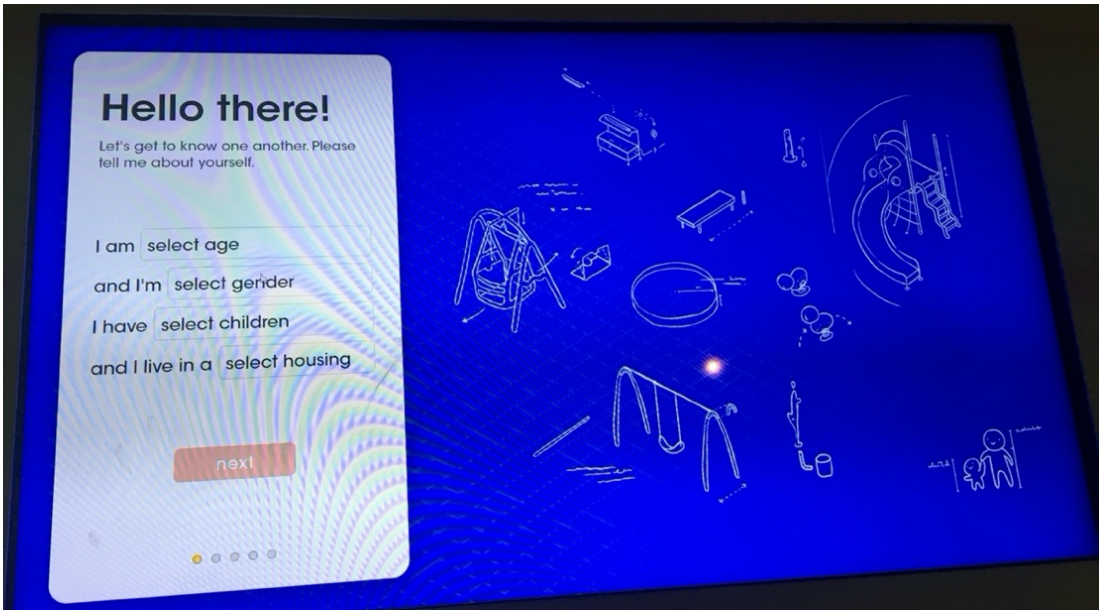
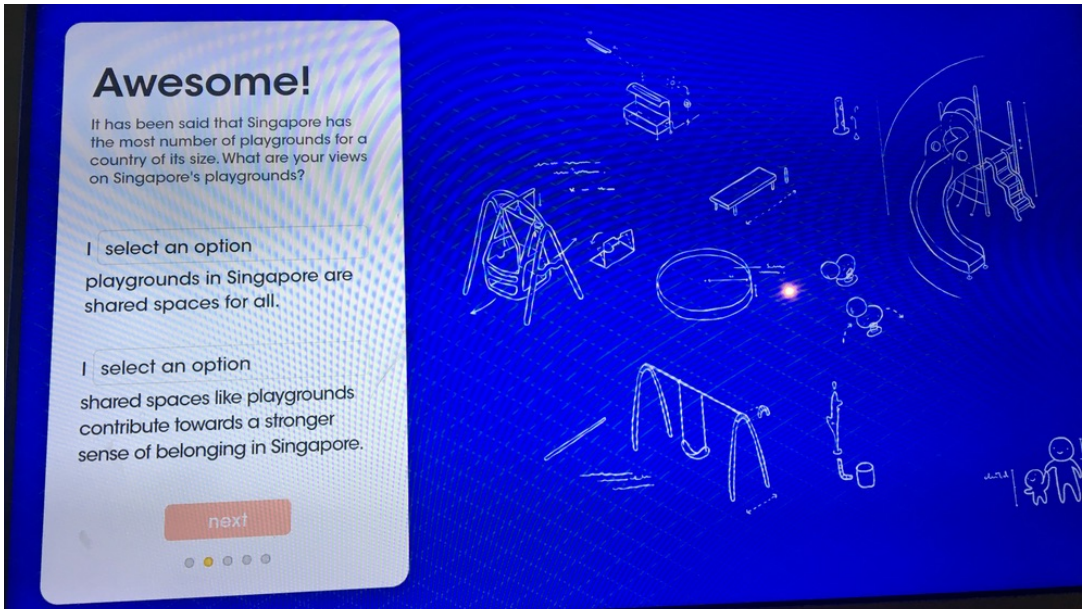


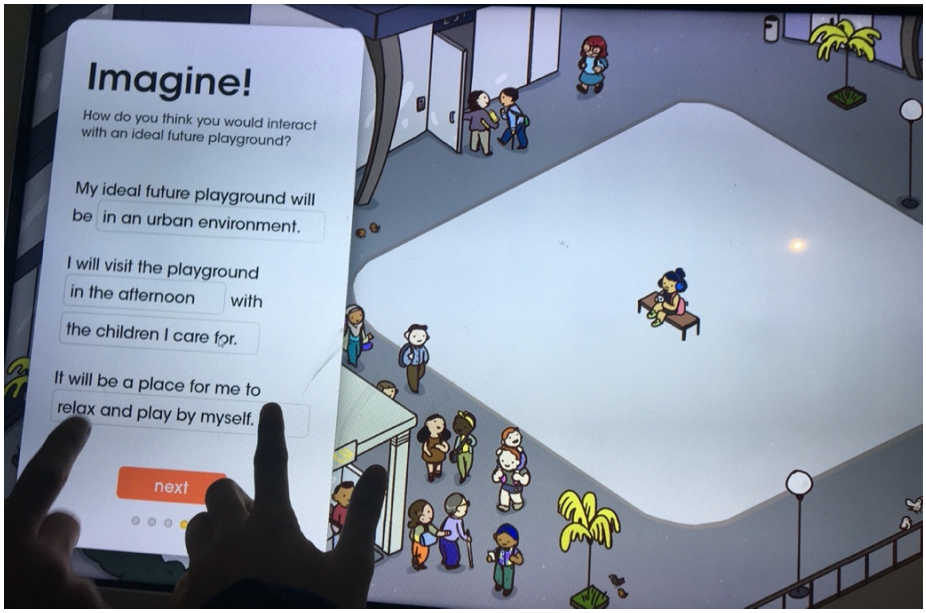
Figure 162: Tomorrow's Playground Today Exhibition, 2018.

First, he inputs his age and gender and giggles as it asks how many children he has. He puts 5, just for fun, and answers honestly that he lives in an HDB. He says he believes "shared spaces like playgrounds contribute towards a stronger sense of belonging in Singapore", the text offered to him on the second page. He then picks a playground in an urban environment, adding a seesaw. He answers he will visit



after school with his sister and wants lots of friends there too. When he finishes, he runs to ask Ying to scan the QR code containing his unique playground design with her smartphone, since he his mum won't let him have one yet.





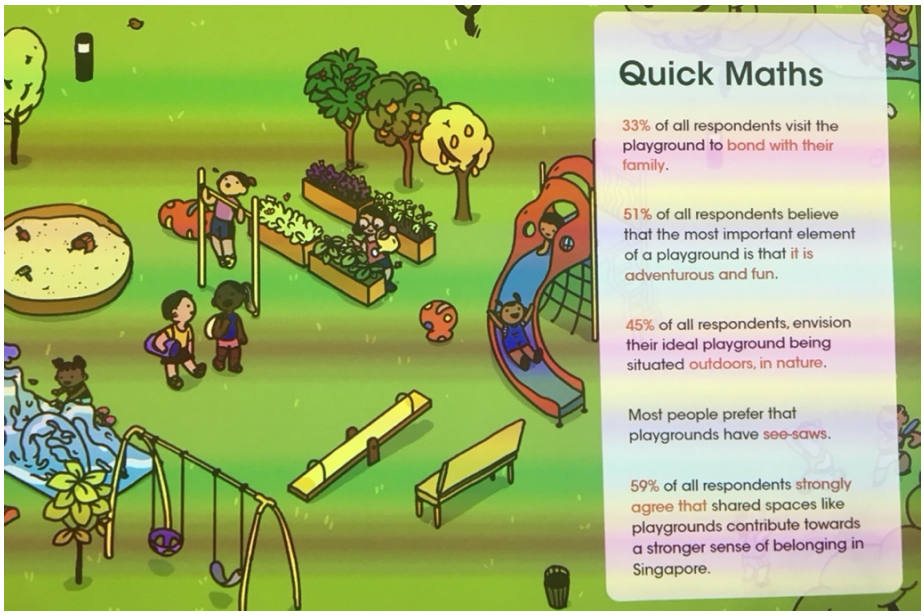


Figure 163: Tomorrow's Playground Today Exhibition.

Another exhibition, titled "Future World", immerses Justin and Ying in a giant cartoon-style map of Singapore roads. The digital rendering pictures iconic Singapore landmarks—the Merlion, Marina Bay Sands Hotel—as colourful hand-drawn objects like spaceships and buses fly across the screen.



Figure 164: Future World Exhibition Video (Right Click to Play!).

A sign before entering the darkened room prompts: "Imagine the future of Singapore and bring it to life!" Adults and children sit at tables covered in paper and markers. Ying and Justin make space and

start drawing. Yin selects a house cut-out and draws her imagined future home: a landed house in open space, near a park. Justin grabs a spaceship, colouring it messily and rushing to one of many scanners. He grabs Ying's arm and shrieks with joy when his spaceship appears on the screen, becoming a part of the eclectic fantasy future Singapore landscape.

The teachers call them back to the bus. Getting off at their estate, they find their HDB playground full of people, including me, for a URA event. "Uncle Larry!" Justin squeals, as he and Ying see the planner that has come to their HDB on Thursdays after school for the past few weeks. "Hi Justin!" Larry laughs. I ask: "Are you excited for our Crayon Conversation today?" "Don't want to draw today, want to play!" he replies and runs off.

As parents watch with amusement, kids play with twenty state planners and eighty volunteers (myself included) in bright yellow vests as they design their dream playgrounds, using recycled materials brought by the URA. This is a new citizen engagement initiative by the same non-profit working with Subhatra, P!D. They scheduled the event for the peak time that children normally play—after school—to play with them. The planners encourage parents to design, too, and Ying, Larry and I laugh as we overhear a child: "Daddy, Mummy, your playground is very pathetic, I don't like it. Come see the play space I built." Ying presses the button on her sensor to indicate she is happy: creating another data point for the URA that leads them to conclude playgrounds and community centres spark joy, generating further state investment in these design activities (Benita et al. 2020). Months after the event, Justin continues to write Uncle Larry with new ideas:

Dear Uncle Larry,

Here are some things I want can you please make it for me. Higher monkey bars, bigger umbrellas, signs in both Chinese and English. Thank you. Your friend Justin.

While Lily is still at work, Ying and Justin are looked after by Auntie Lim, with another boy whose parents work. Auntie Lim is also an elderly smart home resident. When it gets dark, Ying takes Justin up to Auntie Lim's HDB flat. Justin runs around to try to make all the smart home sensors in Auntie Lim's flat blink at once (I'm sure Esther will *love* interpreting that, I think, when Auntie Lim tells me about Justin's antics), then falls asleep on the couch. Ying finishes her maths homework early and helps Auntie Lim shape dough for curry buns to take home to her mum, as Lily is usually too tired to cook. Ying tucks Justin in and goes to sleep, hanging the "lab on a lanyard" sensor next to her bed.

3.2 Playing with the Smart Nation

HDB playgrounds are key material-symbolic resources through which the state materialises future imaginaries and fosters affective identifications with the nation. The National Design Museum cites HDB as a leading figure in the creation of Singapore symbols since early days of independence. Shaping children's imaginaries from a young age through the space of the HDB, the state-built playgrounds are "imaginative children spaces that conveyed a sense of national and cultural identity" (Figure 165). Playground design intentionally leaves "strong impressions on many young minds", saliently exemplifying how the state projects imaginaries using the material-semiotic resources of the HDB, specifically through the family (the "building block of the nation's future" for Balakrishnan, as cited in Chapter 4).



Figure 165: Housing & Development Board Playgrounds 1974-1985. National Design Museum, 2019.

Ying (as a literal and figurative building block, producing and projecting Smart Nation data) also learns how to replicate state visions of Singapore's future through her school lessons in smart data visualisation and through school trips to state agencies placing those lessons in a larger state sociotechnical imaginary. As discussed in Chapter 5, we must *learn* how to replicate and reinvent future imaginaries through everyday embodied practice, and we can only do so through the material-symbolic resources that we can access. Intervention in children's material and symbolic family, home, school, and play structures is therefore an important intervention into their capacity to imagine some futures at the exclusion of others.

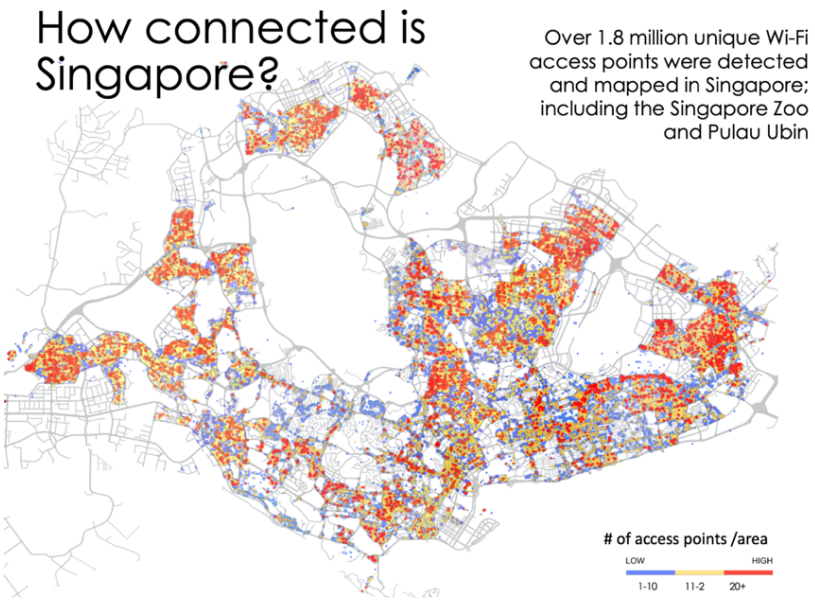


Figure 166: Wi-Fi Connection Points mapped through National Science Project. NSE 2016.

Through Ying and Justin's experiences, we see the three Smart Nation material-symbolic resources repeatedly enacted: futurity, through domestic space like "our playgrounds, our future" (Figure 167); connectivity, through the sensors Ying and her fellow students wear to allow planners to increasingly visualise the island (Figure 166); and standardisation, through the "lab on a lanyard" project which literally makes the student body part of the Singapore as living lab imaginary (Figure 153).

Ying and Justin repeatedly materially and affectively engage with the Smart Nation as sociotechnical imaginary: in drawing, planning, playing, touching, producing data, and processing data. They practice smart citizenship by interacting with the Smart Nation in myriad ways in their daily lives, both replicating and reimagining it through data flows and material and affective engagement with its infrastructures. By reimagining traditional playground forms, Justin imagines different futures which will then be re-materialised into newly built playgrounds based upon his play. Engaging with and reimagining these play structures, as a result, is a form of affective political engagement that also reimagines the symbols themselves and the sociotechnical imaginaries they project.



Figure 167: "Our Playgrounds, Our Future" Exhibition. National Museum of Singapore, 2018.

Ying's daily conscious and unconscious engagements with her sensor and with the smart urban environment around her means that she both replicates and reimagines the Smart Nation, through feeding it data and using that data to cultivate her own sense of self, nation, and smart citizenship. As part of the living lab, her daily practices feed back into the mapping system that URA planners use. In living her life, she and her fellow students learn to replicate or reimagine through the same geospatial systems that these planners use. Her smart citizenship practices are affective, cybernetic, diverse, and differentiated, expressed through many daily material engagements with smart digital and urban space. In the next section, I describe how the younger generation of planners uses these geospatial systems to imagine futures differently from past planners, reimagining the Smart Nation sociotechnical imaginary

as well. They also transform the way that other planners learn how to replicate the Smart Nation, creating new forms of generational transmission.

4 Differentiating Smart Citizenship

In this section, I share a conversation with Geography university students to show the diversity of smart cities and smart city services they differentiate between to evaluate their relationship to the Smart Nation. I illustrate that a "vertical reading of smart city politics", in which "bottom-up democracy" is pitted against "authoritarian control" (Zandbergen and Uitermark 2020:1733) overgeneralises residents' diverse desires and obfuscates their differential abilities to spatialise smart citizenship. Next, I describe young planners presenting their designs for future housing, based on engagement with elderly residents, to show how sociotechnical imaginaries like the Smart Nation are slowly reimagined through repeated material engagement.

My study of differentiated residents who spatialise citizenship in diverse ways explains why some forms of spatialised political engagement do not provide some residents the material-symbolic resources needed to reinvent smart city futures or access citizenship. It also illuminates forms of spatialised political practice hidden by an undifferentiated understanding of smart citizenship. My analysis specifies the limitations of quotidian forms of resistance and refusal, showing where it is almost impossible to avoid differentiating surveillance in the Smart Nation or access (smart) citizenship by gaining the right to belong "in place" or reproduce. It also shows how smart city sociotechnical imaginaries change over time, by surfacing feedback loops in the overlapping daily practices of residents, state planners, and international and domestic developers.

4.1 Differentiating Forms of Smart Citizenship with Future Geographers

I sit with twenty Geography students, most of whom will work for the Singapore state after graduation, in a two-hour session on living in the Smart Nation. Their diverse opinions, despite similar age and

education, helps showcase how different smart citizens spatialise smart citizenship. They conceptualise the Smart Nation as offering different capacities for empowerment and self-expression: sometimes improving their quality of life and access, sometimes restricting their senses of autonomy and choice. All three major Smart Nation imaginaries (standardisation, connectivity, and futurity) surface repeatedly. Students trouble state imaginaries of Smart Nation standardisation by articulating Singapore's difference from other countries, replicate connectivity by discussing efficient data flows, and re-spatialise Singapore's futurity by debating whether it is "ahead of the pack."

I first ask them to describe their technological everydays: "What urban technologies do you engage with daily? Think about today as an example." The students give rapid-fire responses:

> "Transport, using EZ link card, contactless cards for travel payments"
> "Convenience apps—Google maps, things that make your day easier. Things that check the shuttle bus that never come (laughter). Travel apps."
> "Using Pay-Lah ("you just had lunch, that's why!" More laughs.) Cashless payments. In other places Ali Pay, WeChat pay."

I ask who uses contactless app payments daily, and most do. A few don't:

> "I feel it's very troublesome—you have to wait, scan, when you just give the cash its easier."
> "I feel it's not very safe."
> "Yeah, Bank will just say—it's your fault lah! For not adding security."
> "My way of protesting the whole movement toward completely cashless campus. Who do these methods serve?"

They articulate different meanings of participation in Smart Nation futures and desires for involvement. Some feel the Smart Nation should have more citizen involvement, like Liana:

> I think there needs to be more community solicitation. Now power is in hands of government, especially in the case of China. Without community solicitation, government doesn't know that it might be overstepping boundaries. Need a balance. We need to have citizens as stakeholders.

Yi Ling agrees:

> We don't just need more data—we need more community and civic participation in this larger conversation. So we don't just leave the recommendations to selected special committees that are formed by governments, or private corporations.

Xiaopeng disagrees:

> There's a limitation to that. Thinking back to who controls the data. The government kind of knows that they are being intrusive, the aim of using the technology is to be intrusive so that things can work better. There are limits to how much a citizen can do.

Alethia agrees, citing the connectivity and efficiency of services:

> When you register at a government office—for a house at HDB or permit at LTA—we take for granted that a lot of the data about our address, NRIC numbers, personal citizenship numbers, are captured in a government-wide network. We take for granted that if we go from HDB to ICA to LTA that they already have the data. We may need to provide them the NRIC number or FIN number, but then they have the data. At least here, we assume that this is the case. It's regulated in a reliable way. If you go to other countries, you'll find yourself running from office to office giving them the same pieces of information over and over.

The young geographers trouble the standardisation necessary for Smart Nation export, consistently citing incommensurable differences between Singapore and other countries. Students repeatedly compare Singapore to China and the US/Europe (slightly less), positively and negatively. Jing Yi expands Alethia's point about other countries and emphasises difference, arguing that the same state data-gathering action signifies something different depending on the political, economic, and social context of the smart city:

> We are talking about different political-economic contexts. Something happening like this in China signals something unsettling, whereas here in Singapore it could be something more innocent and an everyday example of government oversight, which we are used to. But in US and Europe, someone would say 'how could you have that level of information on your citizens.' Like in job interviews—in Singapore, they ask 'you have a young family, would that affect you?' Whereas in the US and Europe it's illegal to ask these kinds of questions. Has to do with social contexts—what is acceptable, so what is under government jurisdiction changes.

Daniel adds:

> I don't trust smart homes in the UK because you know corporate greed is going to intervene. They say it's to reduce water consumption but really I think they will use it to raise their prices more at peak times.

Daisy says that these national considerations affect how she determines what data is acceptable for the government to collect:

> It's ok to collect data, but not so extreme like China such that it governs the way people can behave. Crossing the road, you want to improve that! The government should make known to public how they are going to use the data, so we can say: yeah, that's a good use.

Alethia adds:

> The balance has to come from the government itself, because ultimately they are setting direction and usage of what they are using. And also depends on what we take to mean about privacy and personal freedom. Like we don't see cameras in public space an invasion of privacy, but in another country they might. It's what citizens determine as too much or too little.

Xiaopeng laughs: "Yeah, here in Singapore, you put cameras outside the MRT and we won't say anything. In a Western country, they call it surveillance, talk about data privacy, blah blah." He continues more seriously:

> While most people are talking about smart cities, we are talking about a Smart Nation. A national government, nation-wise basis. Singapore is a weird space, we are both a city and a nation, a country. When you put it together it sounds really grand, but it's because of the geographical anomaly. This also means in Singapore when you implement smart city solutions, you are capturing a country-wide phenomenon that has implications for national level policy that might not be the same in larger countries.

The national connectivity of services initially brought up by Alethia as the often-unrecognised benefit of Singapore over other countries repeatedly emerges throughout the conversation as the Smart Nation's key positive impact, replicating what state planners had said to me. Students notably distinguish between kinds of Smart Nation services when evaluating citizen engagement. Most see automation as beneficial for improving public works, increasing social good and easing labour:

> "The Smart Nation initiative has helped shape Singapore, especially transport and urban mobility. The sensors are used to enhance traffic flow and safety, holistic approach to traffic management. Agencies can work together with other transport initiatives for goods like free public transit, a vehicle quota system."
>
> "Same thing about smart city services: sensors manage condition of roads, traffic lights, streetlights, send data to centralised system so people could be automatically sent out to do maintenance, doesn't require manual inspection of each road."

Whether Singapore is "ahead of the pack" comes up often, frequently spatialised in comparison to China. Students intimately tie this debate over futurity to how connected Singapore is digitally, illustrating how intertwined the two imaginaries are:

> "A year ago, China—omg I went there, everyone is using cashless mobile payments. I don't know how to use it; how does it work. We always thought of ourselves in Singapore as a Smart Nation, credit cards seen as a smart solution, efficient. Now in China we are seen as behind. People also use their phone for transit. Tap it like EZ link card. I've seen only few people do it in Singapore. What defines smartness changes over time, we look to other places to see what the future is and try to get ahead again."

> "I think Singapore is smarter than China though, because even though they have things like better contactless payment integration, Singapore has a more connected and integrated system."
>
> "Singapore is not just smart for the sake of being smart, like other places. There's an attempt to integrate all the portals online so access is a lot easier. Singpass means you can do every government service imaginable from one app."
>
> "Singapore is the gold standard smart city because it has the most extensive effort to collect data on daily living and feed it all into one geospatial platform, so the vision is much more integrated and connected."

In the end, they decide whether they want to participate based upon contextual information which differs based upon the service, the data being gathered, who gathers it, and who benefits from its use. Amal echoes Daniel and Daisy, saying that smart city data collection is about transparency and use, which she determines contextually and needs information to decide:

> It's a give and take. Ultimately if I'm going to give the government the data, I'm wondering how they use it for. Transparency must be set up really clearly. Otherwise why should I give you this data?

Hearing a tension emerge between being discerning about one's data and giving data to the government to improve life's efficiency, I ask how they negotiate the trade-off between privacy and efficiency, and what they think happens to their data. Daniel responds:

> I don't think it's as simple as a continuum between efficiency and privacy. It's always put as a trade-off, and it's not a trade-off, there's more involved in the process. To feel like a centralised system is good, you have to have a really high level of trust in the institution that is centralising the data. So, the government. I don't know if I do.

These points about the many dimensions of the smart city—differentiation of services and data, invisible sensing for efficiency vs more civic participation, and who was controlling the data—are cited by Ruby as complicating the conversation about smart citizenship:

> It affects our lives in invisible ways most of the time. It's interesting when we talk about urban tech, we are touching on a wide range—transport, travel, consumption and retail, government services. There are so many different ways in which ICT reshape the ways that we do things as commuters, consumers, citizens. Covers a wide dimension, hints at the problems of doing smart city research. It covers so many dimensions—what do you pick on? And if you just pick on one thing, travel apps, you go into so many different dimensions—is it end user? Is it underlying infrastructure? Is it firms that make data and apps available? Or companies that make use of that data?

Alethia imagines a future smart technology that would make her life easier:

> I remember seeing an ad—you'll have a smart fridge in your home that monitors, can track that you are down to last carton of milk, less than half-full, auto-send an order to grocery store account and put in your cart. Things running low on, already in cart. Or can automatically deliver to your home without you doing anything.

Students repeat that "passive" sensing technologies can enable labour-reducing forms of smart citizenship, requiring a more nuanced analysis emerging from residents' own different cost-benefit articulations. According to Sassen (2012:131), such smart initiatives seek to make technologies invisible "and hence put them in command rather than in dialogue with users." But like single working mother Lily, residents see compelling reasons for technologies to remain invisible: for certain government services, "passive" feedback offers the least time-intensive way for residents to improve them.

Critiques of unknowing data extraction from citizens are vital but can underrepresent the different desires of residents themselves, some of whom want public works to be invisible and optimised, minimising the labour required when trying to access services. Automatic waste disposal can save domestic workers (usually women and/or non-citizens) time and labour, with political effects on their freedoms. "Passive" data on subway taps helps governments alleviate crowding without asking residents to do extra labour to provide feedback, and collects feedback from every user, rather than just those with time to have their say. This data is not passive: it comes from citizens' active, bodily material engagement with smart technologies, as evidenced by Alvin, Esther, Subhatra, and Ying's interactions with transit in their technological everydays. Yet as evidenced, that data can be used by the state to limit rather than expand their possible futures, which I turn to next.

4.2 The Limits of Smart Citizenship

In previous sections, I troubled the hierarchical dichotomies between "active" and "passive" smart citizens in critical literature and described how everyday resident material-imaginative and spatial practices can transform state sociotechnical imaginaries and change its use of Smart Nation space and

technologies. I now articulate the limits of smart citizenship as practice. I detail situations where reimagining state-designed spaces through everyday practice cannot materialise national "belonging" through public housing access or state recognition of citizenship rights, the right to be "legitimately present" in the Smart Nation through residency permits (Lyon 2003), nor the right to produce Singapore's future through legal reproduction.

As the students point out by differentiating smart city services and citizens, the important question is *who* can safely take advantage of Singapore's automated, connective systems. As Lyon (2003:674) argues, "digital discrimination" is enacted through the "differential application of surveillance technologies" as "flows of personal data—abstracted information—are sifted and channelled in the process of risk assessment, to privilege some and disadvantage others, to accept some as legitimately present and to reject others." Eubanks (2017:6) highlights the repetitive nature of this differentiating process and how it replicates a "feedback loop of injustice", disproportionately marginalising specific populations.

I give two examples where smart citizenship is differentially spatialised: the Employment Pass Services Centre and the National Electronic Health system. These examples also show that sometimes *not* having the ability to make your own data "flow like water" through a system designed to stop those racialised, sexualised, aged, or nationalised like you is what renders you invisible or "out of place." The posthumanist disaggregation of data from a single body in the smart city, in this case, is not liberatory, since the categories the data are broken down into are still "ordered racially by way of surveillance" and marked to reify historically continuous exclusionary boundaries (Browne 2015:17). As described in Chapter 4, not everyone has access to the material-symbolic resources of connectivity to spatialise their futures with, due to the decades-long standardisation practices enacted by the state through

differentiating surveillance, and not everyone is invited to metonymically stand-in for the nation and its futures.

The Employment Pass Services Centre materialises residents' differing abilities to spatialise smart citizenship through practice. Unlike in other nations, where getting a work permit is a tedious, obscure, and slow process, permits are highly automated as part of the Smart Nation plan: recall in Chapter 5 the effort in multiple National IT Masterplans to streamline these processes, to increase Singapore's ability to be a connected global port both materially and symbolically.



Figure 168: Employment Pass Services Centre Testimonial Board, 2018.

This imaginary of connectivity is expressed through the testimonials advertising the centre as "place to connect with the rest of Singapore." Becoming an official smart citizen, if you have the legal right to work in Singapore, is quickly and seamlessly materialised through the centre as you sign in on the touchscreens and give your fingerprints. You use your biometric data to signify your right to smart citizenship and your belonging, also fast-tracking your entry at the border. But as discussed in Chapter 4, not everyone is allowed to join the national family, and rejection from this automated system is equally swift. This smart citizenship system also tracks foreign domestic workers, ensuring they do not

procreate and break rules expressed through their work pass. Futures are differentially expedited and restricted through the smart city system.

Health records are another example of differential smart citizenship expressed through data flows. The National Electronic Health Record system makes patient medical records travel across state healthcare institutions. For elderly smart home residents like Subhatra, who otherwise had trouble narrating their medical history, the system can be literally lifesaving. However, for queer residents like Colin or non-citizens, intervening in automated medical data transfer was important, because something like a positive HIV result could mean deportation. As Daniel put it as our session closed:

> Who watches the watchmen? It's a challenge right, because when you talk about false positives it just is a word that goes off your tongue, but what if for example I am IDed as HIV positive when I'm not and that is transmitted across the system. Raises questions about choice, what's my ability to query back into the process, to solve that issue. The public policy side—who and what has that responsibility, and where does it lie? With technologists? Government? Civil society? These are the questions we have to wrestle with.



Figure 169: Government Advert for National Electronic Health Record System, Facebook.

It is therefore important to carefully nuance which invisible smart city technologies are labour-reducing and coercive, for which residents, as well as which and whose biometric data signifies inclusion in the smart city. Residents agentively articulate and navigate these trade-offs (sometimes even challenging

the concept of trade-offs, like Daniel). They have nuanced ideas about participation that do not conform to active/passive or bottom-up/top-down binaries nor privilege the former kinds of smart citizenship. Like Colin in Chapter 6, they mobilise situation-dependent smart citizenship practices and imaginaries.

This differentiation helps specify exactly how sociotechnical imaginaries like the smart city are co-produced. Co-production does not imply that production of the smart city happens evenly or equally, only that it is produced by a range of actors through daily practice in ways that require careful articulation. The invisibility and visibility of one's data and of smart city surveillance technologies, as well as the inequality and unevenness of co-production, has both empowering and restrictive effects for residents. Effects can feel empowering when the smart city alleviates their labour in ways that free them to participate in activities they enjoy, activities that generate new smart citizenship imaginaries outside of the state's focus on productivity and reproduction, for example. Effects can be restrictive when residents have less ability to make desired change in the smart city sociotechnical imaginary, for example due automation processes that deny them housing or citizenship. As Fiske (1998:17) argues, "although surveillance is penetrating deeply throughout our society, its penetration is differential", calling attention to the repetition of differentiating surveillance in smart city technologies and how it can be reimagined.

In the next and final section, I bring together many of my Smart Nation interlocutors' practices, spaces, and technologies described in this thesis to give a concrete example of how resident, developer, and planner co-production causes state smart city sociotechnical imaginaries to change.

4.3 Reimagining Smart Nation Futures: Learning with a New Generation of Planners

As I argued in Chapter 5, state planners learn how to replicate existing state Smart Nation sociotechnical imaginaries through institutionalised training with limited material-symbolic resources, which they respatialise in digital planning maps like GEMMA. In this section, I show how changing these learning

genealogies, as younger planners work with different material-symbolic resources and learn different planning methods, leads to a reimagining of the Smart Nation sociotechnical imaginary and a transformation of both the maps and the smart urban infrastructure they create.

One of Larry's P!D planner colleagues, Erica, discussed P!D's work on the Smart Nation plan:

> There is a thought leadership position in Singapore—we have to re-train the state. Not just designers, planners, architects can claim that they are the place-makers. Place-making is a system. Who does the city belong to? All of us. You'd be surprised, there's a lot of talk about apathy in Singapore, but 85 percent of people who talk to us want to help, they just don't know how.

At an event called "Future Housing for the Silver Generation", future planners present their designs for future elderly living spaces to an audience of elderly residents, state planners, developers, university professors and students. Statistically, most will be employed by the state once they finish education. I watch these young planners literally make new maps of the future, working with elderly residents to reimagine rather than replicate the Smart Nation and its metonymic processes.

The prompt for their design projects is simply: "Future housing is…"

4.3.1 Reimagining Connectivity

The first of 20 groups put their map of a reimagined HDB estate on the screen. "Future housing is…live+work." This group reimagines connectivity, using the existing connective infrastructure of the HDB to connect elderly residents in differentiated ways according to their unique interests and desires. Wong explains:

> To design this, I asked my parents what they do with their free time. They said, 'I go to the market, I go for my morning coffee.' What I want and what my parents want is actually vastly different. I use Instagram, they use Facebook. I also hung out in the HDB with them and observed some things. The HDB park is usually underutilised, but because of Pokémon Go there's people using it. It might tie people together, change how we view housing in the future, to have that digital overlay from our handheld mobile devices, which everyone uses, including my parents.

He continues:

> Even between my parents, they want different things, and so do their friends. One does not want to stop working and wants to have more ability to pursue different hobbies and work at

> home. One of them says: When I retire, I don't want to stop learning. I want to upgrade my skills; I don't want to stop working. And another: I feel like my life is lost now that I have 2 young kids, on the other end I want to keep learning. And another: How can we make things vibrant beyond just gardening, which is what they try to encourage for older people? I'm not a gardening person, I don't have green thumbs, can you make something for me?

Working with the constraints of existing HDB structure, the team transformed the common areas into flexible workspaces, where neighbours can hold classes and workshops, building on existing fibreoptic cable networks. They call the design "NETWORK", connecting people to each other and to resources allowing them to individualise their spaces:

> One day I could go to pottery class, one day learn how to build apps. How could we learn within the estate? Designed for learning pods within residential housing in hope that people will come learn and teach each other, create vibrant kind of retired housing for the diverse interests of the elderly: artisan, IT, health, wellness, music.

This kind of social connectivity also inspires a different project team, who imagine future housing to be "recreating kampong spirit." They add ramps to the existing lift structure, allowing elderly residents to slowly walk through common areas, leading to more social interaction between neighbours and removing the literal and figurative distance between places in the HDB estate. Another team calls their design "live and play", creating "semiprivate communal spaces to serve residents on every other level. So hobbies can take place there: telescope park, reading terrace, planting terrace, chess garden."

4.3.2 Reimagining Standardisation

The next project team suggests that future housing is "flexible housing." Alexis imagines this flexible living model to permit diverse family arrangements in the future, reinventing the HDB family standardisation materialised in HDB's current building infrastructure:

> This design has hexagon view so units are modular, flexible, and interchangeable...Units are designed so that you can piece together any way you want. If HDB wants to make a new estate, choose kinds of building types you want and piece together. Multigenerational living together, can knock down a wall. People want to live alone? Also possible within the same estate, in any configuration, since hexagonal. You can easily reconfigure it any way you want.

She attends to details: "Elderly spend a lot of time on toilet, so you can see a view from the bathroom."

The final team proposes that future housing is "intergenerational living." The project reimagines the state's 3Gen HDB plans, describing the 10% decline in 3Gen households since 2000 to 23% of the population. Boon says: "I thought one of the main reasons why multigen living hasn't worked is because ample living space is ample fighting space. Over laundry, bathroom schedule, interaction with pets." But one of the residents he talked to corrected him:

> My peers tell me I don't want to stay with in-laws. But growing up in the kampong the intergenerational part is what brought my grandmother out of the house to engage with others. I want that too. Growing up, some of my fondest memories were in the kitchen with my parents and grandmothers. Taught me importance of culture, respect, and life skills. But most of us never cook anymore, we just eat out. I want to know whether architecture could help people come out, could shape the lives of the new silver generation.

Given that a lot of elderly residents and their children do want to live closely with others, Boon proposes a configuration that reimagines the family unit as more flexible. Dual-key configurations with common living areas, multipurpose spaces where the elderly can join everyday activities, allow for both privacy and connection enabling different social and familial relationships to be expressed through space. He imagines going beyond traditional nuclear, heteronormative family living currently imagined by HDB:

> In the future, units like this can also become co-housing. Families don't just live by themselves but share house with someone else like a housemate. Perhaps in future elderly couple can live in flat with caretaker or housemate, reduces risk of isolation.

Students also trouble the Singapore as living lab model, stressing how different Singapore was from other cities. Anthea emphasises a "hyper-local" approach:

> How many of you have seen images from the West, America, Europe, lovely installations, food trucks in the park? Have you seen any of that happen in Singapore? No? Because it's too hot! Cannot just teleport things from America, US, to Singapore or back. Us in Singapore we tend to do that quite a bit. But every city is unique. We need to emphasise a hyper-local approach, based in research with our own people, instead of just copy-paste.

All these reimaginings of future HDB space emerge from the project's directive to engage with elderly residents in their own spaces, as they go about their daily lives, and are expressed through new mapping practices. This planning project had a direct impact on HDB space, based upon engagement with seniors. Boon said that in the HDB itself, the young planners:

> Marked up paths that people take from their home, to hallways to lifts, to different pathways and ramps, to see how difficult or easy it was for people to get around. We had people with wheelchairs, dementia, walking frames. We gathered that feedback and submitted it to town council. They responded within 2-3 months and put in the changes so that residents could move around safe.

The young planners showed many pictures of seniors appropriating HDB spaces in unplanned ways. In the HDBs where co-design workshops occurred, like Subhatra's, they found the SACs were highly active. But in other HDBs where this emplaced planning had not yet occurred, they found "lots of closed spaces. Lots of rows of red benches, steel, locked up. TV locked up; kitchen locked up." Residents brought chairs from their own flats and congregated outside the HDB estate drop-off points, not designed for this purpose. They also found that seniors liked to spend time outside, even if spaces were not designed for it. As one young planner said, elderly residents would "Appropriate own void deck, bringing own TV, fridge, table, chairs. Collect stuff, bikes, repair them, sell them. Selling vegetables and making a flea market. And they decorate the whole place as Chinese New Year year-round." The crowd laughed. "Something is wrong with our HDB design, we don't know how people behave."

The students repeatedly stressed that the seniors are non-homogenous: they have diverse and differentiated interests expressed through their daily practices. Some wanted to live with their children, some didn't. Some wanted to take art classes, some wanted to learn how to code, and some wanted to just hang out and socialise with other residents. Many wanted relief from odd jobs in the form of better working opportunities. As one young planner put it: "Ageing is not even just a particular age group. We need to cater to everyday needs and think of ageing as process of life, look at it in different stages. We need to put their aspirations and dreams into something physical, as designers. I see the city as a growing organism, something that can keep changing."

Through this process the young planners increasingly saw this design for the older generation as design for themselves, for the aspirational futures they wanted to live:

> In the end, we are also designing for us because we are going to grow old. You see a lot of situation of growing elderly, your grandparents, a lot of illness. A lot of personal experience. In the end it's a personal matter because it's designing for my grandmother ageing and the elderly around me. In the future do you want to have no support or not have a conducive environment for us to age? We are wanting to create a better environment for our futures ourselves. We are no longer just designing elderly care homes; it is much more than that. New facilities, new way of connecting each other. Beyond just healthcare or mobility devices.

Crucially, standardisation and connectivity were both materially and symbolically reimagined through these designs for the future. Young planners stressed flexibility and open plans rather than standardisation, of both housing forms and family structures, across projects. They imagined connectivity, like elderly residents in Chapter 6, as social connectivity emerging from a desire for differentiated and diverse opportunities for their daily practices. Their planning designs emerged from the daily lives of residents and their own personal experiences: "We really have to draw from our personal experiences and think on the ground, what's the situation like and how can we use the skills we have to let elderly have experience that can benefit them."

Not a generic "public", specific residents care about the difference that their differences make in the smart city (Ginsburg 2012; Rose and Novas 2005). Parents are invested in the design of their children's HDB playgrounds; elderly and less mobile residents understand what makes SAC spaces accessible; domestic workers have more insight into useful smart home technologies; migrant labourers' experiences matter more when evaluating workpass automation. As Larry says: "Another group in society often overlooked is children. Who designs playgrounds? Architects, developers, town councils. But who are the real playground experts? It's the children."

This kind of smart citizen engagement does not mean planners make residents do all the work. Instead, planners like Larry still do active work in engaging residents. But that work goes into figuring out what residents' needs are by observing their daily practice, in their own spaces. Planners then use their expertise to translate resident diversity and difference into the state's smart city design practice. Larry suggests that the state should invest more in learning how to do such translation work.

After the students, a URA planner working with Larry on P!D projects spoke. “It is becoming clear that we are not actually observing the city. So now we can study the layout of the HDB, the plan, and figure out how to map these studies into the plan. Back in our lab, office, how do we look at our situation and the whole landscape of senior living in Singapore?”

He continued: “We have used this ongoing design work with seniors, understanding that each of them has a story to tell, and ask how to design for each of them even in their difference. So we took something old, the 5Cs, and turned them into the 5Cs that seniors need: continuity, compensation, connection, contribution, and challenge. We realised we needed to de-institutionalise and differentiate.”

Following the event, the URA displayed the new maps from this Design for the Future Silver Generation project, and their reimagined understandings of standardisation, connectivity, and futurity, in the URA Singapore City Gallery. Alvin now walks by them every day and students like Ying and Justin will learn them on school trips.

Theorising smart citizenship as affective, material practice enacted every day across public and private domains, rather than as giving voice in a democratic public sphere, illuminates a range of smart citizenship practices that unevenly co-produce the smart city sociotechnical imaginary. It is critically important to distinguish between different kinds of residents in the smart city, as residents are non-uniformly affected by smart urban infrastructure, resulting in different senses of empowerment, and because not all residents are equally responsible for or affected by the problems that the smart city seeks to ameliorate. Recognising this difference partially counters the neoliberal implications of generalised calls for active, bottom-up smart citizen engagement. Theorising smart citizenship as practice in an “intimate public sphere” (Berlant 1997) widens who critical literature counts as a smart citizen while also making real, differentiated constraints on smart city co-production more visible.

5 Discussion

Many critics argue that smart cities' top-down governance turns residents into passive producers of data while further entrenching neoliberalism (Greenfield 2013; Kitchin 2014; Luque-Ayala and Marvin 2016; Kitchin, Coletta, and Leighton 2017; Vanolo 2014; Hollands 2015). This body of literature generally calls for smart city residents to become "active participants", "smart citizens" producing the smart city from the bottom-up (Townsend 2013). While these critiques seek to ameliorate inequality, efforts to make smart citizens create smart cities often use a limited theory of participation as voice and visibility in a democratic public sphere and replicate neoliberal processes by offloading civic labour onto residents.

That most existing literature cites a gap between hopeful desire for citizen participation and actual citizen participation suggests existing theories of smart citizen participation need rethinking. Planners and smart city scholars look for and encourage "active" smart citizenship in an imagined public agora, but this misses a wide range of material and affective resident engagements which generate smart city futures. Neglecting intimate spaces also often misplaces where actual barriers to overcoming citizenship inequality exist. My analysis both builds on scholar concerns that the smart city replicates inequality and broadens what constitutes smart citizen participation to better understand that inequality.

As detailed in this chapter, I found residents were resistant to "active" participation. In Lily's words: "Isn't the point of the smart city to participate less?" Planners had difficulty getting citizens to join "participatory design" hackathons in their planning offices: the more active participation that co-design required outside the patterns and spaces of their daily lives, the less likely residents were to participate. But my interlocutors' resistance to "active" citizen participation in smart city creation does not mean they did not participate in its design or push back against development decisions. I showed how theoretical distinction between active and passive participation ignores the many ways residents like Subhatra, Ying, Lily, and Larry participate in smart city creation through their quotidian spaces and

activities. While some smart cities scholars criticise targeted citizen inclusion attempts, arguing that engagement with citizens should be "holistic" and not "utilitarian" (Cardullo and Kitchin 2017), I found residents largely wanted to participate in practical, issue-specific ways that maximised their impact and minimised the time they gave. Residents use smart city discourses tactically and often have complex, strategic relationships with "neoliberal" or "technocratic" programs and practices (Ferguson 2010; Mbembe 2001; Simone and Sneath 2004). I argue that we should follow resident understandings of these programs and practices to produce more nuanced theories of smart citizen participation. Like Mattern (2018), my student interlocutors, and Larry, I see a different possible paradigm of participation: "Wouldn't it be better to use algorithms to identify areas and issues of concern, and then to investigate with more diverse, localized qualitative methods?"

I suggest a new vocabulary of smart citizenship that moves away from "top-down" vs "bottom-up" design and "active" vs "passive" participation binaries, and away from voice and visibility as preferred modes of citizen participation. I instead propose a framework for understanding smart citizen participation through observing residents' recursive embodied, material engagements with the smart city, drawing from feminist and postcolonial geographical epistemologies of labour and urban space. A focus on the public and the visible obfuscates women and minority political engagements, which often occur in private spaces through material engagements with the built environment. I discovered forms of resident participation I would have missed only researching in "public" spaces. I focused on women, minority, elderly, young, and queer residents, those least likely to participate politically by being vocal and visible in a democratic public sphere. Defining citizen participation as voice and visibility in a public sphere invisibilises material and imaginative civic labour that citizens already perform in the smart city and fails to consider the roles residents want to take in smart city creation.

Taking seriously both my interlocutors' imaginings of better lives enabled by better urban governance and their desire to not actively "participate" in the term's more limited sense, I understand smart citizenship as embodied, affective, spatial, and material rather than simply vocal or visual. In doing so, in this chapter I have been specific about how, exactly, resident everyday embodied engagement remakes the smart city and the citizenship imaginaries projected through it. These reimaginings of smart city and citizenship are deeply political, since they literally make space for residents formerly excluded from national futures. Applying an anthropology and geography of infrastructure to the smart city informs this understanding of smart citizenship as material, affective practice. Infrastructure is lively (Amin 2014) and people are infrastructure (Simone 2004): not just metaphorically, but literally, as Ying shows. She is "infrastructuralised" through her "capacity to sense and transmit data" (Luque-Ayala and Marvin 2020:211). As infrastructure, she and Subhatra can also materially and symbolically change the smart city through their daily embodied engagements with it, also changing their senses of self and nation—what Amin (2015:245) terms "civic orientations" which are "formed in intersections of personal biography, locational experience, and wireless dwelling."

As a result, theorising citizenship as primarily enacted in the public space of the idealised "polis" or "agora" is *not* a viable way to understand what is at stake in smart city development, and bodies assembling in public space is *not* the precondition for the political (Beverungen and Sprenger 2017:16). Nor is the smart city a "digitally hollowed-out polis" requiring people to "visibilise political voice" to politicise it (Luque-Ayala and Marvin 2020:21). Instead, while politics of "titles, pipes, and bricks" (Bear 2015; Anand 2012) may not be as visible as other forms of politics, analysing them "enlarges the ground of the political" by "adding more modes of organization and action into the political arena" (Amin 2014:156; Amin and Thrift 2017; Bialski et al. 2015). Residents materialise smart citizenship by imagining futures with bodies, technologies, and infrastructures in the smart city, transforming the smart city itself.

6 Conclusion: Reimagining the Smart Citizen

Analyses of smart citizenship often centre on how to "get citizens to participate" in the smart city. In this chapter, I detailed diverse and differentiated resident practices to argue analyses should instead:

1. Analyse resident everyday practices taking place *in their spaces*, not just those which require residents to come to a different location to participate in participatory design or consultation sessions.
2. Observe with what residents do, not just what they say when asked to speak, and how they *materially and affectively* engage with the smart city.
3. Attend to resident *difference* and diversity and how residents spatialise different forms of smart citizenship in response to surveillance, rather than trying to create a generic (republican) model of the "smart citizen." Focus on what residents are already doing in their daily practice to co-produce the smart city, and how they are differentially inhibited, rather than defining smart citizen competencies or goalposts for them to achieve based upon benchmarks from abstract ideal typologies or other cities' models.

As evidenced, residents continuously engage with smart urban infrastructures to co-produce the smart city, and their refusal to "actively" participate or engage in prescribed ways is also a form of feedback that planners react to. Together they generate the "actually existing" smart city (Shelton et al. 2015). A more textured understanding of how the state and residents co-produce the smart city emerges from this analysis, illuminating how different residents want, are able to, and are inhibited from spatialising smart citizenship.

These broader understandings of smart citizenship are required to capture the richness of practices that materialise urban futures (Lynch 2020). Reimagining the smart city happens through repeatedly enacted spatial practices, "in ways we participate in and co-create hourly, daily" (Barns 2019:9). I argue that this understanding of smart citizenship as practice leads to a more accurate mapping of where and how residents can reinvent the state's future imaginaries. Attending to the

specificity of differentiated and diverse urban residents, and their ability to refuse and reimagine some kinds of data flows but not others, also illuminates how they unequally and unevenly spatialise citizenship in the smart city.

These diversified and differentiated models of smart citizenship open up a different imagining of urban futures. Theorising the smart city as space where the state enacts "material-discursive projects of future-ing" (Leszczynski 2016:691), reveals "alternative projects of 'future-ing" being imagined through these spaces. Locating the potential for enacting alternative futures from those imagined by the state in the "material and spatial relations of the city" and pushing beyond smart citizen frames that restrict political action in the smart city to "petitioning the state for rights" brings "marginalised, hidden, and alternative" activities into view to "make them more real and more credible as objects of policy and activism" (Lynch 2020: 661, 666; Gibson-Graham 2008:613). Attending to less visible modes of smart citizenship uncovers imagined futures that are both "deeply territorialised and attuned to the needs and conditions of particular communities" while "radically open" to other possibilities (Lynch 2020:666).

I could have included many more technological everydays and geographic counter-stories, each person spatialising a different kind of smart citizenship through everyday practice. This difference is not infinitely variable, however. Each person I described is limited and enabled in their daily practice by similar smart urban infrastructures and material-symbolic resources, mediated by their differentiating logics in ways that differ based upon shifting but specific social and geographical positionalities, as well as affective identifications and commitments. I hope to have shown their spaces of overlap as well as difference, to illustrate how they co-produce the smart city together through their everyday practice, sometimes replicating and sometimes reimagining existing smart city sociotechnical imaginaries as they make space for the future.

CHAPTER 8: CONCLUSION

1 CODA

During my 20s and 30s, I became familiar with the old downtown as I walked, bussed, and MRT'ed about in the course of work and play and felt at home. Alas, gazing at the steel-glass structures with marble-and-granite facades of the new downtown on that day, I felt like a total foreigner in my own country. Is all this supposed to be the future of Singapore? Is this supposed to be my future too, I wondered…

For almost 47 years, I have constructed my identity as a Singaporean from my experiences of existing in various spaces across the country; at the same time I have gained sufficient maturity to decide myself whether or not to accept new environments as part of my evolving sense of self. I became more conscious than ever of how space affects one's identity.

Verena Tay, A Sense of Place, a Sense of Self (2012,viii).



Figure 170: Archifest: Design for Life. 2018.

On the boardwalk outside the iconic Marina Bay Sands Hotel, across the water from the Downtown Core, a young planner named Erica gives a talk to a group of Singaporean and foreign weekend visitors to this area of the city. Erica is trying to understand what imagining the future of places in Singapore means for residents: "This image flashed across international blockbuster movies like Crazy Rich Asians—right here, right where we are." She gestures at the downtown Singapore skyline behind

her. “New York, London, the skyline seems similar somehow. Glitzy lights. But what lies beneath the image? What goes beyond that?”

Erica talks about the smart city as a “business improvement industry” full of buzzwords about “liveable cities, loveable cities, innovation,” citing the URA’s recently announced fund for the improvement of ten business districts in Singapore. “But what does it all mean?” She asks. “Is it just a brand thing so more tourists come into the city? Making a ‘creative cities’ network? At end of it, how can we make actual placemaking be a part of it? Not just putting in a sexy corporate programme.”

She asks residents in the audience to describe their favourite places in Singapore. My interlocutor Pheng, a young poet, reads his piece:

> *I lived in Taiwan for four months, and so, having been re-born as a foreigner-traveller in a country where mountains arrayed themselves into peaks, and seas opened themselves up to the horizon, I experienced a kind of death in Singapore. The death of my foreigner-traveller self. Denial. Bargaining. Hopelessness. Madness (institutionalisation included). I experienced the stages of loss, and then some. So where did I go to bargain with Fate to re-live my traveller days? Which places did I frequent, in a kind of numb acceptance of my existence in this plasticky, theme-park-like anomaly of a sterile city in the gritty region of Southeast Asia?*
>
> *Wala Wala bar in Holland Village*
>
> *There I give up my hopes of enjoying a Revolver (a popular indie-music live-band venue in Taipei) in Singapore. After a couple of drinks, I even move my body to the song-covers from the live bands there. How I miss original indie music! Soon enough, all that sentimentality is forgotten after a pint each of San Miguel and Asahi*
>
> *Loof bar in the Bras Basah area*
>
> *I took a date there once. Our conversation went from the philosophical to the whimsical. My favourite part? When she said how buildings-under-construction looked alive, as if they were sprouting, clothed in the green veils of their scaffolding. I've never heard someone wax lyrical about what I considered to be the curse of urbanisation. I still go there sometimes. I half-suspect that my willingness to pay for the pricey cocktails and beers stem from my fond memories of that date.*
>
> *Ann Siang Hill*
>
> *Here I slake my thirst for novelty with weirdly-named whiskeys and alcoholic concoctions. Monkey Shoulder. Gin and Chronic (not a typo). I pretend that in a conversation not too distant in the future, an appreciation for the fruity tones of blended whiskey, gleaned from hastily-Googled online reviews, would convey a certain sophistication to my conversation partner.*

Cemetery in the downtown area

I stumbled upon this place. I was looking for a shred of heritage in the pile of glass-and-metal buildings in the city core. Laying quietly next to a dis-used church, grave-stones marked the deaths of whom I'm sure were prominent figures in Singapore when she was transitioning into independence. I've never gone there again. But because it was an unexpected discovery, and because of the fact that it was where I met another local who seemed to be (re)visiting Singapore, I hold it in a quasi-reverent light in my memories.

Erica concluded her talk:

> Your eyes will open when you approach a particular space or place. Is this a place that is a good place? How can I make a place be a part of a city? This is what our city in time to come is going to focus on. We cannot just be building and unbuilding, tearing things down. In 10, 50 years' time, what is that Singapore and who gets to decide? It's us, we are the people and we get to decide. In Singapore we hear lots of "cannot". But we have to ask, why cannot? And we don't want to just talk talk talk. let's just do it. Enough talk, let's do what we want to do.

Through this thesis, I have told a particular story of the smart city, which like all stories is rooted in a particular time and place. Yet I have tried to show how the unique experiences of my interlocutors in my unique field site can tell us something about imagining smart city futures as a whole and generate a theory of smart citizenship that can inform research in other smart city contexts. My analysis builds upon longstanding social theories of the story as central to nation-building, practices of collective remembering and forgetting defining who and what belongs in the nation and its future (Bhabha 1990). Stories are told through temporal and spatial frames, as we imagine our futures *through* and *with* our places and the materials they give us to imagine with, through our sensory and affective engagements with them. I have argued that the way we build our (smart) cities, as a result, fundamentally shapes the kinds of futures those living in them can imagine and bring into being. I have also argued that imagining the future happens through *both* talking and doing. It is a material practice performed with and through the urban forms and digital technologies that permeate digitally mediated cities.

In this dissertation, I answered the following research questions:

RQ1: How does the state project its future imaginaries through the digital and urban space of the smart city?

RQ2: How do smart city residents replicate and reimagine state future imaginaries through these same digital and urban forms?

I created a theoretical and empirical map to systematically analyse *how* residents' everyday embodied practices co-produce the digitally mediated smart city, providing a textured and non-vertical account of state and resident agency. Providing a model for understanding how future imaginaries become collectively held and evolve over time, I showed how states tell stories about national futures not just through speech, but also through the narration and materialisation of history (as a "metonymic march of images" and "generationally transmitted system of signifiers" (Goh 2004:19)) through sociotechnical projects like the smart city.

In understanding the smart city as a repeated material projection of national imaginaries rather than an abstract corporate or state imaginary divorced from the realities of ordinary urban residents' lived experience, I showed how smart city imaginaries are built and sustained through the repeatedly enacted daily practices of state planners and developers as well as those of other residents, who all experience and co-create the "technological everyday" of the digitally mediated smart city (Amin 2007). I demonstrated that sociotechnical imaginaries like the smart city are not imagined and built once: they must be continually rearticulated to become collectively held and are projected through material-technological forms.

The smart city as a national sociotechnical imaginary is replicated through everyday institutional practices projected through and with smart city planning technologies, as Alvin's experience shows. It is replicated using these existing material-symbolic resources by "smart" ministers and state planners trained in how to use and replicate technological systems to imagine futures like the state. Their everyday engagement with material planning technologies replicates the smart city sociotechnical imaginary as they repeatedly enact it through those same technologies. These technologies, planning

practices, and imaginaries are continuous with pre-existing national sociotechnical imaginaries, building upon imagined signifiers of national identity repeatedly generated by state planners since independence to create a collective sense of nationhood. This model provides a method of understanding what the smart city signifies and performs in different national and urban contexts.

The telling of other stories through reimagining these generationally transmitted signifiers as they are expressed in material-technological forms opens up space for other futures, whereas replicating the signifiers re-enacts the same stories. The everyday embodied practices of state planners like Alvin, international developers like René, local developers like Esther, older residents like Subhatra, and young residents like Ying and Justin illuminate how national stories are replicated and reimagined through differentiated repetition as people co-create their selves and their worlds minute by minute, sometimes rupturing and sometimes perpetuating the futures imagined by the state.

State planners may replicate genealogically transmitted plans for the future of urban space and shape the smart city projects that implement them, but residents like Mei, Colin, Subhatra, and Ying frequently engage with smart urban infrastructure in unexpected ways, producing "geographic counter-stories" to the national stories told through the smart city (Kobayashi 2005). Residents disrupt the imaginaries expressed through maps, plans and domestic infrastructures: standardisation, by living in the smart home in diverse and differentiated ways; connectivity, by disrupting seamless data transfer and seeking other forms of sociotechnical connectivity than those prioritised by the state; and futurity, by reimagining the reproductive and productive futurity expressed through smart home infrastructure, requiring the state to create other kinds of living spaces which make space for other futures.

In short, stories matter as they make things come to matter (Ghertner 2015; Fortun 2008). By telling a history of the future (Rosenberg and Harding 2005) of the Smart Nation in Chapter 4, I showed how state planners use storytelling practices, repeatedly projecting imagined futures into the city's

urban infrastructures to shape resident behaviour and define who can spatialise (smart) citizenship. I detailed the stories they tell and the material-symbolic resources they use to tell stories with. I explained the roots of the Smart Nation sociotechnical imaginary as expressed through the HDB, which state planning agencies position as standardised, through both racial harmony and uniform smart domestic urban infrastructure; futuristic, both because of socioeconomically productive filial "Asian Values" and rapid technological progress; and globally and technologically connected "living lab" for other nations to test smart home technologies. Projecting itself as a technologically advanced, futuristic "global city" which attracts such international connections has long been central to Singapore's nation-building project. I also showed how state agency-sponsored smart home projects, as part of the Smart Nation project, are continuous with state attempts to project national futures through domestic space and international partnerships.

If the smart city is a particular story told by the state through its material-technological forms, like all stories it must be retold to continue having effects. In Chapter 5, I showed how state planners learn how to "Imagine like a State" and retell the national stories genealogically transmitted through material-symbolic resources. Through trainings done by more senior state planners and by using smart city planning technologies like GIS maps descending from older planning maps, state planners replicate the Smart Nation sociotechnical imaginary through their daily planning practice. They do so using the same materials and symbols to tell the same kinds of stories told to them.

Conceptualising smart urbanism (like the nation) as enacted through stories, made in social and material practice, helps collapse theoretical distinction between linguistic, discursive, metaphorical practice and material, embodied, enacted practice. Stories are not just stories of, they are stories for (Fischer 2015). And they are told through places and material things (like smart cities and technologies), not just in or beside them. They are "material metaphoricity" (Pandian 2019). This is why, in Chapter 6,

I turned to "geographic counter-stories" of the Smart Nation, told through its residents' "technological everyday" to see how residents make sense of their own digitally mediated daily experience (Kobayashi 2005; Amin 2007). Using the material-symbolic resources the smart city provides, individuals individuate and exteriorise in everyday practice, co-constituting their senses of self and their worlds through acts of differentiated repetition in the digitally mediated city as they "bathe in an affective ether of [material] signs" (Rose 2017; Thrift 2009:123). Attention to these geographic counter-stories, I argued, explains how Smart Nation stories are both told through materials and have everyday material effects on residents, making some futures easier to imagine than others. As smart city residents go about their everyday lives, they spatialise stories as they develop a sense of place, self, and citizenship (as a sense of "belonging" in place) (Tay 2012).

As I argued repeatedly in this dissertation, making space for other futures is a literal process, one repeatedly enacted through engagement with the digital-material forms of the smart city, through which futures are repeatedly projected. In Chapter 7, I explained the implications of this relationship between affect and materiality, expressed through resident everyday semiotic practice, for theories of the smart citizen. Always-already digitally mediated urban residents, like those described in Chapter 6, recursively co-produce smart city futures with the state through everyday practice. The Singapore state projects its future imaginaries through the smart city by repeatedly materialising them in smart urban infrastructure. Residents repeatedly and materially engage with these imaginaries, sometimes replicating and sometimes reimagining them, through everyday embodied engagement with those same smart urban forms. Smart citizenship, I argued, is spatialised through everyday practice as residents repeatedly replicate and reimagine smart city futures through many conscious and unconscious interactions with the digitally mediated city. Citizenship is both an imaginal affective identification with the nation and materially spatialised through being "in place" with the "right" documents and data: it is both about an affective sense of belonging and being able to materially access one's right to belong, to

be able to be in the place of one's choosing. By extension, (smart) citizenship is mediated by a relationship between the state and residents, through which who can signify themselves as part of the (smart) nation and produce and reproduce its future is negotiated.

My research proves that smart cities are lively "relational fields of action" (Massey 2005; Cresswell 2004; Mitchell 2000), requiring more analysis of the "many intimate ways we negotiate the diverse affective and social registers of urban places and the performativity of our entanglements of these spaces" (Barns 2019:7). Resident everyday practices in the digitally mediated city are thus distributed and diverse, as they engage with the smart city through digital devices, their homes, and their daily movements through it. They engage the smart city through a "situated urbanism", producing it through their mutually constitutive interactions with digital technology, requiring attention to "how people use space and what the constraints are" (Odendaal 2015:32).

This is the kind of attention that the local developers like Esther realise they need to co-produce a smart city that works for residents, and these are the practices through which the smart city sociotechnical imaginary evolves through co-production. Through everyday practices of dwelling in the (smart) home, residents create a different relationship between the smart city and Singapore's future than that imagined by the state, leading to material and symbolic changes in the smart city. Residents continuously engage with smart urban infrastructures to co-produce the smart city, and their refusal to "actively" participate or engage in prescribed ways is also a form of feedback that urban planners react to. These affective and spatial citizenship practices are crucial forms of political participation, causing shifts in state smart city sociotechnical imaginaries, often left out of smart city analyses.

These more inclusive theorisations of smart citizenship are required to capture the richness of affective and spatial practices that materialise urban futures. Residents resist being standardised out of existence through technologies of state future-making, seek other affective identifications and forms of

connectivity, and live their lives according to other temporalities than the futurity imagined and enacted by the state. And rather than continuing to "knock off useless blocks with dental dexterity" to make space for the state's imagined futures (Boey, *The Planners)*, planners and developers sometimes make space for these resident reimaginings instead. They also encounter spaces and interfaces where the limits of practicing smart citizenship become clear, shedding light on the state's power to materially and symbolically exclude some residents from the nation's future.

In the rest of this chapter, I present recommendations for future research stemming from my work. I then conclude by summarising the main contributions of this thesis.

2 Recommendations for Future Research

My research generated a series of questions which necessitate further study. In this section, I recommend applying my work to future research on participation and non-participation in smart city co-creation initiatives; privacy and data security; different forms of governance and their impacts on the contextual development of smart cities; the perceived sterility of smart cities and its effect on the affective experience of residents; and the role of aesthetics and design in the co-production of smart city futures. I could not include a range of ethnographic data leading to these other analytical foci due to scope and space constraints. I encourage exploration of these important questions in future smart city research and analysis.

2.1 Smart Citizen Participation

The question of what citizen participation in the smart city should ideally look like has been a subject of numerous recent writings (Cardullo and Kitchin 2019; Datta 2018; de Waal and Dignum 2017; Manchester and Cope 2019; Shelton and Lodato 2019; Hemment and Townsend 2013). I address this question in Chapter 7, and my research invites further analysis of how calls for increased citizen participation interplay with neoliberal modes of governance—such as how different kinds of citizenships

are formed through participatory activities like hackathons (e.g. Irani 2015). Neoliberalisation in this context is characterised by shifting responsibility for the labour of city improvement onto individual citizens, less able than governments and corporations to absorb the risks involved in forms of active participation which require the valuable resource of time (Castells 2000; Neff 2012). While literatures discuss the problems with outsourcing what were once public services to private corporations (Cardullo and Kitchin 2019) and the financialisation processes occurring in smart cities (Sadowski and Pasquale 2015), my research shows that more nuanced understandings of how residents conceive of their own participation in the city are needed—particularly outside of European contexts, where relationships between the state and 'individuals' have constitutive historical differences.

Unpacking the relationship between citizen participation, the labour involved in "co-creating" smart cities, and the expectations these frameworks create of both governments and residents is crucial to ensure that calls for bottom-up participation empower rather than burdening residents. Why many residents largely choose not to participate in processes of co-creation or are apathetic to smart city initiatives also merits further study, requiring a contextualised retheorisation of participation and of the concept of co-creation. Methodologically, a qualitative approach which asks residents how they themselves conceptualise participation in the smart city could help with this retheorisation, ensuring that academic calls align with the actual needs and desires of residents in the smart city.

2.2 Individual Privacy and Data Security

I touch upon data privacy and security throughout the thesis because variably articulating privacy as a value, a right, and a trade-off permeates my interlocutors' discussions on the smart home and on sensor technology in general. A wealth of smart city studies use Foucault's (1977) concepts of biopower and governmentality to explain how the smart city's surveillance technologies discipline and rationalise resident bodies, inscribing them in a body politic (Gates 2011; Klauser and Albrechtslund 2014; Maalsen

and Sadowski 2019; Cheney-Lippold 2011). Deleuze's (1992) theories are used to similar effect to explain how the smart city can be employed to create "control societies" which disaggregate people into pieces of information (Sadowski and Pasquale 2015; Luque-Ayala and Marvin 2016; Halpern, Mitchell, and Geoghegan 2017). Many international smart home projects, as René articulates in Chapter 5, were set in Singapore due to the lack of data privacy laws. The data collected by the projects did not belong to the residents from whom it was collected: it either belonged to the state, the corporations providing the technology, the university, or some combination of the three (exemplifying Mattern's (2016) theorisation of academic-industry-government complexes in smart city development).

An analysis of data ownership and the implications of surveillance in terms of ethics and individual privacy could be the subject of an entire thesis. It is the subject of a multi-country comparative study currently being undertaken by NUS, for which I was interviewed as an expert in 2020. The project asks whether smart city stakeholders see data as a public good or a form of private property, foregrounding the ambiguous relationship between the two as it is expressed in specific national contexts. My research indicates that the question of who owns smart city data and what value different actors accord it merits further attention. This question could be further explored using a "follow the data" approach to understand how and what kinds of data are gathered, transmitted, stored, and used in smart city contexts, to whom the data belongs, what information it discloses, and what kinds of conclusions it is used to draw, by whom.

I also observed, tied to this question of individual privacy, a fear around data security at the level of the state. Recall state planner Alvin's inability to access anything outside of the government intranet in Chapter 5. This decision to disconnect government computers from the Internet, which happened during my field research, occurred due to a series of high-profile data security breaches. Smart home developers also talked at length about data security on the level of aggregated data (not individual

privacy): for example, they were not allowed to use any data storage method transmitting smart home data to servers outside of Singapore, on state orders. This issue of data security is analytically tied to the question of the value of data, and what specifically is worth protecting, as well as what data is considered private, by what actors. Methods of further study could include legal and policy analysis, analysing data protection laws and how they change over time, including whom and what they protect.

Finally, my research shows that the question of what data is/are, what uses they can be put to, and how those interact with interlocutors' imagined uses merits further inquiry. Many planners and developers I interviewed cited a lack of larger state understanding about why they were gathering so much data. The state's approach, as multiple planners put it, is to gather as much data as possible and figure out what to do with it later: "more is better." Future work applying my analysis could situate this valuation in social science research on big data mythologies (e.g. boyd and Crawford 2012; Neff 2013; Klauser and Albrechtslund 2014; Couldry and Powell 2014; Bowker 1994). It could also employ expert interviews and organisational ethnography studying the specifics of data use and protection in state and corporate smart city settings.

2.3 Authoritarian and Technocratic Governance

The question of whether exporting the Smart Nation is actually possible is closely tied to the question of what the (semi-)authoritarian, technocratic form of governance employed in Singapore permits and forecloses in comparison to governance forms in export destination countries. The costs and benefits of this autocratic, technocratic form of governance were repeatedly articulated by my interlocutors and in literature on Singapore's urban planning practices (Chua 2011; Woods and Kong 2017). Subsequent work could focus solely on the expressed "trade-offs" so pervasive in my interlocutors' language—recall young people living with their parents like Mei, queer residents like Colin, and the NUS Geography students' articulations—that they connect both to a form of comparison between national political-

cultural contexts (China, the US, the UK, Europe) and to the privacy concerns articulated in section 2.2. Building on my work, further comparative research is necessary to develop and understand these questions of smart city and technology export across national contexts. My research shows that existing smart city literature leans heavily on Euro-American understandings of governance, political expression, and corporatisation. It suggests the analytical claims stemming from those understandings might need to be more carefully interrogated—perhaps provincialized (Chakrabarty 2000; Datta 2018)—to better theorise the aspirational global nature of smart city development.

Tied to this question of governance context is a larger query about what and whose ends domestic smart technology is meant to serve (and where that data goes), related to existing work on the smart home and domestic surveillance (e.g. Maalsen and Sadowski 2019). Behavioural scientists use approaches like nudge theory and gamification to encourage certain behaviour using smart technology, which the smart home developers I worked with were keen to utilise (Thaler and Sunstein 2009). This attempted use of smart technology to induce subconscious behaviour change is an important area for further study, following my question of what futures state planners and developers try to instantiate through smart urban infrastructure. Using qualitative observational and ethnographic methods to do such research would also help detail the answer to the questions: Who owns the future? Where is the future "located"? What intended and unintended consequences do such technologies have?

2.4 Building Utopia: Sterility, Soul and Smart Cities

In his poem Pheng describes Singapore as a "*plasticky, theme-park-like anomaly of a sterile city in the gritty region of Southeast Asia",* and he was far from the only interlocutor to lament the "sterility" of the Smart Nation. A key future research question generated by my study is what makes smart cities feel deficient in this way: why do many smart cities, which have in common cutting-edge, futuristic technological amenities, feel to visitors and their inhabitants empty and soulless?

According to creator of MIT Media Lab's Smart Cities program William Mitchell (2005:107), Singapore's research megacentre One North, home of A*STAR and the international smart home developers, is "innovative in its program, ambitious in its urban design, and adventurous in its architectural realization." But Mitchell (2005:108) asks of its attempt to set itself apart from bland research parks via architecture: "Can such elements and policies become the stuff of true twenty-first century communities? Or will they just produce corporate compounds at busy nodes in global networks: larger versions of international airline lounges, with slightly less transient populations?" Airline lounges and shopping malls are both quintessential "non-places", lacking a sense of "community", and common descriptors of Singapore's flavour of urbanity (Auge 2009).

This concept of "non-place" relies on a belief in authenticity, usually tied to a nostalgic sense of historicity or culture, and/or a rejection of commodification or capitalist means-end rationalities. Smart cities exemplify deficient "non-places", erasing history or "natural" development and designed to maximise residents' comfort and productivity through a highly technologised urban fabric (Auge 2009). Place-making (as Erica pushes for at the beginning of this chapter) has been theorised, especially by queer scholars, as a struggle to "reappropriate city space for purposes other than means-end productivity" (Chisholm 2005:28). Similarly, Castells (1983:167) argues that "when a space becomes meaningful, exchange-value is no longer the dominant issue." Heidegger (1971) maintains that for space to be meaningful and become place, it must disrupt the experiencer from the banality of productivity. Given these discussions of exchange-value as creating cultureless non-place, it is interesting that Singapore is often derisively referred to as a "giant shopping mall." When I told people that I work in Singapore (even Singaporeans), I received reactions such as: "Why don't you study somewhere more interesting? Hong Kong is a much better city, way more culture." I wonder how we might reconcile or juxtapose these discussions of meaningful, authentic, or culture-ful space with descriptions of

Singapore's urban environment. Is exchange-value the dominant value in the Smart Nation (or the smart city) at the expense of other, more "enriching" values? Does productive futurity produce sterile cities?

Future work on this topic could use my research to problematise the concept of authenticity, as many interlocutors pushed back against these categorisations of Singapore (how can a place they grew up and live in be inauthentic?) while also ethnographically examining that many viscerally feel something lacking in cities which share planned and strategic rationalisation of the built environment, attempts to permeate the urban fabric with futuristic smart technology, and intensification of practices of conspicuous consumption (e.g. Dubai, Singapore, Songdo, Brasilia). Inhabitants and visitors find them to be missing qualities they repeatedly refer to as "human." I urge further qualitative human geography research in such cities, focusing on place and affective experience, to investigate this connection between smart cities and sterility or deficiency.

2.5 The Affective Use of Images and Nostalgia for the Future

As argued in this dissertation, the future is a relational imaginational construct which people work to configure (Gell 1992; Zeitlyn 2015; Munn 1992; Koselleck 2004; Guyer 2007), better visualised as constellations of relationships formed with other time periods than as a sequence of events like "beads on a rosary" (Benjamin 1968:263). Future-making is in many ways an aesthetic game involving temporal play to imaginatively and affectively evoke a sense of futurity (Hassoun 2016). In this thesis, I frequently return to the "affective ether of signs" experienced by residents in the digitally mediated city (Thrift 2009:123). The visual language of the smart city has a coherence across different national urban contexts, to the extent of drawing upon similar colour palates and textures in depictions of future smart cities that have not yet been built: evoking "sensations of unreality: illimitable vastness, brilliant light, and the gloss and smoothness of material things" (Rose and Willis 2019; Jameson 1990:68). The architect Rem Koolhaas (2014) gives a particularly damning indictment of smart city aesthetics:

> When we look at the visual language through which the smart city is represented, it is typically with simplistic, child-like rounded edges and bright colours. The citizens the smart city claims to serve are treated like infants. We are fed cute icons of urban life, integrated with harmless devices, cohering into pleasant diagrams in which citizens and business are surrounded by more and more circles of service that create bubbles of control. Why do smart cities offer only improvement? Where is the possibility of transgression? And rather than discarding urban intelligence accumulated over centuries, we must explore how to what is today considered "smart" with previous eras of knowledge.

Yet I show that these aesthetics, rather than being "empty", come into being and have material effects through processes of signification, through which people consciously and unconsciously play with the relationship between signifier and signified to do material work. Writers like Baudrillard (1989), Benjamin (1968), and Appadurai (2013) have explored this concept through semiotic philosophical and historical analysis, and future research, drawing from mine, could situate these reflections ethnographically and geographically. These aesthetics are linked to the experiences described in the previous section, mediating residents' affective experience of the smart city and reflections on its soulfulness and deficiency (note productive futurity emerging again as aesthetically problematic).

Subsequent research could apply my work to empirically describe these aesthetics of the future ("glistening buildings and spectacular architecture"), which actively rule both who and what is included in plans for the city's future itself, sustaining "material transformation of the present, even when roots of future projection are forgotten" (Ghertner 2015:157,54). These designs are inspired by technological aesthetics drawn from artistic genres like science fiction and cyberpunk through mediums like novels, television, and film (Jameson 2007; Penley 1997), as anthropologists and sociologists studying the future increasingly explore (Abram and Weszkalnys 2013; Salazar et al. 2017; Adam and Groves 2007; Valentine 2017). As Mattern (2014) argues about "design fiction":

> we need to examine the platforms that are already in existence, and those that are proposed for future cities. Even the purely hypothetical, the speculative—the "design fiction," or what Bruce Sterling (2012) calls the "diegetic prototype"—can illuminate what's possible, technologically, aesthetically and ideologically; and can allow us to ask ourselves what kind of a

> "public face" we want to front our cities, and, even more important, what kinds of intelligence and agency—technological *and* human—we want our cities to embody.

These aesthetics can be used coercively, in part through the storytelling practices I detailed in this thesis. From Barthes' (1973; 1988) semiotic perspective, mythical language like that employed by states can foreclose all other possible signifieds of a signifier, naturalising its citizenship imaginaries, thereby foreclosing futures. Yet those aesthetics can also be opened up and used creatively, as I have theorised, employing the world-building capacities of sociotechnical materials like smart urban infrastructures to build different futures. In my research, planner, developer, and resident interlocutors moved between what they saw as marketing materials (the "glossy images" and "data dashboards" created to impress international funders) and the "real" but mundane smarts of the smart city, strategically playing with the relationship between signifier and signified to do different kinds of work.

Research pairing image analysis and in-situ qualitative methods could build upon mine to comparatively investigate both the shared component aesthetics of the future, which I argue are used to signify a kind of common nostalgic affective relationship to the future, and the ways that interlocutors creatively use these relationships of signification to tell stories and generate material changes in their worlds. These aesthetics, when used to tell stories in the interlinked material-symbolic modes described in this thesis, can both open up and foreclose futures.

In the next section, I conclude the thesis with a discussion of its key contributions.

3 Contributions: Building the Future

In conclusion, this thesis explored *how* and *whose* futures are imagined, projected in, and replicated and reimagined through sociotechnical assemblages like the smart city, and by whom. Drawing upon the rich literature on imagining futures through sociotechnical projects of city and nation building in Singapore (e.g. Ban et al. 2004; Bahng 2017; Fischer 2015; Kong and Yeoh 2003; Clancey 2012; Bunnell and Goh

2018; Ho 2017; Klein 2018; Koh 2005), I detailed the relations of power expressed through Smart Nation infrastructure and the differentiated forms of "technical agency" they afford, asking "who can act, when, how, and why" to achieve specific urban futures (Neff et al. 2012:312). Analysing how smart city residents navigate the "technological everyday", I argued, illuminates how state power is expressed and experienced through smart urban infrastructure, as well as urban residents' agency in co-producing smart city futures (Amin 2007).

Through my ethnographic work, I analysed the dynamic relationship between state and resident future imaginaries as they are repeatedly projected, replicated, and reimagined through the smart city, specifically the smart home projects which I used as my case study. I showed that the national story of the smart city (in Singapore, the Smart Nation), is inextricable from historically continuous national storytelling practices aimed to build affective identifications with an imagined community (Anderson 1983). The state's Smart Nation project builds upon pre-existing national sociotechnical imaginaries to project its futures and define who belongs in them. The Singapore state (as governance entity) constructs the Singapore nation (as collective imaginary) using material-symbolic resources, bringing selected residents into a shared imagined future through technological infrastructural projects (Kong and Yeoh 2003; Jasanoff 2015).

I stressed that scholars should analyse smart city and citizenship building as recursive and continuously rearticulated practice rather than a single event of material instantiation, as "futures that matter inhabit the very processes of making technologies possible" (Lanzeni and Ardèvol 2017:119). Future-making happens through the stories people collectively tell with smart city technologies and their understandings of self and citizenship that they develop through their use. These stories are rooted in pre-existing narratives about the role of technology in national imaginaries, continuously replicated through storytelling practices materialised in sociotechnical forms.

My study provided three key original scholarly contributions. First, I displaced a persistent binary I discovered in both critical smart city and wider anthropological literature which separates the "abstract imaginaries" of monolithically-described entities like "the state" from the "lived experience" of "ordinary" citizens. I instead argued that imagining the future is an intersubjective material practice that we must ethnographically trace to understand how various actors, all who possess lived experience, project, replicate, and reimagine smart city futures. It is the difference between their lived experiences, and particularly between the materials they are given to imagine and enact futures with, that produces different and unequal socio-material effects and frictions.

Second, I ethnographically analysed the daily practices of state planners, developers, and other smart city residents to carefully explain how they together recursively co-produce smart city futures, offering a different anthropological analysis than those generated by studying only one of these groups. By systemically analysing how networked infrastructure like the smart city comes to matter, I detailed how a specific set of smart urban infrastructures were projected, replicated, and reimagined through resident daily practice, also analysing the future imaginaries projected, replicated, and reimagined through these smart urban infrastructures. As a result, I explained state power and resident agency by neither universalising the former through totalising "macro" frames like corporatisation nor reducing the latter to an underspecified active "resistance" to the state's smart city in the "micro" world of daily life, affected by but not affecting those "macro" frames. I instead showed how to connect these domains of analysis and explain how they co-produce each other rather than existing a priori, demonstrating how to theorise change in sociotechnical systems and imaginaries.

Finally, I retheorised the "smart citizen" by replacing existing value-laden bottom-up/ top-down frameworks of citizen participation with a more diverse and differentiated theory of resident participation in smart city creation. Rather than asking residents to *become* active citizens by adopting

a republican citizenship model like much smart citizenship scholarship, I showed how we can see residents already actively participating in the political life of the smart city, in quotidian spaces like homes, schools, and community centres and through material, affective engagements that are themselves political expressions of citizenship. My work demonstrates that attending to what residents do and feel, not just what they say, surfaces smart citizenship practices enacted by those often left out of smart city discourses. It also shows the limitations of spatialising one's belonging in-place as part of the nation's future, as some components of (smart) citizenship are more easily reinvented through daily practices of facilitating and interrupting data flows than others, by some residents more than others.

In doing this work, I showed how state future imaginaries are projected and replicated through smart urban infrastructures, as well as how residents reimagine these spaces and futures through their everyday embodied practices: clarifying "what's stuck and what's possible" (Berlant 2011:9). My analysis helps answer key questions on smart urbanism: how smart city planning coheres and enacts normative future imaginaries; what possibilities exist to construct alternatives; how "smart logics configure space" and how that space co-configures those who live in it; and how specific urban conditions "enable and constrain SU pathways" (Wiig 2015; Luque-Ayala and Marvin 2015:2111). My work demonstrates why smart cities are not inherently depoliticising nor follow the same corporate-driven development model, and it can be applied to research in other smart city contexts to better detail the smart city's effects.

My understanding of smart urbanism as an aspirational material and affective practice that must be carefully articulated by anthropologists and geographers is especially needed in sociotechnical analyses of the smart city. It guides critical smart cities scholarship away from totalising frames that homogenise analysis of smart urbanism's effects. It shows how residents imagine and enact smart citizenship beyond state future imaginaries, changing them in small but significant ways through their daily practice, and where constraints to doing so persist. In my analysis, I have intentionally *not* argued

that I am connecting "macro" processes of sociotechnical imagining performed by the state to "micro" processes of individuation and exteriorisation. Taking both STS theories of co-production and posthumanist theories of distributed and differentiated affect and agency seriously requires describing how everyday embodied practices *create* what we have been repeatedly convinced to imagine as universal or national sociotechnical and geopolitical forms. Nation-building projects are aspirational: creating collective imaginaries requires both material and symbolic work to *enact* scales like the micro and the macro, the local and the national, the particular and the universal, and to cover over that work so those scales are taken-for-granted as natural. Tracing these scale-making projects and the frictions they encounter—just ask René—is crucial to understanding how "big" concepts like the smart city are projected and repeatedly re-enacted.

My analysis uncovers forms and dynamics of state power projected through the smart city and the possibilities present for reimagining state smart city futures, accounting both for resident diversity and difference and the restrictions residents face when trying to change the smart city or spatialise smart citizenship. My approach allows us to rigorously analyse how imaginaries become collectively held and reshaped by individuals; how residents' co-produce sociotechnical and citizenship imaginaries through everyday embodied practice; and how states enact power to shape the future by limiting the material-symbolic resources that residents can imagine with—but also how state future imaginaries, because the state must repeatedly project them, make space to imagine other futures. I provide a model for smart city research in other contexts, encouraging other researchers to ask: what symbolic stories are smart city actors trying to tell, through what materials, to bring into being which imaginaries of the future?

In conclusion, the materials that we have to imagine with and the cities that we build matter. Our cities make us as we make them, and shape what futures we can make space for.

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