

The Digitalisation of Swedish Housing: The First Forty Years

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The 'home of the future' has perennially been presented to the public since the era of the great exhibitions.¹ In most cases, these homes appear briefly before disappearing beyond the horizon forever. In this article I revive a few of the less glamorous exemplars, to reassemble a parade of the 'smart' housing of the future in Sweden since the 1980s. Silicon Valley narratives venerate brave pioneers from the 1960s – Cedric Price, Jay Forrester, Stewart Brand and co – lamenting that their contemporaries failed to recognise their ground-breaking work, and asserting that it is only today that the full extent of their genius can be appreciated. This miraculous rediscovery and canonisation is not entirely unproblematic, however. By focusing solely on the original dreamer, whose vision is only possible many decades later, such narratives conveniently omit the failures and setbacks that form part of a longer and far less linear development.

This article deals with smart housing, and it should be emphasised that this is fundamentally different from smart homes. I will describe the reason for this distinction, but for now it should suffice to note that smart home technology revolves around homeowners and convenience for their benefit, while smart housing technologies centre on landlords and the digitalisation of their operations rather than tenants' comfort. Ultimately, the success of any smart housing project becomes a question of getting tenants' cooperation – a notoriously difficult undertaking. Already in 1998, researchers Stefan Junestrand and Ulf Keijer noted that 'the technology itself is the smallest problem. The interesting

question is whether residents are actually interested in and asking for the services provided.'²

The different smart housing projects mapped here together form a parade in which the same future is seemingly repeated, each time under a new moniker. Even more curious, each instance appears to deny the existence of any previous projects – or at least there is no memory of futures past. The process is usually the same: test beds are installed in a housing block to much media fanfare, a minister or a foreign head of state pays a visit to guinea pig families and brave digital pioneers, a host of publications written in an awed tone appear and then the project discreetly fades into the background and vanishes. A few years later, the process is repeated. This serial infatuation with the idea of a smart building is, as suggested above, always around the corner, here, and already gone. All at the same time.

On closer inspection however, we find variations, shifts, nuances. The protagonist – rarely the dweller – changes, from landlord to technology corporation and more recently to the utility companies, the power grid supplier. The systems employed to manage tenants grow larger, charting and memorising more about tenants. From the early 1980s until today, smart devices have been installed in tenants' walls, yet this is a history that has remained almost entirely untold, until now.

Some context

In this article I trace the digitalisation of Swedish housing from the 1980s to the present. Scholarly

attention on the emergence of the smart home has focused on domestic technologies, on the 'home' rather than the building.³ More critical perspectives have formulated a feminist critique of how the smart home tends to put the male homeowner's leisure at the centre while habitually ignoring women's domestic labour.⁴ Very little has been published in architecture or the social sciences on the history of the digitalisation of housing, as opposed to homes.⁵ My focus in the following is not primarily on the technology itself, which has indeed changed radically over time. Instead, I concentrate on the way the technology transforms the tenant-landlord relationship, on the view of those whose lifeworld is interfered with, how they are expected to act, and how they have reacted to the installation of smart technologies to regulate their lives.⁶

The focus on housing rather than the home lends itself well to geographical contexts where rental housing is the norm rather than the exception. Sweden constitutes an interesting case study here. The country often adopts technology quickly, and there have been active projects to digitalise dwellings from the early 1980s onward.⁷ Sweden also has powerful municipal housing corporations who themselves cultivate high-flying digitalisation ambitions.⁸ To my knowledge, this article offers the first long-term historical overview of the relationship between housing and smart technology in Sweden. Previous publications addressing the digitalisation of housing have focused on individual measuring and billing, or on broadband, or they have sought to provide a snapshot of the present moment.⁹ I believe that even if the specifics of each round of digitalisation here are Swedish, the larger general development will resonate in other contexts in continental Europe and potentially beyond.

Approaching smart housing from this angle places the article in relation to three overlapping topics within the discursive landscape of the architectural discipline. The first concerns the relationship between technology and architecture in the everyday use of buildings. One seminal moment in

this genre is the 1948 publication *Mechanization Takes Command* by Siegfried Giedion.¹⁰ In it, Giedion and his students set out the 'anonymous history' of how technology had continuously transformed life inside buildings. Giedion focused on technological invention and not its implementation in architecture; Reyner Banham criticised this in his 1969 book *The Architecture of the Well-tempered Environment*, which sought to explore how the technological innovations documented by Giedion were introduced in actual buildings.¹¹ Since Banham, this topic has resurfaced on different occasions, most recently in *Elements of Architecture*, the 2014 Venice Biennale curated by AMO and Rem Koolhaas, which traced the technological development of building elements and its impact on the built environment.¹² I draw inspiration from Banham's take on how technology affects buildings, but has a slightly different focus, specifically, on users' experience and relationship to their landlord rather than how technology is designed into buildings.

The second topic runs partially counter to the first. It concerns the problematic adjective 'smart' as employed for cities, housing, and homes.¹³ This topic is conventionally considered extra-architectural; Koolhaas has noted that when technology corporations call their version of a frictionless city smart, the architect's city is, by implication, 'stupid'.¹⁴ Since then, architectural theorists and historians have occasionally and perhaps reluctantly addressed the smart development of homes and houses, but this is generally considered beyond the scope of architecture.¹⁵ Smart technology, then, is habitually considered as something retroactively added by developers and others, which does not affect the spatial or material composition of the building.

This view clashes with a third topic of architectural discourse: post-occupancy.¹⁶ In the past, attention was primarily directed to the architect and their design process, but nowadays architectural history operates in a broader discursive context, and the narrative does not necessarily come to an end when the building is handed over to the client.

Smart devices put into tenants' homes by landlords are part of a control system of the house and home. Although their impact on a building's style and shape is limited (for the time being), the smart devices nevertheless affect spatial experience and how the dwelling is imagined in the digital age.

This article combines these three topics, addressing smart technological development over time in the field of housing (as constructed rather than planned) with a focus on post-occupancy and on how technology transforms tenant-landlord relations. Rather than mechanical services introduced in buildings, I look at the introduction of digital services using sensors connected to computers to regulate and log life in the flats belonging to the landlord.

Conceptual conundrums

When to begin? The question is frequently asked when researchers trace the story of the digital in architecture.¹⁷ When exactly does housing become smart? Dreams of the automated house have oscillated between the desirable and the nightmarish – the latter is of course a favourite pop culture trope for the modern individual's powerlessness.¹⁸ In the late 1970s and early '80s, these dreams were still highly futuristic, notably expressed in the different versions of the Xanadu houses, which combined automation with Jetson-inspired design.¹⁹ In 1984, the US National Association of Homebuilders coined the term 'the smart home', and in 1986 it even constructed a mobile demonstration home.²⁰

Around the same time, the digitalisation and automation of building management – primarily office buildings – were beginning to appear. Around this time, the concept of 'the intelligent building' emerged; a computerised building, it was supposed to automate responses that previously would have required manual responses. The customer for whom the intelligent building was conceptualised was the building's landlord or manager, whose management tasks would be optimised. The conceptual label was first applied to City Place Building in Hartford, Connecticut, designed by

Skidmore, Owings and Merrill and completed in 1983. Its intelligent systems to automate building services were installed by Building Systems, a subsidiary of United Technology Corporation, itself a collaboration between companies that had previously primarily fulfilled military contracts and were now seeking civilian business opportunities.²¹

There are two narratives in the 1980s. One attends to the needs and comfort of the resident/homeowner, and the other focuses on the landlord/manager. The aim of the latter is not to increase the tenant's comfort but rather to optimise the management of the building. Soon enough, however, this logic was transferred to housing and social housing. Smart housing can be seen as 'the intersection of housing with smart technologies', as one researcher put it.²² For clarity's sake, I want to emphasise the distinction I make here between the smart home or house and smart *housing*. Here, smart housing is concerned with questions of rental housing: provision, distribution, and tenure, and importantly for this article, the tenant-landlord relationship. I argue that there are two significant differences setting smart housing apart from both the logics of the smart home and the intelligent building. Characteristic for the smart home is the homeowner's voluntary installation and use of a smart system over which they have control. As Lynn Spigel notes: 'smart homes are an industry and as such they are targeted at the lifestyles and presumed aspirations of the consumers who can afford them'.²³ Smart housing, on the other hand, is installed by the landlord in the walls of homes where tenants have limited power to resist the installation and little or no control over the collection of data from the private home, let alone how it is used by the landlord. In the intelligent building – as conceptualised in the early 1980s – tenants and landlords were corporate entities. Smart housing is characterised by a tenant-landlord relationship that involves a different power asymmetry: particularly in social housing, the tenant is dependent on the landlord, and one cannot assume that the tenant

can simply choose another residence. Feminist critique of smart homes has highlighted that the technology intended to make life easier for the male homeowner was blind to the needs and comforts of other members of the household. Below, I will interrogate what could be called a blind spot in the rise of smart housing: the tenants, and how the 'making smart' of housing transformed the conditions under which they live their domestic lives.

The multiple stages of smart housing

What follows is a story of lives forgotten and projects discreetly abandoned, where the wiring inside the walls is the only trace of what once was the future of the digital dwelling. Different stages denote different moments in time when smart technology seemed to be the future. Each stage involves the retrofitting of a public housing block constructed within the framework of the large housing programmes of the 1960s and '70s. By no means are the projects presented an exhaustive list; there have been numerous other smart housing experiments, including private ones.²⁴ The projects presented here are geographically concentrated in Stockholm and Gothenburg, but nonetheless representative of development in Sweden more broadly. As vanguard projects, these experimental test beds are dead. As smart housing they were failures, and as lessons they remain unlearned. Summoning them back to life in this manner serves not only to show repetition, but also what has changed over time. All the projects aimed to apply smart technology to control tenants' energy consumption. Fundamentally, the projects concerned behavioural change, either through disciplinary technology or through attempts to discipline inhabitants to monitor their own behaviour. A common feature for all of the cases is that things did not go according to plan. Sometimes this was a result of technological failure or miscalculation, but importantly, tenants often reacted to the projects with indifference or active resistance.

Stage one: 1984–1986

With the oil crises of the 1970s, energy scarcity was painfully felt in most segments of Swedish society, and housing was no exception. Public housing constitutes a substantial part of housing in Sweden, especially after the large housing programmes of the 1960s.²⁵ Heat and hot water in Swedish public housing are generally paid collectively as part of the rent, with costs negotiated annually between the property owners association (Fastighetsägarna) and the Swedish Union of Tenants (Hyresgästföreningen). The sudden fluctuations in energy prices prompted research on saving energy in public housing; public housing corporations were large and powerful actors who could test solutions that, if successful, could be implemented across the housing stock. An early suggestion proposed transferring heat and hot water costs to the individual tenants; collective billing meant that individual tenants had no cost incentive for saving energy.²⁶

Installing individual meters was prohibitively costly and considered unjust; flats with multiple exterior walls consume far more energy than flats sharing walls with other flats that benefit from heat leakage from all directions.²⁷ An alternative to charging for energy consumed is to charge for the 'comfort temperature'; that is, households pay for a specific indoor temperature, regardless of where in the building the flat is located. Comfort temperature is guided by a thermostat rather than a conventional meter. We should remember that although it is an old invention, the thermostat is the quintessential cybernetic device. Norbert Wiener famously used it as the primary example of a device that works through negative feedback in a self-balancing system.²⁸ However, an ordinary thermostat only measured the temperature in the flat, and did not take the tenants' habits into account. Even if tenants left their windows open through the winter, for example, their comfort temperature-determined energy bill would remain the same, and the installation would fail in its purpose to create an incentive

for tenants to save energy. The solution was found in a computer system in which sensors could react to tenants' behaviour and trigger different responses.

The earliest smart system for the digital control of tenants' indoor temperature is found in the patent application for a 'technique and device for the control of temperature in heatable spaces' submitted in 1980.²⁹ The invention was intended to permit individual billing for heating in multi-household residential buildings with a central boiler. A patent was granted in 1984, and the system, marketed as Termax, was presented to the public later that year.³⁰ [Fig. 1] Each tenant agreed with their landlord on a comfort temperature that Termax would maintain in every room of the flat. Each radiator would be equipped with a thermostat, in turn connected to an individual data-card in a central computer to which only the landlord had access, controlling the flat's radiators from a distance. Landlords would adjust the rent according to the agreed upon comfort temperature: a lower temperature equals lower rent. The patent application places special emphasis on preventing tenants from sabotaging or manipulating the equipment. All windows, internal doors, and the front door were fitted with sensors to minimise heat loss through ventilation; when a window was opened, all radiators in that room would shut off, making it impossible to waste energy (or ventilate the room and maintain the indoor temperature at the same time). If the door to another room or set of rooms was open, the radiators would shut down in those spaces as well. The system could be coordinated with the tenant's daily schedule and could be programmed to alert the emergency services if, for instance, the tenant was at home but did not use the bathroom door for more than twenty-four hours.³¹

Technology was called upon to incentivise tenants to conserve energy by enforcing certain behaviours and individualising the group of tenants who had previously constituted a collective with a common relationship to the landlord. Termax was installed in 284 flats, and the experiment ended in something of a disaster. Frustrated by the system's

inflexibility, a large portion of the tenants rebelled against the system, sabotaging the equipment by cutting the wire that linked the thermostat and the radiator valve, discreetly reclaiming control of the temperature in their flats.³² Here, the system was clearly imposed on tenants who found the system oppressive – effectively, the system punished them for seeking fresh air, and the landlord assumed a somewhat paternalistic, mistrustful role. The goal of preventing the system from being abused by individuals fits well with the general discussion about and nascent neoliberal re-modelling of the welfare state, placing responsibility with the individual rather than the collective. Technology, then, was introduced to curb abuse. The same politics of individual metering, and the same rhetoric, returns in many later projects with similar ambitions.

Here, one might emphasise the individualisation of the tenant. In the past, tenants were addressed as members of a collective. Rent negotiation, for instance, is a collective procedure. Termax produced a situation in which each tenant negotiated separately by setting a comfort temperature; the tenant-landlord relationship becomes individual; the tenant is no longer integrated in the tenant collective.³³ The act of sabotage could possibly also be read as a way of resisting this process.

Stage two: 1999–2000

Individual metering seemed less urgent when energy prices stabilised in the 1980s. Toward the end of the decade, deregulation and privatisation became central themes in both housing policy and building services, and this development continued through a housing market crash in the early 1990s.³⁴ Electricity, telecommunications, media, and housing became markets rather than state-provided infrastructure, and the number of personal computers multiplied exponentially during the IT-boom. Following general trends of dismantling welfare state housing and replacing it with a more market-oriented condition, the tenant was no longer seen as a tenant, but as a customer. The assumption was

that this customer, if properly informed, would make rational decisions about, for instance, their energy consumption. Consequently, the smart housing projects of this time sought to inform customers and provide them with a wall-mounted control panel where they could follow their own energy, heat, and hot water consumption and compare it to previous usage.

The combination of these and other factors led to many smart housing renovations being initiated in the years up to the turn of the millennium in various cities and towns around Sweden, including Gävle, Skövde, Landskrona, Malmö, Uppsala, Stockholm and Gothenburg.³⁵ One prominent example was owned by Poseidon and located in Gothenburg (as had been the case for Termax). The IT-house (IT-huset) was part of the renovation of a run-down and stigmatised housing estate in Högsbohöjd in 1999–2000. [Fig. 2] When the estate was renovated, the public housing corporation dedicated one building containing thirty-seven flats as a testbed for technology. A central aim was to counter the stigmatisation of the estate with this flagship housing project, and as a result, to attract new tenants to the area.³⁶ Smart housing was presented as desirable, and the technology was – at least to an extent – designed to make tenants' lives easier, much like smart home technology. Enthusiastic tenants welcomed reporters from the local press to show off their flats.³⁷ While the renovation itself was not controversial, its effects were considered more problematic. The building's previous tenants were relocated to other flats in the estate, while the IT-house was populated with younger, more tech-savvy tenants who worked in the IT-industry.³⁸ Futurism, it seemed, should be a quality of tenants as well.

The building's smart systems included a lift that would be summoned when a tenant opened their front door, communication systems with the landlord, a noticeboard for the tenants, a digital booking system for the laundry room, the sauna, and so on, a video-doorbell that would photograph people

ringing the doorbell of the flat (and save the images), and more. The new tenants in their state-of-the-art flats could also adjust the comfort temperature in different rooms using the internet, and they were charged for the comfort temperature.³⁹ Upon moving in, tenants were educated in how to use the system and how to save energy. The system had several unwanted side effects, for instance, heat leakage from neighbouring flats would raise energy bills, as would warmth emitted by computers, as tenants then would pay both for the electricity for running the computer and the heat it generated.⁴⁰ It wasn't until the end of the first year that the most problematic aspect emerged: when Poseidon calculated the average indoor temperature in its housing stock, it emerged that average temperature in the IT-house, with its informed consumers, was 0.8°C higher than the housing stock average.⁴¹

The project is interesting for several reasons. One is that the project actively sought to combine the two narratives of smart buildings: the resident-oriented and the landlord-oriented. For a short time, these two smart housing narratives became almost indistinguishable. The aim was to attract a wealthier social group to the area, following an ethos that was popular at the time: design not for the tenants you have, but for the tenants you want. The house was packed to the brim with markers of exceptionalism and services unavailable to other tenants, from live-feed cameras of the parking garage and two daily mail deliveries during which tenants could purchase stamps directly from the mail carrier. As resident-centric as it was portrayed, this customer-oriented system still permitted the public housing corporation to retain total control. Supplying volumes of data to an external corporation with whom one has entered into a contract for this specific reason – a contract that can, importantly, be terminated – is fundamentally different from one's landlord, on whom one depends for a dwelling, collecting this data; it brings the landlord into one's life in ways that have thus far not been problematised in critical discourse.

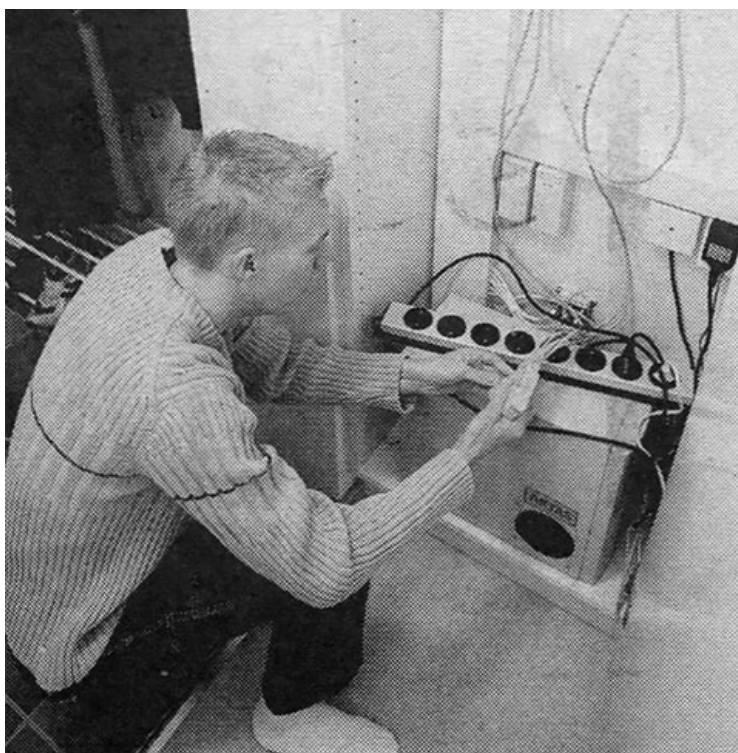
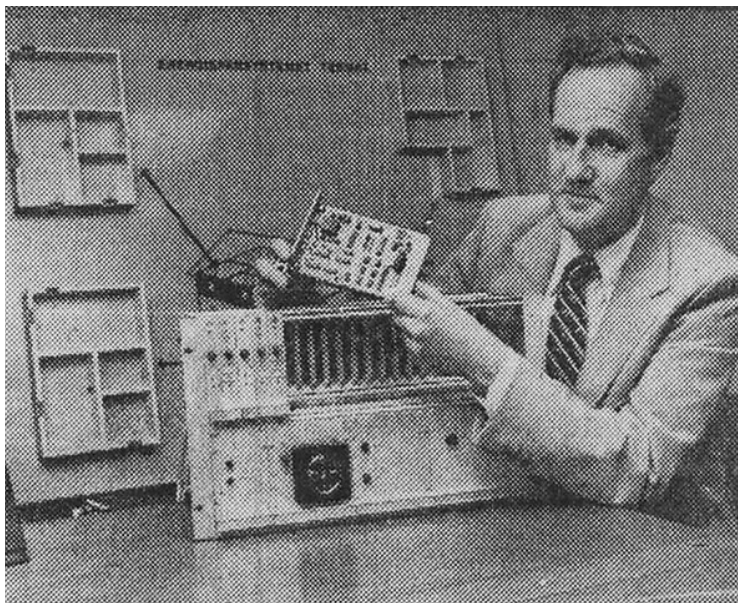


Fig. 1: Sven Hedly shows off the Termax system. Originally published in *Göteborgsposten*, 22 May 1984. Photo: Christian Tyre.

Fig. 2: A tenant shows the IT-cabinet in the IT-house in Högsbohöjd, Gothenburg. Originally published in *GT* on 16 September 2000. Photo: Tommy Holl.

Stage three: 2007–2009

In the aftermath of the IT-crash of 2000, anything labelled ‘smart’ was ridiculed. Public opinion had it that the era of smart was over.⁴² However, only a few years passed until the next generation of smart housing was presented, if with less fanfare than before. In 2007, the Gothenburg-based company Manodo launched the Sbox, a touchscreen panel that promised to significantly lower energy consumption, to be fitted in a wall of a rented flat. [Fig. 3]

The previous generation of smart housing had overestimated how rational and sensitive to cost tenants would be when recorded information is the only motivating factor. Sbox started to introduce educational features, nudges to change tenant behaviour. Among other functions, the Sbox panel displayed electricity, heat and hot water consumption, and it assigned ‘smiley’ or ‘frownie’ icons depending on whether the tenant had remained within or exceeded their target consumption and on their consumption performance over time. [Fig. 4] Target levels were set in relation to the environmental footprint. Making the tenant a rational consumer by not only showing their consumption but also evaluating their performance was a minor modification of earlier attempts.

Like the service building of the previous generation, the new system primarily aided landlords in transferring the cost of heating and hot water to individual consumers. Like Termax, Sbox was part of an independently developed technological system marketed to landlords and housing managers rather than homeowners or tenants. Also, like Termax, the system was poised for expansion; it could, for example, be fitted with an alarm that would notify caretakers if there was no movement in an occupied flat. The built-in microphone could put the tenant in contact with the landlord or the neighbours. It also permitted local businesses to advertise products directly to local Sboxes (in tenants’ homes).⁴³

The Sbox was tested in eighteen flats in Vällingby and in sixteen flats in Kortedala, Gothenburg. The outcome of these tests remains unclear.⁴⁴ After a

trial year, a Vällingby resident was interviewed by a technology magazine. He expressed mild curiosity about the functions but noted that he did not really need them and could not imagine paying for them, although he did think that they might potentially be of use to someone else.⁴⁵ Bostadsbolaget, the public housing corporation that owned the Gothenburg flats, purportedly planned to expand installations of the Sbox to other areas.⁴⁶ In response to a request for further information, Bostadsbolaget replied that no evaluation existed, that the Sboxes in Kortedala had been removed, and that they were unlikely to be implemented elsewhere.⁴⁷

Sbox extended the landlord’s reach into tenants’ flats, with a different focus than Poseidon’s customer-centred approach in Högsbohöjd. Arguably, Sbox entailed a return to management-oriented smart housing while on the surface resembling a consumer-oriented system— although it is admittedly difficult to draw any clear border.

Stage four: 2011–2013

After Sbox, smart housing projects shifted from landlords to utility companies developing smart grids designed to extend all the way from the power plant to the appliances in tenants’ homes. The smart grid has two aims: to extend power production to new entities, such as buildings with photovoltaic cells, which can become small-scale power plants, and to distribute system loads evenly across the day – so-called load shifting – to smooth out peaks and valleys in the demand for electricity and avoid overcapacity in the power grid.⁴⁸ In practice, this would mean a far-reaching coordination of every link in that chain, from the powerplant via the building to the tenant’s dishwasher, so that it runs when the energy load is low. The tenant’s relationship to the power company is mediated via the landlord, who oversees the building’s energy production and consumption. The smart grid, in other words, connects city, building, and home. In Sweden, the first smart grid experiment was a multi-stage project running from 2009–2018 dubbed the



Fig. 3: Manodo deputy CEO Johan Stråkander presents the Sbox. Originally published in *Dagens Industri*, 13 December 2007. Photo: Marie Ullnert.

Fig. 4: Sbox in use in Vällingby. The smiley indicates whether the tenant has been good or bad. Originally published in *M3*, 15 December 2009.

Active House.⁴⁹ For the system to work along the entire chain, appliances in tenants' flats had to be updated to smart appliances that can compensate the system loads, and tenants would find themselves in smart homes over which they had very limited control. The technology is similar to that in the smart home, but again, it is not installed for the resident's convenience.

The smart grid concept was developed for the green flagship development Stockholm Royal Seaport.⁵⁰ The group of actors behind the project sought to test the smart solutions in one thoroughly equipped rental flat in the area, complete with appliances developed for the purpose by Electrolux. The project group advertised for volunteer families through a leaflet with a familiar call: 'Try living in the future now!' The conditions involved living in the flat for a period of two years (2013–2015) and paying partially subsidised rent for the duration of the experiment. A family of four was selected, and they embarked on their real-life experiment as pioneers with high expectations.⁵¹ [Fig. 5] The results were underwhelming, bordering on the farcical. The project was abandoned after six months, when the family had lowered their monthly energy consumption by only 2.5 per cent and saved a total of 74 SEK, approximately €7.⁵² The family reported that the house was 'active' in unexpected ways, reminiscent of the kitchen scene in *Mon Oncle*: the oven was connected to motion sensors and turned off when one left the room, so that one family member had to remain in the kitchen and in motion in order for the oven to work; the system's 'away' switch erased all settings on all electronic equipment of its own accord, and so on. Altogether, these strange malfunctions made life difficult for the inhabitants, who had to adapt their lives to appease the unexpected whims of the smart technology.

The Active House employed technologies that resembled smart home technologies, but control of data and of functions were removed from the tenant, and the technological nightmare of pop cultural portrayals were suddenly very close. Smart

housing, again, seems more concerned with disciplining the tenant than with liberating them from chores and unnecessary costs. Even if this is a highly specific case, it is worth noting that the tenant here becomes increasingly dependent not only on the landlord, but also on the landlord's business partners, a relationship over which the tenant does not necessarily have direct influence if the project is implemented on a larger scale.

Stage five: 2015–2017

The Active House is enabled by digital technology and smart equipment integrated into one smart home system, used to create awareness and ultimately behavioural change for a more comfortable and sustainable way of life.⁵³

A second, expanded phase of the Active House was initiated in 2015, also in Stockholm Royal Seaport. A special interface, the Tingco panel, was developed and mounted in the hallway of each flat. Via the panel, residents could monitor their electricity, hot water and heat consumption.⁵⁴ It also allowed residents to change the temperature and adjust the lighting in the flat. A promotional video for the project shows the male resident cannily lowering both lights and temperature in his flat in preparing to receive a female dining companion.⁵⁵ [Fig. 6] The panel was not only marketed primarily to male users, residents participating in the tests also perceived it as a distinctly male gadget.⁵⁶ In this sense, it reproduced the gender bias that feminist scholars have critiqued for over thirty years.⁵⁷ The project specifically targeted affluent, educated residents, and the logic was that they were likely early adopters and were savvy enough to engage with the technology. The panels were introduced in 154 households in new-build owned and rented housing for the duration of 2017.⁵⁸ Anders Nilsson, a researcher involved in the project, explains that residents were recruited for the trial by the property developer or property managers, and tenants embarked on the limited trial upon signing the contract for the flat.⁵⁹



Fig. 5: The test family in the first phase of The Active House. Originally published in *Dagens Nyheter*, 21 March 2013. Photo: Lars Lindqvist.

Fig. 6: Still from *Smart Energy City*; the protagonist buttoning up his shirt before of the arrival of his date. The caption reads: 'Lower the temperature in your flat'. The Tingco panel is visible, out of focus, on the left.

Results were mixed. There was a mean value decrease of 10 per cent in electricity consumption, while mean value hot water consumption increased by 18 per cent compared to a control group.⁶⁰ Nilsson notes that these results would not necessarily be stable over time, as novelty value had contributed to augmented use, nor would the results be transferrable to any other setting, as the target group had been selected to have maximum impact. Some households did save energy, primarily singles and couples, whereas families' energy footprint increased. The researchers involved in the project set up two different groups: one was incentivised by reduced costs, and the other was encouraged to live more sustainably. Neither group seemed to reduce their consumption in any substantial way; however, on average, the group incentivised by lower costs saved slightly more than those motivated by ethical concerns.⁶¹ The test was discontinued at the end of the testing period due to a lack of interest from the residents.

A second installation of Tingco panels took place around the same time in fifty-four flats in Valla torg, an existing run-down housing estate owned by a public housing corporation in southern Stockholm in 2017.⁶² This was part of the EU-funded programme *Grow Smarter*, for which Stockholm was a 'lighthouse city'.⁶³ The flats were part of a larger refurbishment of the council estate in which some three hundred flats, mostly inhabited by middle-aged and elderly tenants, were refurbished. The refurbishment led to significant rent increases in the existing housing stock, and tenants formed a protest movement where they occupied a local building to organise their resistance to the refurbishment.⁶⁴ The Tingco panels installed here, along with other smart systems – including the weighing and documentation of each flat's household waste – were put in place despite the very loud protests of tenants. The project was ultimately discontinued due to tenants' resistance.⁶⁵ When asked, some tenants said they had thrown away the Tingco device as they saw no point to it.

In the different approaches between the flagship development and the existing public housing, a difference between smart housing and the smart home clearly emerges. When housing goes smart, it tends to reinforce social inequality. What is introduced as an interesting gadget for one social group can be understood as a means of surveillance and a tool to raise rents and motivate renoeviction by another. Smart housing, in this sense, is far from equal.

Conclusions

Before moving on to my conclusions, I would like to repeat that this article is by no means an exhaustive list of smart housing projects in Sweden. For different reasons, I have omitted several projects: IT-BO (Vällingby & Landskrona, 1993–1999), Diligensen (Gävle, 2000), Vallgossen (Stockholm, 2000), Ringblomman (Stockholm, 2001), BO-IT (Skövde, 2001), Tango (Malmö, 2001), and Sverre (Uppsala, 2001), to name a few. I have also omitted projects directly aimed at digitalising assisted living, which is a field of research closely related to smart housing. In this article, I have favoured projects focused on changing the role of the landlord, and on the transformation of the relationship between tenant and landlord.

What conclusions, then, can be drawn from the projects analysed in this article? What do they tell us about the digitalisation of the dwelling? The first thing to note is that smart housing differs in kind from the smart home, even if the technologies involved are closely related. By moving choice and, to a varying degree, control from the tenant to the landlord (or power supplier), smart technology changes the relationship between tenant and landlord and transgresses the boundaries of the home. While smart home technologies, like digital assistants or smart phones, divulge one's private information to a corporation, that is the individual's choice. In smart housing, one's landlord and their tech partners acquire real-time information about one's habits in an imposed transgression of the sovereignty of the

home. The issue of privacy is thus fundamentally different in smart housing than in discussions of the smart home. The outcome where a landlord's power supplier can monitor an individual's activities at home seems especially dystopian in times of geopolitical upheaval where government-owned multi-national power companies function as extensions of the nation states behind them.

A second conclusion is that the digitalisation of the dwelling is a multi-faceted process with different actors starting out with different aims and motives. We are better served by approaching the digitalisation of the dwelling not as a single process, but as several digitalisations converging on the dwelling from different directions. Where the smart home serves the homeowner or tenant, smart housing concerns a range of different actors whose interests intersect in the multi-household residential building. This adds layers of complexity to the digital dwelling as it is now and will be developed in the future, introducing new alliances and new relationships between actors in the construction and management of multi-household residential buildings.

Third, the sequence of smart housing projects in renovations of 1960s housing blocks shows that smart housing remains controversial. As soon as ambitions exceed the bounds of a limited experiment, tenants have resisted the implementation of smart technology, from sabotage through cutting the wires of the Termax thermostat to the squatting of buildings by tenants to protest the upgrading of their homes in Valla torg some thirty years later. It is fair to suggest that tenants generally do not share their landlords' vision of smart housing. The digitalisation of the dwelling may be optional for the homeowner, but it is mandatory for the tenant and is often installed against their explicit wishes.

A fourth point to note is the repeated failure to generate the desired behavioural change in tenants. The emphasis on innovation in the field of anything smart, where the focus is on the future, means that there is an active failure to learn from previous attempts to approach similar problems.

As Junestrand and Keijer noted some twenty-five years ago, the problem is not the technology, but that the products and solutions need to connect with the end-users, here the tenants, who often find themselves in the shadow of the technology used and unable to affect it.⁶⁶

A fifth conclusion is that digitalisations of the dwelling differ in its application among different social groups, not only in terms of whether installation is voluntary or not, but also in that the installed equipment serves different purposes. Where the smart home is intended for the homeowner and designed to make their everyday life more efficient and leisurely, smart housing more often aims to optimise housing management and by extension, tenants' interaction with the building's infrastructure. On the rare occasion that a smart housing solution is introduced in a co-op-owned flat or an upmarket rental, the approach is softer, participation voluntary and presented as an experiment for a limited time, rather than a permanent fixture; the different ways of introducing the Tingco panels in the affluent Stockholm Royal Seaport and the run-down housing blocks around Valla torg illustrate this. In this sense, there are different digitalisations for different socio-economical groups that mean different things. Digitalisation offers the homeowner convenience and leisure, and surveillance is a hypothetical risk, while the tenant comes under direct surveillance, often by their own landlord, and is in many cases expected to live their life in specific ways. In the first case, personal data is used to sell the homeowner things, in the second, it is employed to (micro)manage the life of the tenant. This type of micromanagement echoes the control of Amazon's warehouse workers and workers in the gig-economy at large, and as a development, it is permeating more workplaces and home offices in the post-pandemic world.⁶⁷ Perhaps the future of the digital dwelling is more about learning to appease motion sensors than the vision of a homeowner of the future luxuriating in their smart home.

Notes

- Every effort has been made to obtain authorisation for the use of all copyrighted material in this article. We apologise for any inadvertent omissions and would be pleased to insert the appropriate acknowledgment in the digital edition of this publication.
1. Lynn Spigel, 'Designing the Smart House: Posthuman Domesticity and Conspicuous Production', *European Journal of Cultural Studies* 8, no. 4 (2005): 403–26.
 2. Stefan Junestrand and Ulf Keijer, 'Bostaden i informationssamhället: Ett arkitekturperspektiv', in *Informationsteknologi i projektering och förvaltning* (Stockholm: KTH, 1998), 13; my translation.
 3. Examples include: Deborah Chambers, *Changing Media, Homes and Households: Cultures, Technologies and Meanings* (London: Routledge, 2016); Frances K. Aldrich, 'Smart Homes: Past, Present and Future', in *Inside the Smart Home*, ed. Richard Harper (London: Springer, 2003), 17–39. Others speak of the smart house, where the focus is on telecommunication capabilities; see Spigel, 'Designing the Smart House'. Even broader overviews of the social effects of digitalisation tend to focus on the private home and the public spaces of the city, omitting housing. See, for instance, Stephen Graham and Simon Marvin, *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition* (London: Routledge, 2001).
 4. Anne-Jorunn Berg, 'The Smart House as a Gendered Socio-Technical Construction' (Trondheim: Centre for Technology and Society, University of Trondheim, 1992), https://www.ntnu.no/c/document_library/get_file?uuid=b77e6da1-2511-4d43-a390-33d61b378e28&groupId=10265; Anne-Jorunn Berg, 'Technological Flexibility: Bringing Gender into Technology (or Was It the Other Way Round?)', in *Bringing Technology Home: Gender and Technology in a Changing Europe*, ed. Cynthia Cockburn and Ruža Fürst-Dilić (Buckingham: Open University Press, 1994), 94–110.
 5. There is a growing body of literature focused on smart housing from a perspective of platform capitalism; this literature focuses on contemporary conditions, not historical accounts. See, for instance, Sophia Maalsen, 'Smart Housing: The Political and Market Responses of the Intersections between Housing, New Sharing Economies and Smart Cities', *Cities* 84 (1 January 2019): 1–7; Sophia Maalsen, "'We're the Cheap Smart Home": The Actually Existing Smart Home as Rented and Shared', *Social and Cultural Geography* 24, no. 8 (2023): 1383–1401; Desiree Fields, 'Automated Landlord: Digital Technologies and Post-Crisis Financial Accumulation', *EPA: Economy and Space* 54, no. 1 (2019): 160–81; Desiree Fields and Dallas Rogers, 'Towards a Critical Housing Studies Research Agenda on Platform Real Estate', *Housing, Theory and Society* 38, no. 1 (2021): 72–94.
 6. I build here on a study mapping Swedish housing with landlord-installed technology to manage their relations with tenants. Since this subject has not been researched widely, my study relies on a form of snowball sampling within six different archives and databases: 1) The archive of Bygghälsögruppen (The Building Research Council), a national construction-research-oriented institution that published reports on all research relating to construction until the council was disbanded in 2000. 2) The archive of reports from abroad by the Swedish science attachés at embassies around the world. These reported on developments in other countries, including early smart housing experiments in other European countries, and provide both terminology and a sense of when novel developments occurred. 3) The archive of the Institute for Futures Studies (formerly the Secretariat for Futures Studies), which conducted speculative research aiming to anticipate effects of computers on daily life in the early 1980s. 4) The archive of daily and professional press (using Media Retriever and the Royal Library's database). 5) Broader library and research catalogues (Royal Library and DiVA) to capture research that falls outside of the narrow focus of Bygghälsögruppen. 6) The database of the Swedish Intellectual Property Office for information about patents taken out for specific technological devices developed for smart housing purposes.

7. Sweden has also collaborated with other European nations, notably France, on similar programmes. See Bachir Mekibes, *Informationsteknologi i vardagslivet: Franska erfarenheter i svenskt perspektiv* (Stockholm: KTH, 1994).
8. According to public statistics, 58 per cent of dwellings in multi-household buildings are currently rented. In 257 of a total of 290 municipalities, rental housing is the dominant form of tenancy in multi-household buildings. Public housing corporations own 26 per cent of all multi-household building dwellings. SCB, 'Nästan 5,1 miljoner bostäder i landet', Statistiska Centralbyrån, 2022, <http://www.scb.se/hitta-statistik/statistik-efter-amne/boende-byggande-och-bebyggelse/bostadsbyggande-och-ombyggnad/bostadsbestand/pong/statistiknyhet/bostadsbestandet-31-december-2021/>.
9. There are partial mappings, notable among which are Lennart Berndtsson's mapping of individual metering of heating and hot water, and later publications by Boverket, as well as mappings by researchers like Simon Siggelsten, although these focus on individual measuring and billing rather than the use of IT in the process. A better example is perhaps Anna Hrdlicka's interviews with public housing developers engaged in smart housing projects around the year 2000. See Lennart Berndtsson, 'Individuell värmemätning i svenska flerbostadshus' (Stockholm: Statens energimyndighet, 2003); Lennart Berndtsson, 'Individuell mätning av värme och varmvatten i flerbostadshus' (Karlskrona: Boverket, 2005); Boverket, 'Individuell mätning och debitering i befintlig bebyggelse' (Karlskrona: Boverket, 2015); Simon Siggelsten and Stefan Olander, 'Individual Metering and Charging of Heat and Hot Water in Swedish Housing Cooperatives', *Energy Policy* 61 (1 October 2013): 874–80; Simon Siggelsten, *Individual Metering and Charging of Heat and Hot Water in Multi-Apartment Buildings* (Lund: Lund University, 2015); Anna Hrdlicka, *Den breda vägen: Vision – verklighet – vision: En betraktelse över bredband och bredbandstjänster i boendet i Sverige under 1990-talet* (Stockholm: Institutet för framtidsstudier, 2004).
10. Sigfried Giedion, *Mechanization Takes Command: A Contribution to Anonymous History* (Minneapolis: University of Minnesota Press, 2013).
11. Reyner Banham, *The Architecture of the Well-Tempered Environment* (London: The Architectural Press, 1969), 15–16.
12. Rem Koolhaas, James Westcott, and Stephan Petermann, eds., *Elements of Architecture* (Milan: Marsilio, 2014).
13. While there have been various uses of the term 'smart' since the 1980s, the notion of a 'smarter city' was introduced in 2011 by IBM, while the 'smart home' was introduced in 1984 by the National Homebuilder's Association. Germaine Halegoua, *Smart Cities* (MIT Press, 2020); Frances K. Aldrich, 'Smart Homes: Past, Present and Future', in *Inside the Smart Home*, ed. Richard Harper (London: Springer, 2003), 17–39.
14. Rem Koolhaas, 'The Smart Landscape: Intelligent Architecture', *Artforum* 53, no. 8 (2015): 212–17. Koolhaas extrapolates his ideas about smartness from the research in preparation for the *Elements of Architecture* exhibition a year prior.
15. The more prominent works that do engage with smartness include: Justin McGuirk, 'Honeywell, I'm Home! The Internet of Things and the New Domestic Landscape', *E-Flux*, April 2015, <https://www.e-flux.com/journal/64/60855/honeywell-i-m-home-the-internet-of-things-and-the-new-domestic-landscape/>; Sergio M. Figueiredo, Sukanya Krishnamurthy, and Torsten Schroeder, *Architecture and the Smart City* (Abingdon: Routledge, 2020); Antoine Picon, *Smart Cities: A Spatialised Intelligence* (Chichester: John Wiley & Sons, 2015); Orit Halpern, Robert Mitchell, and Bernard Dionysius Geoghegan, 'The Smartness Mandate: Notes toward a Critique', *Grey Room* 68 (September 2017): 106–29.
16. Rem Koolhaas and Kayoko Ota, eds., *AMO Post-Occupancy* (Milan: Domus d'Autore, 2006); Ila Bêka and Louise Lemoine, *Koolhaas Houselife* (Bêka & Lemoine, 2008).
17. The difficulty of pinpointing a starting point is apparent in the very title of one of the publications

- in CCA's research programme Archaeology of the Digital: Andrew Goodhouse, ed., *When Is the Digital in Architecture?* (Montréal: CCA, 2017).
18. Examples include: the 'psychotropic house' in J.G. Ballard's story 'The Thousand Dreams of Stellavista', in Ballard, *Vermilion Sands* (New York: Berkley, 1971) and Jacques Tati, dir., *Mon Oncle* (Specta Films, 1959). Positive projections of the future home include the exhibitions of Ugo la Pietra's 'Casa Telematica', see Hans Teerds, 'La Casa Telematica Milan (IT): Ugo La Pietra', *DASH | Delft Architectural Studies on Housing* 11 (2015): 136–41, the House of the Future by Peter and Alison Smithson for the *Daily Mail* (1956); see Dirk van den Heuvel, *Alison and Peter Smithson: A Brutalist Story Involving the House, the City and the Everyday (plus a Couple of Other Things)* (Delft: TU Delft, 2013); Beatriz Colomina, 'Unbreathed Air 1956', *Grey Room* 15 (2004): 28–59. Going back even further, we find the Dymaxion House by Buckminster Fuller (1927) and Le Corbusier's L'Esprit Nouveau pavilion (1925).
 19. Roy Mason, Lane Jennings and Robert Evans, *Xanadu: The Computerized Home of Tomorrow and How It Can Be Yours TODAY!* (Washington, DC: Acropolis Books, 1983).
 20. Chambers, *Changing Media, Homes and Households*, 155.
 21. At the time, the *New York Times* wrote: 'intelligent in this case means that each building's services will be orchestrated by a computer system and linked by a fiber-optic network – a trademarked system called a "Data Highway" – running through its core. Functions such as heating, ventilation, lighting, transportation, security, fire protection and, most important, telecommunications and electronic office services will be integrated, providing economies in construction and management.' Steven J. Marcus, 'The "Intelligent" Buildings', *The New York Times*, 1 December 1983; Ronald Fernandez, *Excess Profits: The Rise of United Technologies* (Boston: Addison-Wesley, 1983); Thomas Fisher, 'Intelligent Architecture', *Progressive Architecture* (May 1984): 167–72. The intelligent building discourse was introduced in Sweden on a broader level in the early 1990s: Anders Ewerman, *Intelligent hus: state of the art 1992* (Stockholm : Statens råd för byggnadsforskning, 1992); Arne Rejdin, *Fastighetsförvaltning med användning av informationsteknologi* (Stockholm: Byggnadsforskningsrådet, 1994).
 22. Smart housing as a concept has different definitions. While the smart home and the intelligent building were defined by corporations or corporate interest groups with a client in mind, smart housing as a concept has no intended buyer, but is rather an analytical category used by researchers. The definition of smart housing I propose here is that smart housing is marked by the convergence of smart technology (computerised meters and sensors installed by the landlords in the flats of the tenants to help manage their relationship with the tenant) and housing. Another definition is proposed by Sophia Maalsen, who investigates the intersection of smart technologies and the housing market. Maalsen, 'Smart Housing', 1.
 23. Spigel, 'Designing the Smart House', 421.
 24. From the early period, these include: IT-BO (Vällingby & Landskrona, 1993–1999), Vallgossen (Stockholm, 2000), Ringblomman (Stockholm, 2001), BO-IT (Skövde, 2001), Tango (Malmö, 2001), Sverre (Uppsala, 2001), Diligensen (Gävle, 2000). After 2010, there is a sharp increase in projects of this kind as micro controllers have become more accessible and easier to programme.
 25. In 1985, the public housing corporations owned approximately 37 per cent of all dwellings in multi-household buildings (excluding single family homes – *lägenheter i småhus* – from the statistics). SCB, *Statistisk Årsbok 1990: Statistical Abstract of Sweden*, Statistisk årsbok för Sverige (Stockholm: SCB, 1990), 121, [https://share.scb.se/ov9993/data/historisk%20statistik/SOS%201911-/Statistisk%20%C3%A5rsbok%20\(SOS\)%201914-2014/Statistisk-arsbok-for-Sverige-1990.pdf](https://share.scb.se/ov9993/data/historisk%20statistik/SOS%201911-/Statistisk%20%C3%A5rsbok%20(SOS)%201914-2014/Statistisk-arsbok-for-Sverige-1990.pdf).
 26. Rune Buresten et al., *Datoriserade styr-, regler- och övervakningssystem utrustning för AB Göteborgshems värmeförsörjning på Hisingen i*

- Göteborg (Stockholm: Statens råd för byggnadsforskning, 1981), <http://hdl.handle.net/2077/46411>; Värmemätning utredningen, 'Mätning och debitering av varmvatten: Principbetänkande från värmemätning utredningen' (Stockholm: Liber Förlag, 1983).
27. Simon Siggelsten and Bengt Hansson, 'Incentives for Individual Metering and Charging', *Journal of Facilities Management* 8, no. 4 (2010): 299–307.
 28. Norbert Wiener, *Cybernetics or Control and Communication in the Animal and the Machine* (Cambridge, MA: The MIT Press, 1948), 96.
 29. Sven Hedly, 'Sätt och anordning för styrning av temperaturen i uppvärmbara lokaler', Swedish Patent Database, Patent SE 8002576-0, SE 435974, PRV SE 8002576-0 (Lerum, filed 3 April 1980, and issued 29 October 1984).
 30. Göteborgsposten, 'Snillrik elektronisk apparat ger varje lägenhet sin värme', *Göteborgsposten*, 22 May 1984.
 31. Ibid.
 32. Berndtsson, 'Individuell värmemätning', 69–70.
 33. Compare with Gilles Deleuze's discussion on cybernetics in 'dividuals' and 'dividuation'. Deleuze contrasts the individual who is indivisible with the dividual, who is made separate and no longer part of a group through the use of technology that functions like a gas, filling the space between people. Gilles Deleuze, 'Postscript on the Societies of Control', *October* 59 (1992): 3–7.
 34. This is an extremely brief summary of a complex chain of events. For a more detailed overview, see: Boverket, 'A History of the Swedish System of Non-Profit Municipal Housing' (Karlskrona: Boverket, 2008); Karin Grundström and Irene Molina, 'From Folkhem to Lifestyle Housing in Sweden: Segregation and Urban Form, 1930s–2010s', *International Journal of Housing Policy* 16, no. 3 (2016): 316–36.
 35. In the following, I skip over one of the most-discussed examples of smart housing in Sweden, IT-Bo, conducted in Stockholm in the mid-1990s. Because the project seems to have been conducted principally as an experiment, without any clear landlord-initiated agenda, I omit it from this study. For more on this project, see: Magnus Hunhammar, *Utveckling av IT-baserad boendeservice: Ett design-teoretiskt perspektiv* (Stockholm: KTH, 1998). For an overview of smart projects from these years in public housing, see: Hrdlicka, *Den breda vägen*. Privately initiated smart new-build projects at this time have been analysed in Greger Sandström, *Smarta hem: Köpmotiv och nytta* (Stockholm: KTH, 2003).
 36. Hrdlicka, *Den breda vägen*, 75.
 37. Håkan Boström, 'De bor i Sveriges första IT-hyreshus', *GT/Expressen*, 16 September 2000; Malin Clausson, 'Uttag överallt: utom på toa', *Göteborgsposten*, 6 September 2000; Ola Nylander, "'IT-huset": är det framtidens bostad?', *GT/Expressen*, 6 July 2000.
 38. H-J Håkansson, 'Poseidon bygger för ett fåtal', *Göteborgsposten*, 11 January 2000; Lena Larsson, 'Poseidon bygger för alla', *Göteborgsposten*, 18 January 2000.
 39. This system was developed by Gothenburg-based KTC.
 40. Berndtsson, 'Individuell värmemätning', 71.
 41. Ibid.
 42. Kjell Löfberg, 'Smarta hus en rejäl flopp', *Dagens Nyheter*, 28 February 2004.
 43. Gunilla Skoog, 'Ny dator kan spara vatten och elektricitet', *Göteborgsposten*, 9 November 2007.
 44. This experiment was expanded in a second stage 2009, when another ninety-four flats were fitted with Sboxes, and it appears to have been included in the lifestyle concept Next Step Living, an early co-living experiment conducted by Bostadsbolaget in 2010.
 45. Elin Blom, 'Sbox: En guide till ett smartare hem', *M3*, 15 December 2009, <https://m3.idg.se/2.1022/1.279236/sbox--en-guide-till-ett-smartare-hem>.
 46. Manodo, 'Manodo SBox sköter kommunikationen i Bostadsbolagets nya boendekoncept', 10 September 2010.
 47. Private email correspondence with Bostadsbolaget, 2022.
 48. Fortum et al., 'Stockholm Royal Seaport, Urban Smart Grid Pre-Study (Final Report Summary)',

- 2011, 18; Sarah J. Darby, 'Smart Technology in the Home: Time for More Clarity', *Building Research & Information* 46, no. 1 (2018): 140–47.
49. Corporations included in the first stage of the Active House involved: Fortum, ABB and Electrolux in cooperation with developers, researchers, and the National Energy Agency. Fortum et al., 'Urban Smart Grid Pre-Study'.
 50. For the background of the development project, see Jon Loit, *En stad i världsklass: Hur och för vem? En studie om Stockholms sociala stadsplanering* (Uppsala: Uppsala universitet, 2014).
 51. Lisa Näs, 'Deras lägenhet är ett forskningsprojekt', *Dagens Nyheter*, 21 March 2013.
 52. Helen Ahlbom, 'Smarta fiaskot för prestigebygget i Norra Djurgårdsstaden', *Ny Teknik*, 14 February 2015, <https://www.nyteknik.se/nyheter/smarta-fiaskot-for-prestigebygget-i-norra-djurgardsstaden-6336033>.
 53. Fortum et al., 'Smart Energy City: Final Report – Stockholm Royal Seaport' (Stockholm, 2018), 19.
 54. I use the word resident here as this project involved both rented and co-op-owned flats. In Stockholm Royal Seaport, the building was heated by water-based district heating, which meant heating was shown at the building level rather than at household level. Anders Nilsson et al., 'Smart Homes, Home Energy Management Systems and Real-Time Feedback: Lessons for Influencing Household Energy Consumption from a Swedish Field Study', *Energy and Buildings* 179 (15 November 2018): 17.
 55. ABB Sverige, *Smart Energy City: Ett unikt forskningsprogram för energianvändning i smarta städer*, 2016, <https://www.youtube.com/watch?v=LrRzf34WEIY>.
 56. Nilsson et al., 'Smart Homes', 21.
 57. See: Berg, 'The Smart House as a Gendered Socio-Technical Construction'; Berg, 'Technological Flexibility'.
 58. Of these, eighty-two were co-op-owned flats and seventy-two were rented. The project was divided into two separate parts; Active House was one part and the other focused on the power grid itself. See Fortum et al., 'Smart Energy City: Final Report'.
 59. Nilsson et al., 'Smart Homes', 17.
 60. *Ibid.*, 23.
 61. *Ibid.*
 62. Grow Smarter, 'D5.4 Final Report on Results of Technical and Social Validation' (European Union, 2019), https://grow-smarter.eu/fileadmin/editor-upload/Reports/GrowSmarter_Validation.pdf.
 63. Grow Smarter was an EU-funded Horizon 2020 project that ran from 2015 to 2019, involving 'lighthouse cities' like Stockholm, Barcelona, and Cologne. It consisted of several projects in Stockholm and elsewhere. See European Commission, 'GrowSmarter Project: Fact Sheet H2020', CORDIS, 2020, <https://cordis.europa.eu/project/id/646456>.
 64. Jessica Ritzén, 'Hyresprotesterna på Valla torg fortsätter', *Dagens Nyheter*, 9 November 2015.
 65. Stockholmshem, 'Års- och hållbarhetsredovisning 2019' (Stockholm: Stockholmshem, 2019).
 66. Junestrand and Keijer, 'Bostaden i informationssamhället', 13.
 67. Workplace monitoring seems to be rapidly spreading to new arenas, and we may be facing a situation where different types of housing increasingly become the objects of surveillance. Christopher Mims, 'The Way Amazon Uses Tech to Squeeze Performance Out of Workers Deserves Its Own Name: Bezosism', *Wall Street Journal*, 11 September 2021, <https://www.wsj.com/articles/the-way-amazon-uses-tech-to-squeeze-performance-out-of-workers-deserves-its-own-name-bezosism-11631332821>; Danielle Abril and Drew Harwell, 'Keystroke Tracking, Screenshots, and Facial Recognition: The Boss May Be Watching Long after the Pandemic Ends', *The Washington Post*, 24 September 2021, <https://www.washingtonpost.com/technology/2021/09/24/remote-work-from-home-surveillance/>.

Biography:

Fredrik Torisson is a post-doctoral researcher at the Institute for Urban Research at Malmö University. His research can be placed within the fields of architectural and urban history and architectural theory. He is particularly interested in the intersections of material, financial, technological, legal, social, and ideological aspects of architectural production.

