

2 Uploading real estate

Home as a digital, global commodity

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Introduction

Susan Smith (2008, 521) conceptualizes the home as a hybrid of mobile capital, physical materials and subjective lived experiences. Digital real estate platforms are increasingly playing a key role in these relationships; they not only shape but can also rupture the entanglements between the flow of cash, the materiality of real estate and the more subjective use values of home. A good example of the way that digital real estate platforms are reshaping home is BrickX, a small-scale real estate technology (tech) start-up in Sydney, Australia. Their promotional video, quoted verbatim below, strips the idea of fractional real estate investment from its complex financial industry moorings, leaving it in its most elementary form.

BrickX: The new way to enter the property market.
BrickX buys properties in prime locations.
Then divides each property into 10,000 'Bricks'.
A 'Brick' = A fraction of a property.
A \$1 Million property = \$100 per 'Brick'.
'Bricks' start at \$66.
Invest in 'Bricks' across a range of properties.
Earn monthly distributions from rental income.
Share the capital returns.
While we take care of the property management.
BrickX: The new way to enter the property market.
What are you waiting for?

(BrickX, 2015, how-it-works)

Complex fractional financial practices underwrote the subprime mortgage implosion that resulted in a global financial crisis (Dufty-Jones 2016). The more primitive fractional 'financial alchemy' (Ferguson 2008, 270) of BrickX breaks the dwelling down into a set of constituent parts that can be traded independently of the home itself. The use of fractional financial alchemy, argues Ferguson (2008, 254), 'is not so much about real estate as

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about surreal estate' whereby the constituent parts of a dwelling are detached from the subjective use values of the home. These constituent parts are commodified and sold to the highest bidder; there could be thousands of kilometres between those living in the dwelling, the mortgage borrower (e.g. BrickX) and the fractional surreal estate investors.

BrickX (2015) identifies strongly with the real estate tech industry, and particularly with the industry discourse of 'disruptive technology'. It is surprising, however, that the digital uploading of residential real estate onto internet-enabled real estate technologies has not attracted more attention. We are at the beginning of a digitally driven, global expansion of the residential real estate industry. Millions of local residential homes from at least a quarter of the countries around the world have been uploaded onto the internet for sale as global commodities to be traded by a new stratum of global real estate professionals and investors (Juwai 2014; Rogers 2016a; StreetSine Technology Group 2014). The globalising real estate industry is increasingly comprised of national and international real estate sales agents, property developers, financial advisers, home loan brokers, foreign investment lawyers, immigration consultants and information technology professionals (Rogers 2016a; Rogers *et al.* 2015). While collecting empirical data for a study on Chinese investment in Australian real estate, I encountered a set of conceptual problems relating to the digitisation of the real estate industry across the Asia-Pacific. Some tech professionals were claiming that the unboundedness of their 'innovative technology solutions to property investing' would 'disrupt the [real estate] status quo' (BrickX 2015, about). The digital functionality and global scale of this new real estate industry forces us – conceptually, methodologically and empirically – to move beyond the nation-state centrism that frames much of the debate about domestic and foreign real estate investors (Tiwari and White 2010).

The boundaries of real estate and nation-state, money and materials, people and homes, are being rearticulated through internet-enabled real estate technologies (Rogers 2016a). Real estate technologies are central to the operation and interconnection of global real estate professionals and businesses across different legal, spatial, cultural, linguistic and technological frontiers (Isin and Ruppert 2015; Rogers *et al.* 2015). To take a regional example, the Australian-backed but Asian-based real estate tech start-up Juwai (2014) is one of the largest international real estate websites operating in the Asia-Pacific. The Australian co-founder and co-CEO stated that he 'realised that large numbers of [mainland] Chinese were buying property in Hong Kong [and he asked himself] ... so where will these buyers go next?' He 'realized the potential for an international property portal for Chinese buyers. After a year of ... doing research and focus groups in China and building our website, we launched in 2011' (Millward 2014, 1). The Mandarin word Juwai translates as 'home overseas' and the company's core business is to advertise foreign real estate and to procure real estate sales across nation-state boundaries for real estate companies from around the world.

The emergence of global real estate tech companies, like Juwai, opens up a suite of new housing research questions. For example, what will be the effect, if any, on the users of Juwai's global real estate technology when they access the 'most integrated platform connecting international agents and Chinese buyers' on their tablet or smartphone? Juwai (2014, 1) state that their tech product has '2.4 million property listings from 58 countries, giving Chinese buyers the most comprehensive collection of overseas property to search from'. What will be the long-term domestic and foreign housing market effects, if any, if the next generation of Chinese and other nationals power-up a real estate tech product on their smartphone to look for international real estate? I do not propose to answer these types of questions here. Rather, I pose these questions to clear a conceptual space to begin to think about how the globalising real estate tech products – which will increasingly frame how people from many countries around the world will buy and sell residential real estate – might come to confirm, shape or remould different understandings about land, real estate, home, citizenship and property. Indeed, I set out here to ask a more fundamental question about the unbounding of real estate and home. What are the political implications of the digital commodification of real estate, which involves detaching the material dwelling from the subjective lived experience of habitation, into digital data to facilitate new types of capital circulation and accumulation?

Analysing the uploading of real estate

The sections that follow think through these questions concerning digital real estate technologies by focusing on the 'technics' (rules of knowledge production) of real estate (Ortega 1939). First, a brief history of the internet highlights the ideological landscape that frames the real estate tech industry. This discussion accounts for small real estate data, which refers to information that, with limited analysis or technological manipulation, is ready for human comprehension (Manyika *et al.* 2011, 4). It also accounts for big real estate data sets, or what Burrow and Savage (2014) have called 'large scale digital data'. Manyika *et al.* (2011, 4) argue that 'big data has now reached every sector in the global economy', and this is increasingly the case with the globalising real estate industry. Isin and Ruppert (2015, 26) argue that new socio-technical relationships between people, technological objects and data enable a special class of digital 'speech act' that cuts across these data types, and what is at stake in these digital acts is 'the production, dissemination, and legitimation of knowledge'. Therefore, second, and more substantively, the analysis turns to the real estate technics and ideologies that are being uploaded into the digital and globalising real estate network. It is clear that libertarian, private property and market-based ideologies are central to real estate tech entrepreneurship. When exploring the ideological enframing of these digital technics it is hard to avoid the allure of Jacques Ellul's (1954) seminal neo-Marxist historical materialist study of technology. Ellul (1981,

155) wrote reflectively in 1981, 'if Marx were alive in 1940 he would no longer study economics or the capitalist structures but technology'. I suspect that a tech-savvy Marx would have taken an interest in the BrickX fractional real estate investment platform, and particularly the digital alienation of the investors from the use value of the properties they are investing in. It is not so much the real estate technology that is important here, but rather the real estate technics that are uploaded into the technology. As I show below, the entrepreneurs and tech companies are building particular ideologies into the materiality (i.e., software and hardware) of their real estate platforms. These material manifestations of ideology are designed to flow across the different national and international legal frameworks that frame transnational real estate sales. They are also built to flow across the cultural and linguistic frontiers to enable transcultural real estate sales.

Ellul's corpus is useful for exposing how free-market, capitalist and libertarian ideologies are deeply buried within the tech industry and their real estate tech products, even into the notion of real estate itself. The limitation with Ellul's work is that it is profoundly determinist. Technological determinism, to paraphrase Friedrich Kittler's (2002) famous claim, is the belief that technological media determine our human condition. While Kittler captures, at least intuitively, a part of the contemporary experience of modern communications technologies, determinist thinking, in all its forms, has been heavily critiqued for rupturing the agency of individuals and other social actors by pre-determining human pasts, presents and futures. Marxism, and particularly Marx's form of historical materialism, has also been accused of this type of teleology. Winthrop-Young (2011) argues that Kittler's work is more indebted to the discursive scholarship of Michel Foucault than the determinist historical materialism of Karl Marx. Winthrop-Young (2011, 145) argues that Kittler's statement, that technological 'media determine our situation', is a highly qualified statement that does not presuppose a *telos*. Kittler (2002, 153) argues that 'technological media are never the inventions of individual geniuses, but rather they are a chain of assemblages that are sometimes shot down and that sometimes crystallise'. José Ortega y Gasset's (1939) seminal work on the concept of technics offers a concise survey of the historicity of thinking through the technological techniques or arts of technology. Initially, a technic is discovered, and as Kittler suggests, this often involves many actors and occurs through trial and error, or even by accident. Through repeated use, a technic becomes a conscious practice, and if successful it might be handed down from one generation to another. Thus, the third step in the argument is to deploy Ortega and Kittler's conceptualisation of technics and technological media to undertake a historical analysis of the *technics of the real estate technicians* and the *technics of the real estate industries*. This analysis exposes some surprising ruptures and continuities. One of the most compelling continuities is that the real estate tech entrepreneurs are uploading the real estate technics that created significant housing inequity in

the twentieth century into their twenty-first-century platforms. A key rupture is the emergence of big real estate data, which will increasingly be a sought after and perhaps even tradable commodity.

Isin and Ruppert's (2015, 34) work usefully prompts questions such as: who owns, has access to and is restricted from using the growing volume of real estate data? Who profits from these data, and will some large real estate tech companies seek to control the global real estate data market? Technology theorists have long pondered the dangers of an unfettered commitment to the modern technological project, and they offer different tools for theorising and exposing the embedding of free-market, capitalist and libertarian ideologies within real estate tech products. Martin Heidegger (1977), who is also 'not a determinist' (Lovitt 2013, xiii), famously rejects an instrumental view of technology, such as engineering, that attempts to position technology as an applied science. Heidegger argues that modern technologies are a 'revealing' or 'enframing' (*Ge-stell*), and an exploitation of nature and natural resources (*Bestand*) in the world. For Heidegger, modern technologies create a world of resources to be used and consumed, and this technic is premised on the objectification and quantification of the natural world, which leaves out the 'thinghood' in things. This creates the conditions for producing objects, including landed property and real estate. Jean-Jacques Rousseau (1750) calls into question the Enlightenment idea that technological and scientific progress will necessarily lead to the advancement of society by unifying technological knowledge and wealth with a virtue ethics. For Rousseau and Heidegger, humanity, or what it means to be human, and our subjective realities are intricately bound up with technics and technological objects. In their respective seminal texts, Lewis Mumford (1934) and Ellul (1954) also raise ethical and moral questions to warn that technologies could be used to exercise punitive forms of power over others, or to narrow human experience. Mumford (1934), in particular, argues that this should be challenged and guarded against. Therefore, the chapter concludes by offering some further sites for critical housing scholarship in relation to the global digitisation of the residential real estate industry.

Libertarianism and the real estate tech industry

Considering first the ideological landscape that frames the tech industry, Isin and Ruppert (2015, 34) argue that 'power relations in contemporary societies are being increasingly mediated and constituted through computer networks that eventually came to be known as the Internet'. There is a weighty theoretical corpus devoted to people, technology and societal relationality (Burrows and Savage 2014; Ellul 1954; Mitcham 1994; Tufeki 2014). However, the history of the world wide web and the internet (Keen 2015), and the developing real estate tech industry (Rogers 2016a), are oft-ignored contextual frames for thinking through twenty-first-century real estate relations.

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In 1996, seven years after Tim Berners-Lee invented the world wide web, Robert Franks and Philip Cook (1996) argued that information technologies were poised to exacerbate global economic inequality. In the same year, John Perry Barlow (1996) published *A Declaration of the Independence of Cyberspace* to discursively frame the rise of the internet. The opening of Barlow's (1996, 1) declaration was ideologically instructive:

Governments of the Industrial World ... I come from Cyberspace, the new home of Mind.... You are not welcome among us.... Governments derive their just powers from the consent of the governed. You have neither solicited nor received ours.... Cyberspace does not lie within your borders. Do not think that you can build it, as though it were a public construction project. You cannot.... You have not engaged in our great and gathering conversation, nor did you create the wealth of our marketplaces. You do not know our culture, our ethics, or the unwritten codes that already provide our society more order than could be obtained by any of your impositions.

Barlow's libertarian proclamation provides revealing insights into the early thinking of information technologists. At the end of the twentieth century, these technologists were interested in moving from the 'industrial' into the 'information' age, and thereby denounced geographically bounded notions of governance and citizenship (Isin and Ruppert 2015). They proclaimed the independence of cyberspace in an attempt to reconstitute it as an emerging marketplace *space* that could be decoupled from government regulation and taxation. Cyberspace, occurring to Barlow and his contemporary tech followers, should be self-regulated through a set of independent tech industry cultural and ethical norms. This type of libertarian enframing of technology was not unexpected. Carl Mitcham (1994) was writing about it in his *magnum opus* on technology in 1994. He argued in 'the background of virtually all science and technology studies there lurks an uneasiness regarding the popular belief in the unqualified moral probity and clarity of the modern technological project' (Mitcham 1994, 1). Twenty years later, Andrew Keen (2015), one of Silicon Valley's most vocal contemporary critical insiders, is still uneasy. Keen argues (2015, 189) that a 'disruptive libertarianism', which he describes as a free-market liberalism that is bolstered by a 'disdain for hierarchy and authority, especially the traditional role of government', persists as one of the central ideological reference points in the tech industry. This free-market libertarianist thinking is the guiding ideology at tech conferences and large tech companies in the United States, and has been built into the paywalls of the tech industry's products (Isin and Ruppert 2015; Keen 2015).

Keen (2015, 228) redeploys Silicon Valley's own lexicon back onto itself to conclude that the internet-enabled tech industry is an 'epic fucking failure'. In the tech and venture capital industries the failure of your first tech start-up is celebrated as an entrepreneurial milestone.

The tech industry is not an entrepreneurial failure, but rather a democratic failure. Keen's history of the internet demonstrates that the utopian dreams for an open access and decentralised, but state funded, world wide web of the mid-twentieth century were subsumed into the hegemonic, hierarchical and monopolistic private tech sector of the twenty-first century. Isin and Ruppert (2015, 28) describe cyberspace as 'a space of relations between and among bodies acting through the Internet'; the early phase of cyberspace development was 'primarily a story of how the Internet was invented for national security and civic goals. It's a story about how public money ... paid to build a global electronic network', argues Keen (2015, 38). The economist Mariana Mazzucato (2013) points out that the most successful tech companies received public sector start-up funding (e.g. Apple) or university scholarship funding for the founding CEOs (e.g. Google). Before 1991, the US government maintained legal control of the world wide web and companies that sought access to it were required to limit their use to 'research and education', albeit, as Friedrich Kittler (1995) has shown, this often meant military research and development.

Reflecting on the rise of the world wide web and internet, and the free-market liberalism and disdain for government that information technologists deployed to frame its emergence, it is perhaps not surprising that real estate was so readily uploaded into this technological system. According to some real estate industry sources (Movoto 2014), real estate listings periodically appeared on the internet from about 1994. At the turn of the century, and only a decade after the creation of the world wide web, one of the first Web 1.0 real estate companies 'was founded on the belief that selling or buying a home could be faster, easier and more efficient' (Zipreality 2014). In the same year Move (formally HomeStore) became one of the first internet real estate companies to be publicly listed. Web 1.0 was one of the initial large-scale software paradigms on the internet. This platform is typified by businesses that upload their core business functions onto the internet in a fairly straightforward manner. The assumption behind Web 1.0 technologies is that a company's non-virtual technics will operate in the virtual spaces of the internet in much the same way as they operated before the internet. Uploading the practice of mailing letters onto an internet platform as email, through a service provider such as Yahoo, is a good example of this type of Web 1.0 uploading practice.

Throughout the first decade of the twenty-first century the Web 1.0 uploading of real estate practices, or taking the old real estate technics online, increased significantly. A tech developer from a real estate tech start-up I interviewed in Asia in 2014 stated:

Everything is going mobile of course, and we've benefitted tremendously ... within our first year the smartphone came out. And then we jumped on that. And so we really became an app builder concentrating on property, so managing the information that's there.

(Rogers 2016a, 7)

Large sections of the real estate industry are still operating in the Web 1.0 space. Real estate companies are contracting tech companies to help them upload their core business technics onto the internet, as their first venture into cyberspace. In 2015, most real estate companies in Australia had an online presence of one form or another. These online platforms also allow the real estate companies to expand into regional and global real estate markets (Rogers 2016a). The Australian-backed but Asian-based real estate tech start-up Juwai (2014) is a good regional example, and within four years they became one of the largest international real estate websites in the world.

The rise of big real estate data in the early 2000s expanded the scope for uploading real estate, and it was accompanied with the emergence of a suite of big real estate data companies. The Real Estate Transaction Standard (RETS), a real estate data exchange protocol for real estate professionals, was launched in the United States in 1999. This was followed in the early 2000s with the Internet Data Exchange (IDX), a real estate property search site that allowed the public to conduct real estate searches. These types of data companies are beginning to trade in real estate data. In the Asia-Pacific, in 2006, the Korean government introduced the Real Estate Trade Management System to collect real estate transaction data. In 2011, the North American big real estate data analytics company CoreLogic (2014) acquired RP Data, which provides real estate analytical services in Australia and New Zealand. CoreLogic's stated intent was to further expand in the Asia-Pacific region. In 2014, to take a trans-Pacific case, REA Group (2014, 2), which is majority owned by News Corp Australia, a subsidiary of News Corp, announced their 'intention to acquire a 20% stake in Move' (i.e. the first publicly listed internet real estate company mentioned above). According to REA Group (2014, 2), 'News Corp, parent of our majority shareholder, intends to hold the remaining 80%'.

A study of foreign real estate investment looked at the emergence of digital real estate platforms over several decades. It shows that these technologies have been increasingly upscaled in three keys ways: '(1) geographically, at first regionally and then globally; (2) electronically, to include more third-party big data analysis; and (3) socio-economically, to increasingly target, and at times exclusively, high-net-worth individuals and global real estate investment' (see Rogers 2016a, 9). The long-term empirical question that remains for housing scholars with an interest in information technologies is: are these real estate industries shifting their digital technics onto the newer Web 2.0 software paradigms? The move from Web 1.0 to Web 2.0 represents a paradigmatic shift towards big data and big 'data factories' (Burrows and Savage 2014; Keen 2015). Technology writers have grouped the companies in this category under the technological neologism Googlenomics (Keen 2015). These companies give away their software tools and services for free or close to free, but simultaneously become big data companies that 'target their users' behaviour and taste through the collection of their "data exhaust"' (Keen 2015, 60). The 'laws' of Googlenomics

proclaim that tech companies can create their own markets by operating in the space between ‘the browser’, ‘search engine and destination content server, as an enabler or middleman between the user and his or her online experience’ (Keen 2015, 59).

The history of the internet shows that the danger of Web 2.0 technics is that they drive towards business monopoly and social inequality. Indeed, the biggest Web 2.0 tech companies are banding together to lobby governments, citizenries and even themselves for increasing ‘freedom’ from government regulation across various digital, economic and socio-political spheres (see The Internet Association 2015). Zeynep Tufekci (2014, 1) even argues that Web 2.0 big data companies ‘now have new tools and *stealth* methods to quietly model our personality, our vulnerabilities, identify our networks, and effectively nudge and shape our ideas, desires and dreams’ (original emphasis). Their digital practices, according to Tufekci (2014), Isin and Ruppert (2015) and Keen (2015), can be designed to change the way the users of the technologies think about the world and themselves. Tech industry libertarians, following Barlow’s (1996, 1) declaration, go further still to argue that cyberspace is the new ‘home of mind’, and these are not idle threats. The Web 2.0 giant Facebook has conducted secretive online experiments with users’ data in an attempt to control their mood, leaving Tufekci (2014, 1) to state that the ‘question is not whether people are trying to manipulate your experience and behaviour, but whether they’re trying to manipulate you in a way that aligns with or contradicts your own best interests’.

There is some evidence that the larger, more globally focused real estate tech companies are moving towards quasi-Web 2.0 technologies (Rogers 2016a). Unlike the Web 1.0 technologies, these Web 2.0-style companies manage and own the real estate tech products they build. Their tech products include real-time real estate data user interfaces that are typical of the Web 2.0 software paradigm. Some of the real estate tech start-ups have Australian interests, such as the two Australians that founded Juwai (www.juwai.com). Others are right on Australia’s doorstep, such as the Singaporean real estate start-up StreetSine Technology Group (www.srx.com.sg). By focusing on these two examples, the next section discusses these types of real estate tech start-ups to expose the real estate technics and data that are being uploaded onto the internet.

Uploading residential real estate

The simplest internet-enabled technology for uploading real estate data is a Web 1.0 investor-focused real estate sales interface. These interfaces place the investor at the centre of a relatively closed network of small data about real estate at a particular site (Rogers 2016a). Perhaps the most common are the website platforms that are built for and then managed by existing real estate companies. These companies upload sales information about individual properties onto their own website with limited analysis or

technological manipulation. An Australian example is the real estate company L.J Hooker, who initially commissioned a tech company to upload their local newspaper and real estate shopfront window advertisements onto a web-based platform (ljhooker.com.au). From the early 2000s these Web 1.0 real estate technologies have diversified into third-party real estate websites. In Australia several large news media companies commissioned or secured an ownership stake in the most popular sites, including domain.com.au (Fairfax Media) and realestate.com.au (News Corp, 60 per cent ownership). These real estate technologies allow independent real estate companies and professionals to upload their sales information to a third-party website. It is the technological interface, the ‘embodied’ and ‘situated’ experience of the real estate investor in cyberspace, which represents ‘a complex interplay between real [i.e. material] and digital geographies’ (Isin and Ruppert 2015, 32), that I want to focus on here. For analytical purposes, I have called the digital technic of targeting a real estate investor with a piece of technological hardware and software an *investor-focused* digital act. By using this term I mean to demarcate the technological technic that has been intentionally designed to target a specific population group. The concept of the digital act equally applies, therefore, to real estate professionals (i.e. *professional-focused* digital act) and those who are looking for a rental property (i.e. *tenant-focused* digital act). A good example of a *professional-focused* real estate tech platform in Australia is onthehouse.com.au, which is owned by the Console Group. This real estate tech company, who argue that their ‘software has been supporting the Australian real estate industry since 1992’, states their ‘Console suite’ tech product ‘is designed to help [real estate professionals] build better relationships, talk to more prospects, increase leads, close more deals, operate with greater efficiency, and monetise your data and website traffic’ (Console Group 2015, 1).

The *investor-focused* capabilities of the national real estate websites noted above have more recently been regionally and globally upscaled. In the Asia-Pacific, Juwai claims to operate ‘behind China’s Firewall [by providing] the most integrated platform connecting international agents and Chinese buyers’ (Juwai 2014, 1). The sale of Australian real estate to Chinese nationals through the internet is a key business strategy for this real estate tech company. Juwai (2014, 1) state:

For Chinese Consumers Juwai.com is an international Chinese platform – hosted in China, entirely in Chinese. Chinese consumers get instant access to international property listings, language and search tools, as well as relevant research and information they need to make informed decisions about overseas property purchasing.

In terms of the small real estate data that is flowing through their tech platform to target Chinese investors, for a fee Juwai translates local Australian (and other countries’) dwelling-specific real estate data from

English to Mandarin. They provide in-house cross-cultural and language translations and Chinese social media compatibility: ‘Our professional editorial team translates in a style and tone that resonates with Chinese buyers’, and Juwai’s ‘Mobile App with Chinese social channel integration [is] combined with online Chinese social media features’ (Juwai 2014, 1).

The more sophisticated Web 2.0-style *professional-focused* real estate sales technologies place real estate and other professionals at the centre of a diffuse network of big and small data about investors, property developers, immigration agents, financial institutions and other real estate information (Rogers 2016a). Within the real estate tech industry, Web 1.0 and quasi-Web 2.0 platforms can operate independently or they can sit happily alongside each other within a broader tech platform. Juwai’s portable online analytical tool for real estate professionals is a good example, and it operates alongside their Chinese *investor-focused* digital acts. Their *professional-focused* real estate platform networks real estate professionals from around the world into ‘Juwai’s exclusive audience of 1.5 million high-net-worth Chinese consumers’ (Juwai 2014). The global real estate company Engel & Völkers (2014) also developed an online real estate *professional-focused* product called ‘my life’, which they describe as ‘Practical Knowledge for Sales Advisors’. StreetSine (2014), in Singapore, also ‘integrate big data sets with mobile workflow applications to help real estate-related organisations and professionals employ real-time, relevant, proprietary information in the marketing of their products and services’. Their tablet-friendly platforms ‘provide the property market with computer-generated pricing’, which is a tech product they have trademarked as Home Report™. StreetSine (2014) market their Singapore Real Estate Exchange platform, trademarked as SRX™, to ‘property-related professionals’, including real estate agents, bankers and lawyers. Much like Juwai, their *professional-focused* digital acts operate alongside a suite of *investor-* and *tenant-focused* digital acts, with their tech products also targeting real estate buyers, sellers, landlords and rental tenants. StreetSine’s big real estate data set can provide extremely fine-grained information about Singaporean real estate, all the way down to a ‘computer-generated price’ for an individual dwelling. They call this computer-generated price an X-Value™. As the real estate professionals use SRX™, the technology captures their real estate data exhaust, thereby growing the company’s data set. However, the real estate data set that produces the X-Value™ is only available because of the government’s historic role in the provision of public housing in Singapore (Chua 1997). The government collects the bulk of the real estate data that this technology is built upon. Thus, the role of the government as a real estate data collector and provider is central to StreetSine’s Web 2.0-style real estate technology.

Isin and Ruppert (2015, 26) argue that these new socio-technical relationships enable a special class of digital technic and ‘speech act’, and what is at stake in these digital technics and acts is ‘the production, dissemination, and legitimization of knowledge’. More recently, the Web 1.0-

and Web 2.0-style real estate platforms have had multimedia channels incorporated into the technologies to broadcast high-quality digital audio/visual discursive content about the private real estate market. StreetSine has a regular national radio interview and podcast slot on Singapore's ONE FM radio station. The podcast program covers real estate topics such as real estate prices, home loans and the local private property market. They have been critical of the Singaporean government's affordable housing interventions, such as the foreign investment 'cooling measures' that attempted to mitigate house price increases (e.g. 'Condo market hit hard by cooling measures' podcast on www.srx.com.sg/podcasts). A real estate tech start-up executive I interviewed in 2014 stated: 'now I'm a free-market capitalist-libertarian ... I can see how information technology can help ... allow this asset class [residential real estate] to be a more frequently traded asset class'. The discursive content within these types of multimedia tech products and the statement by the real estate tech executive show that a free market liberalism, which is built upon private property ideologies and underwritten by a disdain for government intervention, is deeply embedded within some of these new real estate technics and digital acts.

The recent formation of the political lobby group The Internet Association (2015) is a good pan-tech industry example. This group is an alliance of some of the largest and wealthiest Web 2.0 tech companies, including Facebook, Google and Amazon. This lobby group argues that every tech company should be 'uninhibited' by government taxation, regulation and censorship. They also argue that they should not be held responsible for the user-generated digital acts they enable through their platforms. For example, they state that 'Internet intermediaries must not be held liable for the speech and activity of Internet users' (The Internet Association 2015, 1). The Internet Association is advocating for an instrumental computer science view of technology, which allows the lobby group to position the 'freedom' to produce electronic code in cyberspace as more important than thinking about an appropriate regulatory environment that might be used to guide their digital acts, and the resultant effects in the material world (Burrows and Savage 2014; Isin and Ruppert 2015; Keen 2015).

The practice of uploading real estate onto the internet is not developed in a political vacuum, and there are many examples of resident-led or researcher-led tech resistance to market-centric real estate practice. It is not my intention to explore these alternative forms of digital real estate technics here. However, The Anti-Eviction Mapping Project (United States) and Our House Swap (Australia) are two exemplary cases that are worthy of mention. The Anti-Eviction Mapping Project is a web-based 'data analysis collective' that uses a crowd-sourcing platform to recruit geographic information system (GIS) specialists to document 'the dispossession of San Francisco Bay Area residents in the wake of the Tech Boom [Web] 2.0' (Anti-Eviction Mapping Project 2015, 1). The public housing tenant-managed Our House Swap website bypasses the state housing authorities' role in mediating

tenants' residential mobility choices (Our House Swap 2015, 1). These types of digital initiatives are enframed by anti-gentrification and collective ownership ideologies that represent counter-discourses to market-centric forms of real estate technic. The Anti-Eviction Mapping Project, Our House Swap, StreetSine and Juwai website technologies show that underneath these technological platforms are a set of organising real estate technics and housing ideologies, which have quite literally been uploaded as forms of real estate or housing power and/or resistance.

The real estate technics that are now associated with buying and selling real estate as private property in the globalising digital real estate industry have a clear lineage back to pre-internet real estate technics in countries like Australia (Rogers 2016b). Over the last century, the real estate industry has categorised their real estate technics and ascribed to their many real estate actions a set of linguistic referents, which are: (1) capital costs; (2) capital lending; (3) growth; (4) yield; (5) liquidity; (6) transaction costs; (7) taxation costs; and (8) ownership rules (Rogers 2016a; Tiwari and White 2010). These technic referents signify the broader set of actions that the real estate professionals, investors, tenants, governments, financial institutions and other actors come together to undertake. I have tracked the repeated use of these real estate technics back in time, to show how they became normalised and turned into conscious and transferable real estate technics (see Rogers 2016b). The agonistic struggles that underwrite these types of performative technics, as Isin and Ruppert (2015, 33) point out, transcend the material/digital world divide – the digital acts are always *in the world*. The pre-internet language acts and real estate technics of local real estate professionals, such as real estate advertisements in local newspapers and shopfronts, were readily uploaded onto the internet as regional and global technics. Therefore, there is a larger historical context that frames the emergence of internet-enabled real estate technologies, which includes the transfer of market-centric real estate technics from pre-internet into internet-enabled real estate technologies. The historical mapping of these real estate technics could further expose how these real estate technologies are mediated across different technological, generational and geographical scales (Rogers 2016b). To understand twenty-first-century digital real estate technologies, housing scholars need to know more about how real estate technics are transferred from one mediating technological to another, from one generation of real estate professional to another, and from one investor to another.

Conclusion

A global digital expansion of the residential real estate industry is underway. Millions of local residential homes from some of the wealthiest countries around the world are being uploaded for sale onto thousands of internet-enabled real estate platforms. While critical housing scholars (Crabtree 2013) and some digital citizenries (Our House Swap) are abandoning and

thinking beyond the technics of housing and land as private property, the globalising real estate industry is digitising, uploading and upscaling the local real estate technics of a former era onto their new tech products. In the Asia-Pacific, the real estate tech industry has uploaded the real estate technics that built the Great Australian Dream. James Kirby (2002) jokes in his financial self-help book *Investing for Dummies* (which, as a speech act, is an important pre-internet real estate mediating technology), 'In Australia ... property is like a game and is followed like the footy'. However, this globalising real estate game is no joke and it has already produced significant housing inequity in several Australian cities. The real estate tech entrepreneurs are uploading these local real estate technics, which created significant housing inequity and exacerbated housing disadvantage in the second half of the twentieth century, as international real estate technics for the twenty-first. These globalising real estate technologies are not presently spurring on creative innovation for a more democratic technics of housing and land. They are not testing new technics that might address the increasingly unaffordable housing landscapes in many global cities around the world. They are not using technology to imagine or discover innovative ways to retool real estate and housing so that it is more equitable and freedom-creating, which are the ideals that the internet was supposedly built upon.

The new real estate technologies that host these market-centric real estate technics readily account for the legal frameworks of different nation-states and the cultural and linguistic barriers that previously restricted transcultural and transnational real estate sales. These real estate technology entrepreneurs are building tech products that have private property and market-centric ideologies built into their very functionality. A further task for housing scholars is, therefore, to analyse the way the real estate investors and professionals are 'downloading' this information onto their smartphones and tablets; to think through the relationships between the user, the technological object and the information that is flowing through a given embodied user and technological object assemblage. The conceptual framing of such a project needs to deal with the way the users interact with these new types of real estate platforms and data to ask whether we can record the subjectivities, if any, that result from these new digital real estate technologies.

Finally, the rise of Web 2.0-style real estate technologies, and the buying and selling of real estate tech companies, has made real estate data *itself* a sought after and tradable commodity. Government regulation should ensure that big real estate data become open source, publicly available and free. Internet history shows that large tech companies are not committed to free open-source big data capture, transparency and social democracy, and the large Web 2.0 tech companies are driving towards technological oligarchy in their respective entrepreneurial fields. What might be lost if real estate tech companies follow suit is the ability to creatively innovate outside the sets of market-centric real estate technics that framed twentieth-century real estate practice. In short, without government intervention the

online market-centric real estate technics of the twenty-first century, much like the local offline technics of the twentieth century, could negatively affect global housing equity.

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