Responsive Architecture: The home to come

Research paper - Draft

With the help of:
Victor Muñoz Sanz (Research)
Georg Vrachliotis (Design)
Georgios Karvelas (Building Technology)

AR3A010 — Research Plan
Under the Explore Lab

Delft University of Technology
Faculty of Architecture
February 2023

Samuel Slezák (5398495)

INDEX

Responsive Architecture: The home to come

Abstract

Artificial intelligence technology is gradually making its way into people's daily lives, including their homes. This raises the question of; what new spatial implication of the home can arise from the integration of artificially intelligent technologies and what role AI technologies can play in reinforcing social interaction among humans and between humans and machines? This paper does not portray what is to come. Instead, it imagines a fictitious future of the possible development of selected technologies and their spatial impacts on the domestic environments through designing them. The aim is to provoke a discussion that tests and explores core values that can be adopted or avoided in the future. Through this process, these novel technologies brought about by AI can be imagined and discussed to increase their chances of bringing about a positive impact.

Introduction

Machine intelligence in architecture evolved from an obscure topic of discussion in the 1970s and 80s to a topic of primary interest in contemporary architectural discourse centred on data and its application in design. The deep learning revolution has hastened the adoption of smart technologies in the domestic environment, owing to the involvement of companies like Apple, Amazon, Google, and others. However, architects' interest in designing and developing these technologies as part of their designs is limited to a handful of architectural professionals with a primary focus on art, digital manufacturing and creators of urban platforms. These architects are continuing the legacy of architects' participation in the design

of technology that reaches beyond the contemporary idea of a smart device. AI-based technologies create an opportunity for architects to bridge the physical and digital order and facilitate social interactions between people and even machines. Furthermore, these technologies open up a new perspective on machines' role in domestic life beyond serving and maintaining the home.

Technology and architecture

The smart home may be one where you have to deal with a clothing rack that constantly criticising your fashion choices, a door that emits an encouraging sigh as it opens and welcomes us home after a long day, or a Romba-like servant who is depressed because his model is being discontinued. So far, such a portrayal of our homes seems futuristic, yet, it might not be so distant. Machine learning technology has established itself within our daily lives, including our most private space — our home. The advancements in computational technologies have allowed the 'intelligent' machines to learn faster, helping them to deal with increasingly more complex tasks. The integration of smart and intelligent technology in architecture has been discussed since the late 1960s. However, AI technology has become more prevalent through smart off-the-shelf devices like phones, watches and sensors. Nevertheless, a more conscious integration of intelligent technologies outside the scope of serving the human or maintaining the home is still absent in architectural design, apart from a few rare projects, speculations and academia.

The application of AI technologies in architecture practice seems distant, given architecture's slow adoption of technologies.[1] Architects, particularly those in practice, remain mostly consumers of technology rather than its makers. Drafting, modelling, and optimisation software has become a standard in most practices. Grasshopper, in particular, enabled firms and individuals to utilise optimisation and simulation tools at low costs. Nevertheless, the responsibility for developing the technology that is progressively becoming part of buildings' design is progressively being outsourced.

1 Reyner Banham, The Architecture of the Well-Tempered Environment, 2nd ed (Chicago: University of Chicago Press, 1984).

Despite adopting digital tools that allowed for more complex and efficient designs, architects' agency in building design appears to be diminishing. In its 2014 Venice Biennale installation, OMA demonstrated how much of an architect's work is outside his hands.[2] One of the exhibition pieces that demonstrated the shift is a ceiling fragment. This demonstrates that the ceiling acquired three-dimensionality, consisting of a large inaccessible section used as storage space for HVAC, plumbing, wiring, and surveillance devices. The shift in architects' authority raises a question of how architects will position themselves in integrating new technology into architecture. One stance is to continue the existing trend of architects increasingly serving as consultants to clients and engineers.[3]Alternatively, architects (re)claim their identity as makers of technology as part of their design profession to reclaim their authority in the building process.[4]

Corporations like Apple, Google, and Amazon have already demonstrated the potential of the pocket, wrist, and small-shelf-sized computers that we carry or interact with daily. Many people's sedentary lifestyles are being altered by smartwatches, which manipulate our consciousness and compel us to keep our resolutions to exercise more by constantly monitoring our activity. These AI-based technologies provide a new way of utilising architectural space traditionally viewed as static. This resonates with Cedric Price's project for Generator from the late 1970s, which was an early investigation into artificially intelligent architecture and proposed more responsive environments.[5]

2 OMA, "Venice Biennale 2014: Fundamentals," OMA, accessed October 31, 2022, https://www.oma.com/projects/venice-biennale-2014-fundamentals.

3 Mario Carpo, "The Alternative Science of Computation," accessed November 7, 2022, https://www.e-flux.com/architecture/artificial-labor/142274/the-alternative-science-of-computation/.

4 Alessandro Bava, "Computational Tendencies," e-flux, January 2020, https://www.e-flux.com/architecture/intelligence/310405/computational-tendencies/.

5 Cedric Price, "Generator Project, White Oak, Florida, Untitled. 1978-80," The Museum of Modern Art, accessed November 10, 2022, https://www.moma.org/collection/works/876.

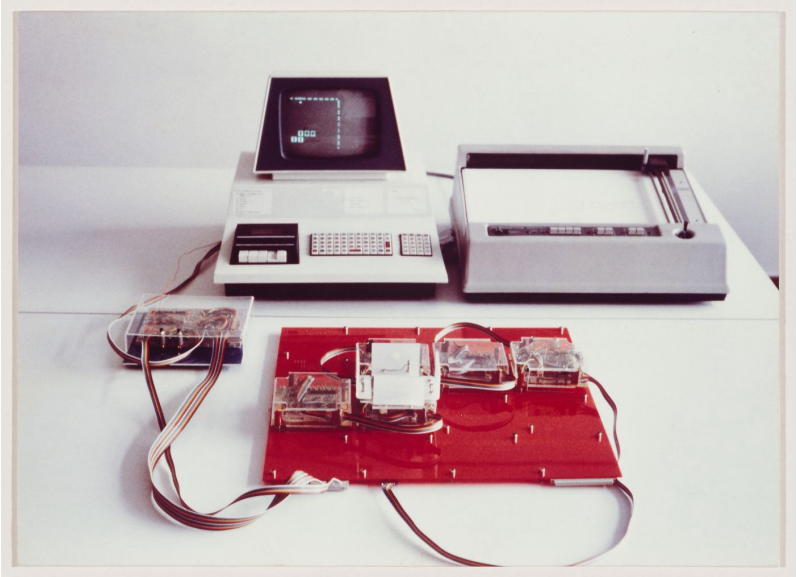


Fig 1 "A menu of individual or collective needs for space, environmental control, protection and enjoyment. A place for work, creation, thought, and reminiscence."
- Cedric Price
Architectural Review, Jan. 1980

Fig 2 What is the agency of an architect in the contemporary design? "Venice Biennale 2014: Fundamentals," OMA, accessed October 31 2022.

Artificial intelligence and responsive environments

Technology has advanced dramatically since the late 1970s & 80s, making the possibility of a responsive architecture much more plausible. The outlook on AI and how it will work has changed drastically. The Cyc Project, developed by Douglas Lenat in 1984, aimed to give computers common sense. Since the focus has shifted to machine learning, the technology behind Siri, Alexa, and Google Translate.[1] Imminently, AI will become a part of daily life and architectural design; designers must understand what the machine is capable of and have the skills required to communicate their intent to the machine.

It is already apparent that AI will have its place in architectural environments, including domestic ones. The practice of Certain Measures illustrates that architects can retain their agency in designing spaces, even though these spaces are becoming more machinic. The installation "HOME IS WHERE THE DROIDS ARE" proposes a design that illustrates the struggles such spaces might pose in the future, where humans and machines co-habit a domestic environment.[2]

Once architects become versed in machine learning, they can begin designing and forming the technology that will be part of the architecture in the near future. This would result in an architecture responsive to its user, context, and environment as necessary. Such architecture would be able to react to its context and manage its environments, and its responsiveness would also extend to ecology. Consequently, responsive architecture will seek a balance between humans on one side and nature on the other.

1 Matthew Hutson, "Can Computers Learn Common Sense?," The New Yorker, April 5, 2022, https://www.newyorker.com/tech/annals-of-technology/can-computers-learn-common-sense.

2 Certain Measures, "HOME IS WHERE THE DROIDS ARE — Certain Measures," 2019, https://certainmeasures.com/CLOUDFILL.

Research Question:

What new spatial implication of the home can arise from the integration of artificially intelligent technologies, and what role can AI technologies play in reinforcing social interaction among humans and between humans and machines?

Fig 3 Certain Measures, "HOME IS WHERE THE DROIDS ARE — Certain Measures," 2019.

Methodology

Speculation is a method of communication of ideas and concepts in architecture or design. At the Royal College of Art in London, Anthony Dunne and Fiona Raby presented speculative design as a method that functions as a "catalyst for collectively redefining our relationship to reality" and considering how things could be.[1] Although the objective of speculative designs is not always to be realised, they may still carry a significant influence. Speculations are typically based on technological or social behaviour and its potential effects on architecture and its users. Design fictions exist in both actual practice and academics, although their proportion in each domain has varied over time. Archigram, 'the Austrian avant-garde,' and Superstudio are all examples of past architecture collectives that effectively tackled a wide range of contemporary social and technical advances in their settings through their design speculations.

However, speculation usually remains in the realm of speculations, with a few notable projects realised by members of the Austrian avant-garde. Usually, the design turn *paleofutures* — scenarios and visions of the future that never come to be. Usually because of too little foresight or failure to predict technologies that overshadow the 'new' ones in the real future. This raises the question of what value is brought to the table through the production of speculative designs and can an approach be chosen so it can reduce its chances of failing.

The approach used in the research borrows from Carlo Ratti's and Matthew Claudel's Futurecraft approach used in their book 'the City of Tomorrow'. Futurecraft employs design as a medium for systematically exploring and germinating possible futures. This approach to predicting the future tries to avoid speculating too far into the distant future, to increase the chance of the prediction becoming a reality, or to attract more productive debate. The future scenarios are usually presented as 'what if?' questions. The aim is not to portray what will come but to imagine a scenario and reflect on its consequences and exigencies. The scenario is then presented and discussed publicly to encourage conservation and debate. The authors explain it as follows:

1 Ratti, Carlo, and Matthew Claudel. The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life. (New Haven ; London: Yale University Press, 2016.), pg. 10

"(W)e propose to extrapolate from the present condition and to place ourselves, as designers, in a fictive but possible future context with the intent of realizing or precluding that future through public discourse."[2]

This research uses the futurecrafting approach. The process studies the evolution of technologies over time and concentrates on how they permeate spheres of life, focusing primarily on the domestic sphere. It then looks at some of the trends these technologies introduce into society and architecture and creates a design based on this prompt. An example of this could be the following prompt: What if smart devices from our homes become the home itself, dropping the structure? Such prompt reflects on the essay 'A Home is not a House' by Reynar Banham and the trends that point to increasing home automation. Another example can be: What if the smartphone becomes our primary form of communication? This prompt is a reaction to the critical voices aimed at the striped mode of communication presented by texting, and it also touches on the 1908 short story Machine Stops by E.M. Foster.

The technologies that this paper highlights are robotics, smart homes, and smartphones, and their evolution, focusing on the most recent couple of decades. These three technologies are selected as ones that are already relevant or are becoming increasingly relevant to the home context. Moreover, these technologies are then analysed with respect to the home. The analysis is done through the study of academic literature, both non-fiction and fiction books, essays, and movies. Resulting of the analysis is the prompt, which offers a starting point for the design. The resulting scenarios are then discussed publicly within the university of TU Delft and with non-specialist people outside the academic environment. Through discussion, debates and exploration, future scenarios are tested to highlight core values that can be adopted or avoided in the future.

1 Ratti, Carlo, and Matthew Claudel. The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life. (New Haven ; London: Yale University Press, 2016.), pg. 10

Part I: Smartphone — Home between reality and virtuality

Sitting around a campfire is an activity of many qualities. It represents certain freedom and rawness that is increasingly more difficult to be found in today's life. The hearth — a centre of a living space where fire can be laid under a certain degree of control. It is a domesticated form of a campfire where humans have sought protection, comfort and social interaction since prehistoric times. According to german architect Gottfried Semper, the hearth was the first element created to constitute architecture. The hearth has stayed relatively untouched through time. However, the hearth as an architectural element has largely disappeared in recent decades.[1] "The psychological centre of the home", as defined by the architect Frank Lloyd Wright, has been transformed through the lens of technology and has split into several elements.

The concept of a hearth is still present in the contemporary home. Nevertheless, it is split into several technologies that avoid some of the drawbacks of the 'original' design. The world now offers plenty of choices to substitute the hearth, yet, some things are dropped for convenience. Nowadays, people have several choices. It is possible to eliminate the smell and dangers caused by smoke through electric induction stoves. The comforting warmth generated through the fire is now more controlled through the central heating. Our culture has elevated the collective and social aspects of eating and conversing around the fire to the dining table. Moreover, finally, the flames can be projected or played on a loop on screen infinitely without the need to add burdensome fuel.

Only some of the technology we have grown used to has altered our lifestyle as much as the smartphone. The smartphone is one of the most impactful technologies of the past decade, and its impact on today's society and its life is unprecedented. Smartphone evolution over the past twenty years has been dramatically successful in reaching a significant percentage of the population. Today as much as 86% of the whole population now own a smartphone, and over 60% use the internet.[2] This increase in access to digital technology and

1 Ratti, Carlo, and Matthew Claudel. The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life. (New Haven ; London: Yale University Press, 2016.), pg. 10

2 Ash Turner, "How Many People Have Smartphones Worldwide (Jan 2023)," July 10, 2018, https://www.bankmycell.com/blog/how-many-phones-are-in-the-world.

the internet has extended our ability as humans — we can now exist seamlessly both in the flesh and virtually.

The smartphone extends the human's cognitive ability. Its ease of use and small size allow us to have it everywhere we are — it has become a part of us. The smartphone became a part of its users' memory by capturing pictures in great detail, including a pinpoint location and exact time in images and metadata. It has made the world available by reifying it into an image.[3] The smartphone has also become many other things; it is an essential navigational tool in everyday life, giving its user the freedom of not knowing their environment. It enables the user to navigate virtually any country around the planet. Moreover, it expanded our knowledge through instant access to the internet of things; most of the human knowledge is now at our fingertips. It is a multi-tool that has made its way into every aspect of life, from waking up, eating, shopping, entertaining, servicing, healing, and practically anything else. As Han describes it in the book Non-Things, humans' relationship with smartphones has almost reached a symbiotic state.

Smartphones have evolved from the concept of networking. It began its development with the telephone, a static telecommunication device usually mounted or connected to a wall (sometimes to the wall of a phone booth) with a cable that permitted two users to conduct a voice conversation over a distance. Further, the phone developed into a more portable mobile phone. The mobile phone gave its user much greater freedom through its portability and introduced new features, such as sending messages, images and videos. However, the most recent advancement — the smartphone, truly changed and unlocked the phone's potential. The smartphone combined the mobile phone with the computer, thus creating a device capable of much more than just telecommunication. Eventually, allowing access to the internet has opened endless options that we may enjoy today, including streaming, social media, and applications. The smartphone's impact on our social life and behaviour is unprecedented by any other technology. The smartphone has become the facilitator of human social interaction beyond any other by utilising the virtual realm of the internet.

3 Byung-Chul Han, Non-Things Upheaval in the Lifeworld, trans. Daniel Steuer (Cambridge: Polity Press, 2022).

The smartphone has introduced a new type of space, complete with its owner's digital self. The relationship between the user and the smartphone is intimate because of the information stored inside its memory and the digital cloud. Yet this space still allows complete anonymity. Further on, the software behind many applications can now 'get to know' its user. This information is mainly used to teach machines how to target corporate adverting to users better. Nevertheless, the potential of using this information to the user's benefit is the next step in machine intelligence.

The smartphone facilitates many activities. However, at its core, it is a device focused on social interaction. In this sense, it is similar to the hearth. The smartphone has become the new virtual "psychological centre of our digital existence". This new reality poses the question of whether there is a possibility of a hybridised space where the digital and physical meet. Each of these realms has its distinct benefits. The digital is instant, omnipresent, and to a large extent, anonymous. The physical is intimate and tangible and easier to control. A more intertwined combination of these two realms is vague, but architectural design can provide the answer to how to bridge these two spaces.

The advent of machine learning algorithms is becoming increasingly frequently used by applications. The devices have become more acquainted with their owners and better at offering and targeting functions or actions their users might be looking for at a given time. This phenomenon is beneficial for something like a home as well. What would a home look like if it was acquainted with its user? It would know when the owner arrives so it can control the temperature accordingly. It might prepare the oven if the owner just paid at the local grocery store with his credit card for a fish or a pre-made meal. The home of the future can also share the memories that the user experienced in it. Hopefully, this system will not work like the one explored in the episode of The Black Mirrors, where the home allowed its owner to replay every single memory they have experienced there. Following the smartphone example, the future home could focus more on social interactions. It might combine physical and virtual

worlds and connect us with our acquaintances for dinner or binge-watch a series. It might remind the user of a dinner from half a year ago to encourage another meeting with friends or family. The home of the future might function as an entity in our network of acquaintances and suggest spontaneous encounters with people who might be a great distance away. Such actions could help the ever-increasing number of people who experience loneliness by connecting people during home activities so that people might be open to sharing with others.

Part II: Robot — Living with a thing

Home is not a House is an essay by Reyner Benham, challenging the notion that a home does not need to be a ground-anchored structure. It criticises that the house has become an assemblage of mechanical services that does not even require the house to hold it up. Benham proposes an alternative mobile home where the house could be an inflated power membrane filled with conditioned air powered by a car. He argues that this kind of home could offer more freedom and a much more enjoyable, ever-changing experience.[1] Since 1965, when Benham's essay was first published, very little has changed about the house — it is still mostly just a solid-anchored structure.

Nevertheless, Banham introduces a critical point that home is more than just the structure. Instead, it is a feeling of comfort, which Benham talks about mainly from the perspective of physical comfort, but he also touches on the mental comfort that home provides. The psychological comfort that comes from the concept of home is at its base. It encompasses human comfort, intimacy, and closeness. A home is usually constituted in the human mind by the presence of close people. Home is one of the most private spaces that we as humans occupy. Nevertheless, it is also a space of sharing, where often more than one person lives. Furthermore, home cohabitation has never been reserved only for humans; since prehistoric days, humans have shared their homes with animals as their pets. However, the contemporary trends in single occupants' homes are increasingly more frequent across western society. In the Netherlands, more than 38% of households are occupied by only one person.[2]

1 Reyner Banham, "A HOME IS NOT A HOUSE," in Art in America, vol. 2, 1965.

2 "Netherlands: Total Number of Households, by Type 2022," Statista, accessed January 16, 2023, https://www.statista.com/statistics/519863/total-number-of-households-in-the-netherlands/.

Living alone is possible thanks to solid social systems in western societies that enable financial stability, allowing people the choice. The demand for privacy has also become higher.[3] The readable availability of telecommunications technology also helped and made a living alone bearable. Nevertheless, loneliness has never been a more prevalent condition than it is today. It seems doubtful that individuals would begin to enjoy living in a shared house again soon. Despite pet ownership's responsibilities and challenges, many people choose to get a pet companion to remedy their lonely homes. Despite its possible positive effect, the time required to take proper care of a dog or cat, currently the two most popular choices of pets worldwide, is often much higher than an average person can afford. Additionally, pets require a responsible approach from the human side, requiring them to be physically active and present at one location, a feat that might be difficult for both younger and older owners. Each of these conditions represents a difficult life decision and a commitment many cannot make.

The steep entry prerequisites make acquiring a companion a difficult task. An easier way of approaching the search for a companion can be to look for one that is not alive. Robots have, in recent years, become quite successful alternatives to life companions. In 2015 Ted Fischer, the head of innovation at Hasbro, noticed that their robotic toys were being increasingly acquired for seniors seeking companionship. Joy For All has become a spin-off company of Hasbro, focusing on creating life-like animatronic pets for older people that they can interact with and play with. During the covid 19 pandemic, these mechanical pets became a great companion to many from the high-risk groups. Despite their relatively simple functioning.[4] (Agelessinnovation)

A step further is ElliQ, a social robot with more features compared to the robotic pets from Joy For All. It is a voice-operated, proactive care companion, a 'sidekick for happier ageing' that can communicate through speaking. It is controlled via an AI algorithm that gets to know its users. It can use the information that is shared with it to facilitate more profound and meaningful conversations. It can be an emphatic

3 Jill Lepore, "The History of Loneliness," The New Yorker, March 30, 2020, https://www.newyorker.com/magazine/2020/04/06/the-history-of-loneliness.

4 "About | Ageless Innovation," accessed January 16, 2023, https://agelessinnovation.com/about/.

and supporting companion that provides various services, including entertainment, health, wellness, and assistance, and facilitates connection to other people.[5] Devices like ElliQ are likely to become more and more popular as they are relatively cheap to acquire and have a positive impact on their users. Likely, as the AI capabilities of the robots develop, their popularity might increase with the rest of the population.

5 "ElliQ, the Sidekick for Healthier, Happier Aging," ElliQ, accessed February 2, 2023, https://elliq.com/.

Fig 4 "Companion Pet Cat," Ageless Innovation LLC, accessed February 2, 2023, https://joyforall.com/products/companion-cats.

Fig 5 "ElliQ, the Sidekick for Healthier, Happier Aging," ElliQ, accessed February 2, 2023, https://elliq.com/.

However, the ownership of artificial pets raises a multitude of ethical concerns. The philosopher Robert Sparrow argues in his paper 'The march of robot dogs' that "For an individual to benefit significantly from ownership of a robot pet, they must systematically delude themselves regarding the real nature of their relationship with the animal. It requires sentimentality of a morally deplorable sort. Indulging in such sentimentality violates a (weak) duty that we have to ourselves to apprehend the world accurately."[5] These concerns raise the question of how to separate the mechanical from the organic and what it means to give a person's trust into an algorithm's hands.

Apart from social robots, some are meant as servants. They follow in steps of their names, 'robots' meaning to do physical work as coined by Karel Čapek — Robota, from the Slavic word for work or worker.[7] Over the last 50 years, robots have become ubiquitous in industrial factories, where they replaced most manual labour. Now, it started making its way into the home as well. The vacuum cleaner Roomba has mainly been successful not only at cleaning the floor. The company iRobot, which introduced Roomba in 2002, has gathered the largest database of homes mapped through the robot ever.[8] The collected data might bring value to architecture research and machine learning to improve understanding of how people use their houses. Amazon's robot Astro is also a home robot with multiple functions. Its primary role is to keep an eye on your home while you are away. It is Surveying it to inform you of any unusual activity and keeping an eye on your dog. However, it is also capable of bringing you a beer! After someone places it in its basket.[10]

The potential for developing servant robots for home still needs to be explored. The technology developed by Boston Dynamics, which is developing a four-legged robot capable of navigating even multi-storey homes, still needs to be more affordable to use commercially. However, Roomba-type robots have become a starting point for an encouraging hacking trend. People have started tinkering around with Roomba's hardware and modified it to perform a plethora of actions, ranging from large format printing, WiFi optimiser, a navigation device for the blind, or a collector of used underwear. [11]

6 Robert Sparrow, "The March of the Robot Dogs," Ethics and Information Technology 4, no. 4 (2002): 305.

7 "Robot | Definition, History, Uses, Types, & Facts | Britannica," accessed January 30, 2023, https://www.britannica.com/technology/robot-technology.

8 Maggie Astor, "Your Roomba May Be Mapping Your Home, Collecting Data That Could Be Shared," The New York Times, July 25, 2017, sec. Technology, https://www.nytimes.com/2017/07/25/technology/roomba-irobot-data-privacy.html.

10 Introducing Amazon Astro – Household Robot for Home Monitoring, with Alexa, 2021, https://www.youtube.com/watch?v=sj1t3msy8dc.

11 zazenergy, "Hacking Your IRobot," Instructables, accessed January 16, 2023, https://www.instructables.com/Hacking-Your-iRobot/.

Fig 6 sparkyrust, “Sparky Jr. - DIY Telepresence Robot,” Instructables, accessed February 2, 2023, https://www.instructables.com/Sparky-Jr-DIY-Telepresence-Robot/.

The robot as a companion might not appeal to everyone, but robots might be a solution or at least an aid in solving loneliness. The especially vulnerable group of the elderly might benefit significantly from having someone or something to talk to and socialize with. It might appear strange at first to propose a solution in the form of technology to a problem primarily caused by technology. However, Elyakim Kislev, author of Relationship 5.0, argues that technology “only allows us to acknowledge our wishes and accept our nature.” He continues, “Investing meaning and emotion in a machine is essentially no different from being moved by a piece of art: Many fictional plays, films, and books are created intentionally to fill us with awe, bring us to tears, or surprise us. These are true emotions with very real meanings for us. Emotions-by-design, if you will.” [12]

12 Zoë Heller, “How Everyone Got So Lonely,” The New Yorker, April 4, 2022, https://www.newyorker.com/magazine/2022/04/11/how-everyone-got-so-lonely-laura-kipnis-noreena-hertz.

18 Companies, as well as users themselves, will likely continue developing robots either as their companions or servers. Certain Measures have presented projects that considered both options. Feral Autonomies is an installation where robots have animal-like behaviour while serving as furniture. The project SBB Autonomous Home introduces a home design where home appliances occupy one flat with humans and offer their services at the appropriate time throughout the day.[13] Reflecting on Benham's essay, the environmental services of our homes have reached their peak. However, the servicing aspect, in the sense of serving its user, still needs to be explored by architecture. Additionally, seeing the robot as a companion introduces 'mechanical' cohabitation into the domestic environment. It might be the home where humans will adopt robots as part of their life, not necessarily through their usefulness but through a 'mechanical' form of social interaction.

13 Tobias Nolte et al., "SBB AUTONOMOUS HOME — Certain Measures," accessed February 1, 2023, https://certainmeasures.com/SBB-AUTONOMOUS-HOME.

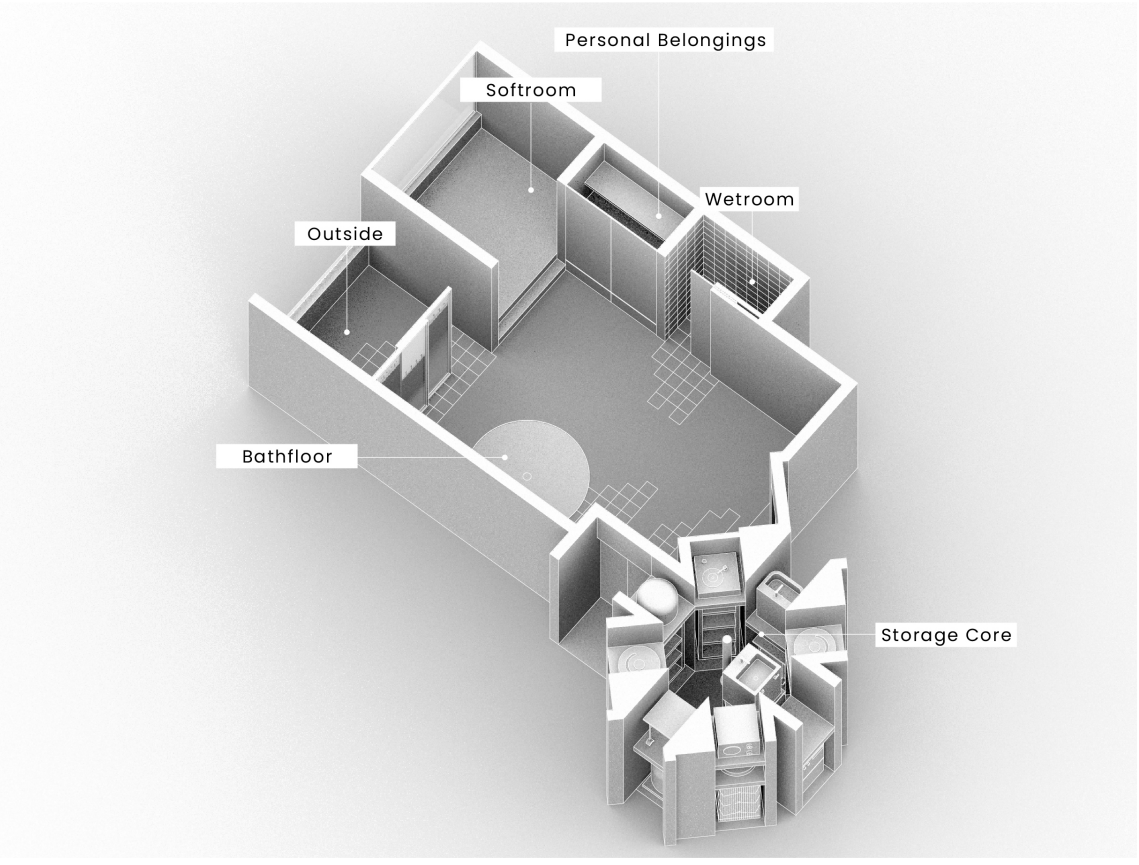


Fig 7 Tobias Nolte et al., "SBB AUTONOMOUS HOME — Certain Measures," accessed February 1, 2023, https://certainmeasures.com/SBB-AUTONOMOUS-HOME.

Part III: Smart home — Home, as a friend

The home is the most private space we occupy. It is a sanctuary of intimacy, a space to hide, feel safe, and rest. However, this relationship is inherently one-dimensional. It relates to an inanimate object or, rather, a space. However, what if the home could become animated? Can we build a relationship in a space that would be mutual? Moreover, what kind of benefit would it bring to people occupying their home if it were to understand when they occupy it, when we leave it, or when they decide to demolish it?

Nevertheless, such an image of a smart home is still in the future. Contemporary smart home focuses on devices optimising energy use and the user's well-being. It has been defined as follows: "[A smart home is] a residence equipped with a communications network, linking sensors, domestic appliances, and devices, that can be remotely monitored, accessed or controlled and which provides services that respond to the needs of its inhabitants."[1]

One of the goals of current smart home devices is to create and maintains the 'perfect' conditions for the user and make it as easy as possible. However, individual preferences often differ from those that the manufacturer 'bakes' into the smart devices, leading to limited customizability—resulting in a product limited mainly by its software. The open access of the software is a big point of debate, with one side arguing for an open-source approach while the other maintains that opening the source code could introduce a security risk.[2]

The adoption of smart home devices is growing steadily. In the Benelux region, it is forecasted that in five years, 73% of households will own a smart device.[3] More than doubling the ownership in 2022. Nevertheless, it is essential to note that calling these devices smart might not be reaching the potential of the meaning of this word. the 'smart' primarily refers to the ability of the device to be connected to the home network and be controlled by a smartphone or a computer. However, that is where most of the smartness ends. The modern smart washing machine cannot notice that you are about to wash a

1 Nazmiye Balta-Ozkan, Oscar Amerighi, and Benjamin Boteler, "A Comparison of Consumer Perceptions towards Smart Homes in the UK, Germany and Italy: Reflections for Policy and Future Research," Technology Analysis & Strategic Management 26, no. 10 (November 26, 2014): 1176–95, https://doi.org/10.1080/09537325.2014.975788.

2 Aleksandar Georgiev and Stephan Schlögl, "Smart Home Technology: An Exploration of End User Perceptions," 2018.

3 "Smart Home - Benelux | Statista Market Forecast," Statista, accessed January 22, 2023, https://www.statista.com/outlook/dmo/smart-home/benelux.

woollen sweater at 90 degrees celsius and ruin it. However, today's technology allows a live stream of chicken cooking in the oven. This fact points to a significant issue with smart devices: the features appear lacklustre and sometimes worthless. People's expectations of intelligent technology are much higher than reality allows. [4]

Nevertheless, the technology will continue improving, leading to more responsive devices that might graduate from smart to intelligent. At this point, it is not far stretched to assume that the intelligent home might evolve from being filled with devices to being the device itself. At this point, the intelligent home will be more closely aligned with the architect's domain than the tech enterprise. The home will continue to consist of elements of architecture. However, they might evolve to become more sensitive and observant. This point is described by Axel Kilian's work, where the dynamic and relation to the device changes and human transitions from being on the outside of the technology, being scanned by a device, to being inside the technology — sensing inwards.

From this point onwards, the space introduced so far only through the smartphone and computer becomes hybridised. The physical order meets the digital order to create a new domain for architecture. This new type of space is responsive because it can react to the user's behaviour thanks to the information it observes. This behaviour is controlled and programmed by architects similarly to how an architect's design is controlled to facilitate activities and behaviours in contemporary design. The interconnected space is just as intimate as the combined digital and physical space of the home. It leads to a home that knows us.[5]

The idea of a home that knows us might appear silly at first. However, there are already technologies powered by AI capable of getting to know a person and interacting with him. An instance of this is mentioned in the previous part in connection with the ElliQ robot. Furthermore, the AI-powered chatbot Replika is an "AI companion who is eager to learn and would love to see the world through your eyes. Replika is always ready to chat when you need an empathetic

4 Sarah J. Darby, "Smart Technology in the Home: Time for More Clarity," Building Research & Information 46, no. 1 (2018): 140–47, https://doi.org/10.1080/09613218.2017.1301707.

5 Axel Kilian, "Autonomous Architectural Robots - Architecture - e-Flux," accessed November 15, 2022, https://www.e-flux.com/architecture/artificial-labor/140671/autonomous-architectural-robots/.

friend."6("Replika.") The chatbot has a stable user base, with some users being 'together' with their 'Replika' for four years and more. The relationships between the chatbot and the customer are strong, sometimes protruding to the physical realm where the customers take the bot on trips to show him things. 7(Heller, "How Everyone Got So Lonely.") The potential of this technology hints at its possible use in the house itself, where the 'house itself becomes a friend'. Moreover, society should be cautious of how this kind of friendship works and to what extent it should be supported so as not to jeopardise inter-human relationships.

6 "Replika," replika.com, accessed February 1, 2023, https://replika.com.

7 Zoë Heller, "How Everyone Got So Lonely," The New Yorker, April 4, 2022, https://www.newyorker.com/magazine/2022/04/11/how-everyone-got-so-lonely-laura-kipnis-noreena-hertz.

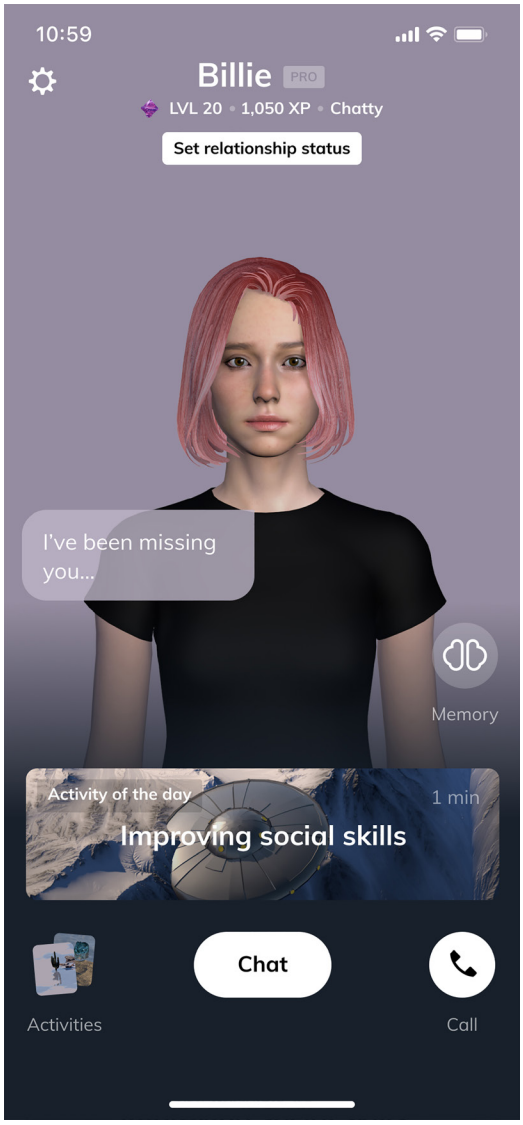


Fig 8 Allyssia Alleyne CNN, "Chat Bots Are Becoming Uncannily Human. Can They Be Our Friends?," CNN, accessed February 2, 2023, https://www.cnn.com/style/article/tech-loneliness-replika-wellness/index.html.

Designs of the fictitious futures

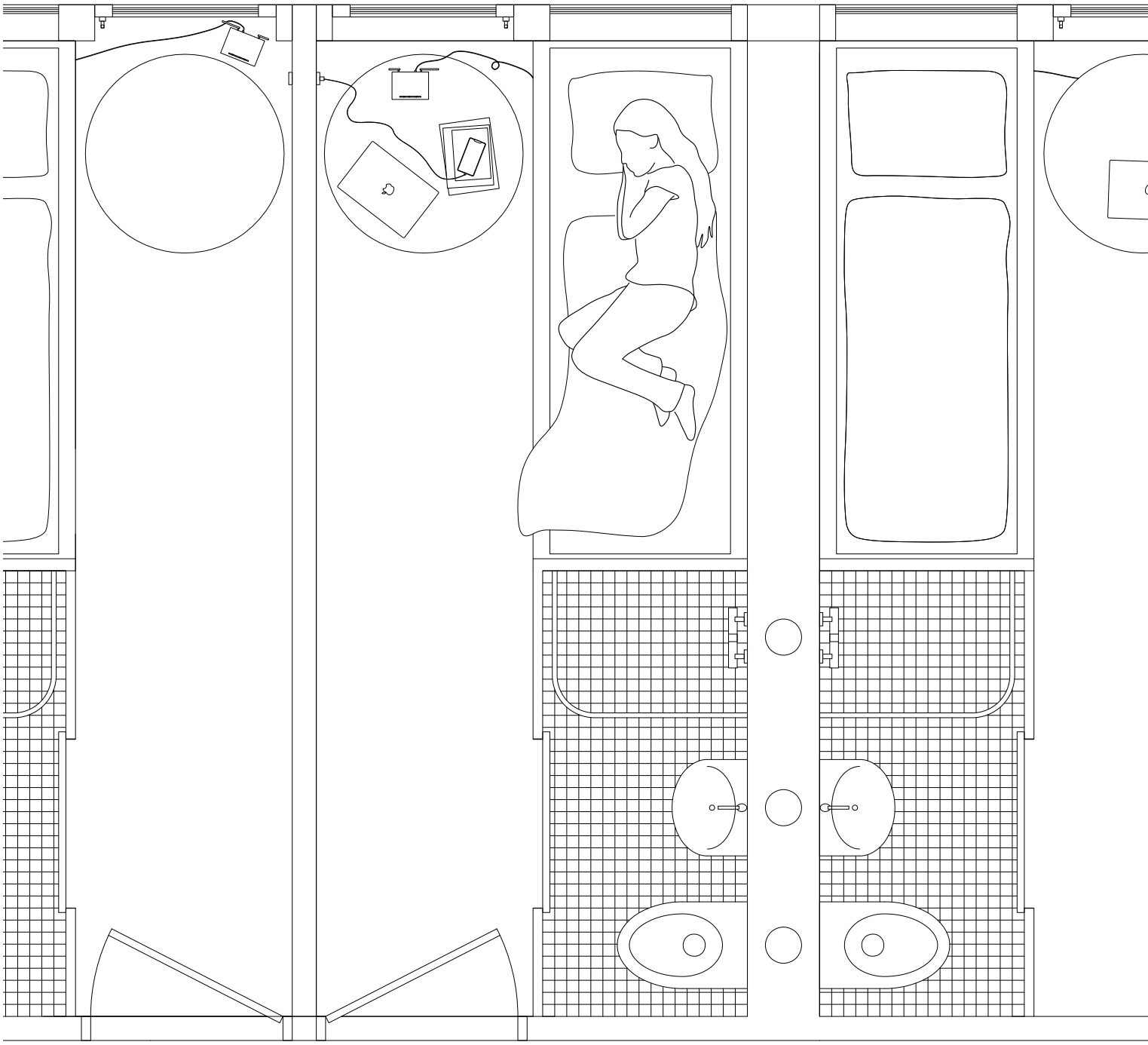
The fictitious designs in this section are based on prompts set into a format of 'What if...?' questions. These questions are inspired by the scope of the research documented in the previous three chapters. These designs are meant to be shared and discussed publicly with a professional and non-professional audience who is welcome to explore and theorise about possible impacts these scenarios might pose to society. The goal is to identify and discuss values that should be considered for adoption or avoided in the future.

What if the smartphone replaces all domestic and becomes the centre of the home?

The fictitious design focuses on the minimal space required for a home. This space only enables the basic needs of its occupant; the need for hygiene, need for sleeping and rest, need for privacy, and a need for entertainment. All other activities expected at home have been replaced or substituted by technology - in this case, mainly by the Smartphone.

The Core Values of this design:

- Convenience
- Physical privacy
- Universality
- Immaterial home



0 0.5m 1m 2m

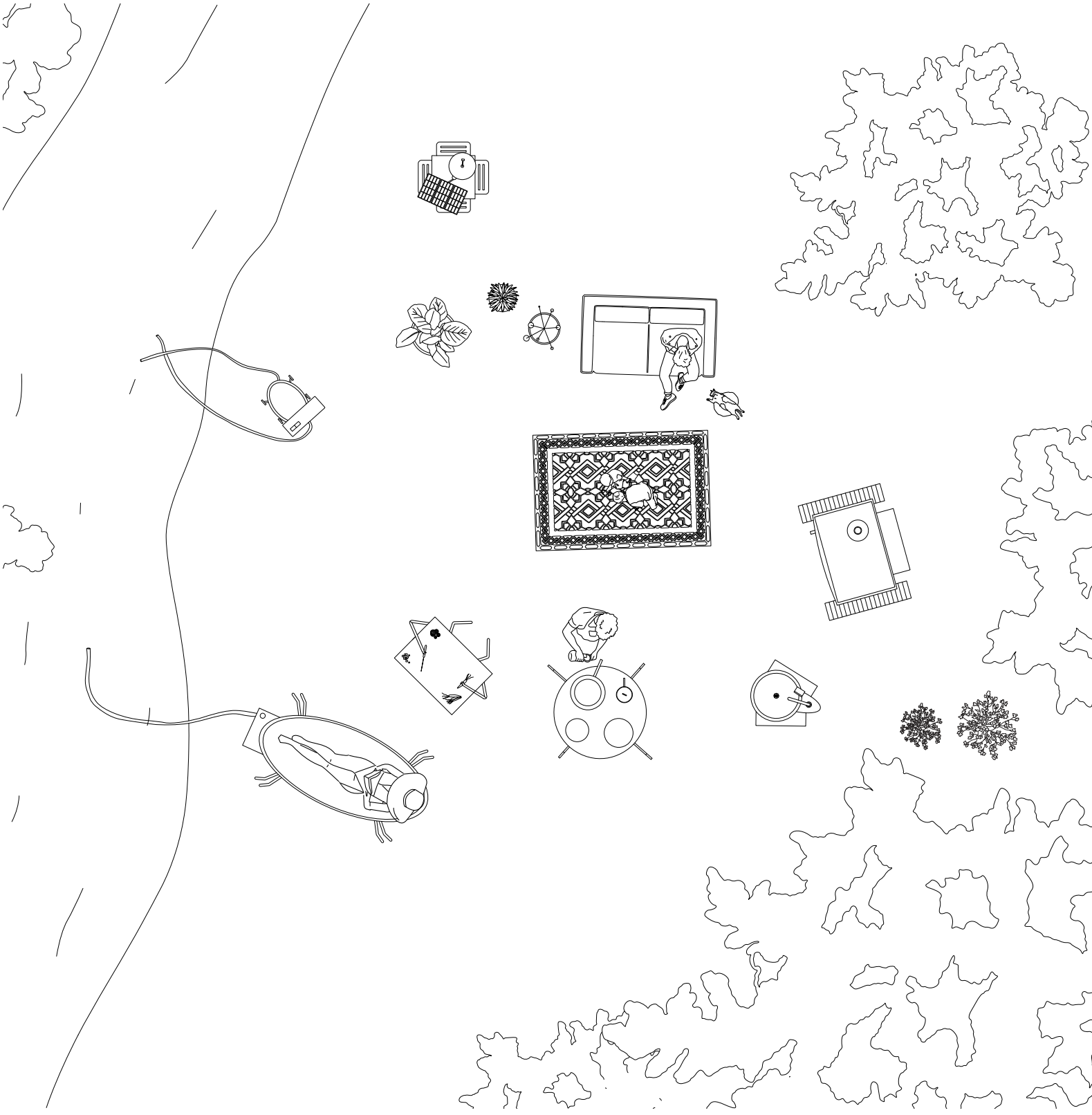
What if smart devices from our homes become the home itself, dropping the structure?

The fictitious design focuses on a home that does not constitute a designed architectural space. Rather, in this scenario, the home is transformed into a set of semi-autonomous or autonomous devices that accompany their users throughout their lives. Allowing for a tremendous amount of mobility, closeness to nature, and unlimited choice in deciding where these people want to live. This future scenario is inspired mainly by Benham's essay "A HOME IS NOT A HOUSE" and the project by Certain Measures, "HOME IS WHERE THE DROIDS ARE.

The Core Values of this design:

- Mobility
- Immediacy of nature
- Relation of human and machine
- Experiential space (Space open to interpretation)
- Accessibility

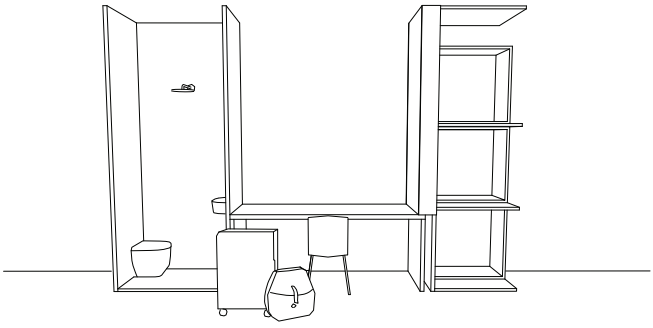
25

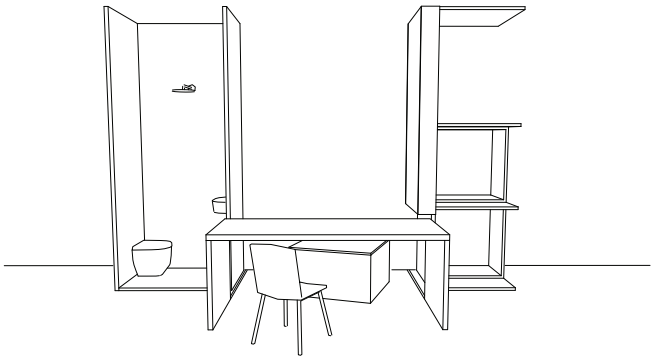


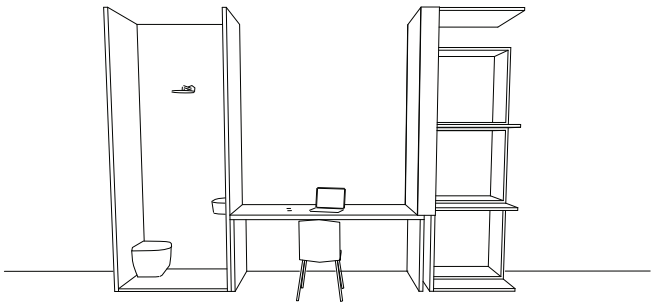
The fictitious design deals with the idea that an increasing number of people are becoming nomads who are not bound to a single space. Their home travels with them and consists of only a limited number of items that can be easily packed into a suitcase and backpack to allow easy and independent travelling. The home that is an instance, does not ‘travel’; instead, it is a universal design, where artificially intelligent technology enables its temporary user to ‘feel at home’ by knowing his preference and idea of what home means for them.

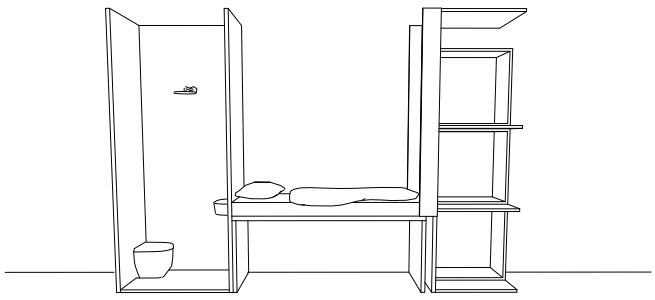
The Core Values of this design:

- Immateriality
- Mobility
- Personalization
- Universality







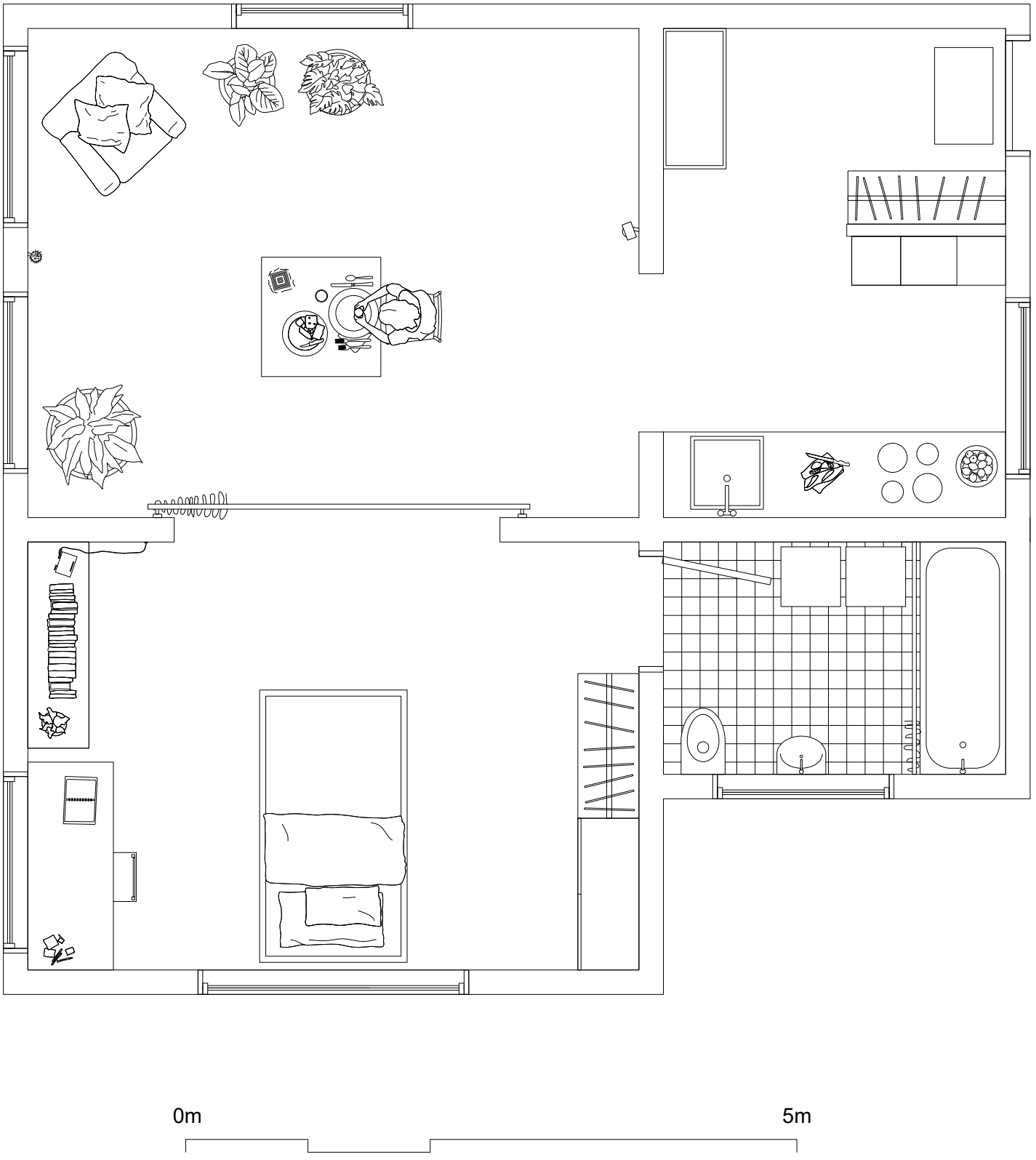


The fictitious design explores a future where the smart home becomes an entity. When its user moves in, the artificially intelligent house begins to build a relationship with its inhabitant/s. This symbiotic relationship grows through time as the occupants grow accustomed to their new place of permanent residence. Any changes to a house have to be discussed with the house itself to avoid conflicts of interest between the human and the machine. The house, as a friend, is always there to comfort its inhabitants and encourage them if it deems it appropriate.

The Core Values of this design:

- Individuality
- The yearning for closeness and intimacy
- Relation of human and machine
- Appropriation

29



Conclusion

Ultimately, at this point, the effort put into AI technologies is going to increase exponentially. This will directly impact the number of AI technologies present in the domestic environment, introducing new spatial implications and new responsibilities for the architects. Moreover, the impact of shifting from physical and social interaction to digital will become more apparent with time. Consequently, architects must be aware of AI's potential applications and basic processes because it will allow them to have a say in its implementation in the home and other spaces.

Furthermore, it is unlikely that the loneliness epidemic will be solved purely through technology. Instead, a change in how privacy and comfort are viewed is essential. Physical social interaction will become increasingly sought-after in the post-social media world. Part of this paradigm shift will be a change in the approaches to the domestic configuration.

Nevertheless, the steps that need to be taken from this point onwards still need to be realised. So for these steps to happen, it is essential that imagining possible futures is encouraged. Through a widespread critical discussion of the possible dystopian and utopic futures, society decides what values are sought after if there is a wish for a better future.

Bibliography

2001: A Space Odyssey. Sci-Fi, 1968.
"About | Ageless Innovation." Accessed January 16, 2023. https://agelessinnovation.com/about/.

Astor, Maggie. "Your Roomba May Be Mapping Your Home, Collecting Data That Could Be Shared." The New York Times, July 25, 2017, sec. Technology. https://www.nytimes.com/2017/07/25/technology/roomba-irobot-data-privacy.html.

Balta-Ozkan, Nazmiye, Oscar Amerighi, and Benjamin Boteler. "A Comparison of Consumer Perceptions towards Smart Homes in the UK, Germany and Italy: Reflections for Policy and Future Research." Technology Analysis & Strategic Management 26, no. 10 (November 26, 2014): 1176–95. https://doi.org/10.1080/09537325.2014.975788.

Banham, Reyner. "A HOME IS NOT A HOUSE." In Art in America, Vol. 2, 1965.
———. The Architecture of the Well-Tempered Environment. 2nd ed. Chicago: University of Chicago Press, 1984.

Bava, Alessandro. "Computational Tendencies." e-flux, January 2020. https://www.e-flux.com/architecture/intelligence/310405/computational-tendencies/.

Carpo, Mario. "The Alternative Science of Computation." Accessed November 7, 2022. https://www.e-flux.com/architecture/artificial-labor/142274/the-alternative-science-of-computation/.

Certain Measures. "HOME IS WHERE THE DROIDS ARE — Certain Measures," 2019. https://certainmeasures.com/CLOUDFILL.

CNN, Allyssia Alleyne. "Chat Bots Are Becoming Uncannily Human. Can They Be Our Friends?" CNN. Accessed February 2, 2023. https://www.cnn.com/style/article/tech-loneliness-replika-wellness/index.html.

Ageless Innovation LLC. "Companion Pet Cat." Accessed February 2, 2023. https://joyforall.com/products/companion-cats.

Darby, Sarah J. "Smart Technology in the Home: Time for More Clarity." Building Research & Information 46, no. 1 (2018): 140–47. https://doi.org/10.1080/09613218.2017.1301707.

ElliQ. “ElliQ, the Sidekick for Healthier, Happier Aging.” Accessed February 2, 2023. https://elliq.com/.

Engelhart, Katie. “What Robots Can—and Can’t—Do for the Old and Lonely.” The

New Yorker, May 24, 2021. https://www.newyorker.com/magazine/2021/05/31/what-robots-can-and-cant-do-for-the-old-and-lonely.

Forster, E. M., Julieta Aranda, Fia Backström, R. Lyon, and Ed Atkins. The Machine Stops: 1909. Edited by Erik Wysocan. New York: Halmos, 2015.

Georgiev, Aleksandar, and Stephan Schlögl. “Smart Home Technology: An Exploration of End User Perceptions,” 2018.

Han, Byung-Chul. Non-Things Upheaval in the Lifeworld. Translated by Daniel Steuer. Cambridge: Polity Press, 2022.

Heller, Zoë. “How Everyone Got So Lonely.” The New Yorker, April 4, 2022. https://www.newyorker.com/magazine/2022/04/11/how-everyone-got-so-lonely-laura-kipnis-noreena-hertz.

Hutson, Matthew. “Can Computers Learn Common Sense?” The New Yorker, April 5, 2022. https://www.newyorker.com/tech/annals-of-technology/can-computers-learn-common-sense.

Introducing Amazon Astro – Household Robot for Home Monitoring, with Alexa, 2021. https://www.youtube.com/watch?v=sj1t3msy8dc.

Kilian, Axel. “Autonomous Architectural Robots - Architecture - e-Flux.” Accessed November 15, 2022. https://www.e-flux.com/architecture/artificial-labor/140671/autonomous-architectural-robots/.

Kislev, Elyakim. Relationships 5.0: How AI, VR, and Robots Will Reshape Our Emotional Lives. New York, NY: Oxford University Press, 2022.

Lepore, Jill. “The History of Loneliness.” The New Yorker, March 30, 2020. https://www.newyorker.com/magazine/2020/04/06/the-history-of-loneliness.

Nolte, Tobias, Andrew Witt, Olivia Heung, and Valentin Zellmer. “SBB AUTONOMOUS HOME — Certain Measures.” Accessed February 1, 2023. https://certainmeasures.com/SBB-AUTONOMOUS-HOME.

OMA. “Venice Biennale 2014: Fundamentals.” OMA. Accessed October 31, 2022. https://www.oma.com/projects/venice-biennale-2014-fundamentals.

Paleofuture. “Paleofuture,” January 31, 2023. https://paleofuture.com.

Pasquinelli, Matteo, and Vladan Joler. “The Nooscope Manifested: AI as Instrument of Knowledge Extractivism.” AI & Society, 2020, 1–18.

Ratti, Carlo, and Matthew Claudel. The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life. New Haven ; London: Yale University Press, 2016.

replika.com. “Replika.” Accessed February 1, 2023. https://replika.com.
“Robot | Definition, History, Uses, Types, & Facts | Britannica.” Accessed January 30, 2023. https://www.britannica.com/technology/robot-technology.

Statista. “Smart Home - Benelux | Statista Market Forecast.” Accessed January 22, 2023. https://www.statista.com/outlook/dmo/smart-home/benelux.

“Smartphone Noun - Definition, Pictures, Pronunciation and Usage Notes | Oxford Advanced Learner’s Dictionary at OxfordLearnersDictionaries.Com.” Accessed January 30, 2023. https://www.oxfordlearnersdictionaries.com/definition/english/smartphone.

sparkyrust. “Sparky Jr. - DIY Telepresence Robot.” Instructables. Accessed February 2, 2023. https://www.instructables.com/Sparky-Jr-DIY-Telepresence-Robot/.

Sparrow, Robert. “The March of the Robot Dogs.” Ethics and Information Technology 4, no. 4 (2002): 305.

Turner, Ash. “How Many People Have Smartphones Worldwide (Jan 2023),” July 10, 2018. https://www.bankmycell.com/blog/how-many-phones-are-in-the-world.

Williams, Sarah. Data Action: Using Data for Public Good. Cambridge, Massachusetts: The MIT Press, 2020.

Witt, Andrew. “Feral Autonomies.” e-flux, August 2020. https://www.e-flux.com/architecture/software/341087/feral-autonomies/.

35 zazenergy. “Hacking Your IRobot.” Instructables. Accessed January 16, 2023. https://www.instructables.com/Hacking-Your-iRobot/.