Extending possible futures of summer comfort in Dutch households

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PHASE 2

Anticipating the Role of Smart Technologies in the Dynamics of Everyday Life

TU/e
EINDHOVEN UNIVERSITY OF TECHNOLOGY

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CONTENTS

SUMMARY

Due to climate change, the frequencies, temperatures, and durations of heatwaves and levels of solar gain in the Netherlands are expected to increase. How Dutch households will deal with these new circumstances is still uncertain, but the experienced and anticipated consequences of climate change have set in motion a range of developments that are (re)shaping Dutch practices of summer comfort.

This report is part of a case study that explores whether and how preventing lock-in into the unhealthy and energy-intensive dependence on artificial cooling is still possible for the Dutch context, and what role interaction design could play in this. The case study is comprised of three phases, focusing on probable, possible, and preferred futures respectively. This report presents the results of Phase 2, which focused on extending the range of ways in which Dutch households may respond to the warming climate.

Inspired by the performative power of future visions, this phase focused on diversifying imagined futures of summer comfort away from the dominant 'techno-hedonist' persona who prefers customized, pleasurable aesthetic experiences requiring low effort. Instead, it assumed futures in which people are willing and able to learn new skills and to change their expectations of comfort and 'normal' living within a changing climate. To achieve this, the project integrated four related design approaches and concepts that distinctly refocus design attention away from techno-centric futures: Practices-Oriented Design, Co-performance, Critical Design, and Role Play.

These methods were implemented in three different contexts: the core project, an Industrial Design bachelor course (ID Green), and an Industrial Design master course (Researching the Future Everyday). This resulted in a series of sixteen concepts.

THREE DIFFERENT CONTEXTS: 16 CONCEPTS

Core project concepts

Inside-Out	A practice of performing heat-generating activities such as cooking and showering outside during hot weather
Living at Night	A practice of living at night and sleeping during the day
Collective Sleeping	A practice of sharing cooled spaces for sleeping
Sweat Fashion	A practice of dressing in which sweating is celebrated and stimulated
E.VIE	A dominant smart home assistant that prioritizes low-energy summer comfort

ID Green concepts

Dry Footbathing	A practice of keeping cool by submerging one's feet in a membraned foot bath
Holesome	A practice of working and studying outdoors in earth-cooled pits
Indoor Grass Patch	A practice of keeping an indoor grass patch to cool down and relax on during hot weather
Yoga Campaign	A practice of collective yoga moments designed to help the human body stay cool
Dutch Siesta Revolution	A practice of taking a long break at the hottest time of day
HOTEAING	A practice of cooling body and mind by eating spicy food, drinking hot tea, and performing yoga
Living Shirt	A practice of wearing clothing with integrated air-plants that live on the wearer's sweat

Researching the Future Everyday concepts

UrbiCamp	A practice of young urban people setting up their workspaces outdoors
Little Helper	A low-energy practice of summer comfort for the elderly supported by a Little Helper
Chilly Popper	A practice in which people use portable 'poppers' to temporarily cool down a space
Cooling Patch	A future in which government-distributed cooling patches make bodies more heat-resistant

Reflection on the range of concepts resulted in five alternative, supplementary design spaces:

1. **TEMPORAL REORGANISATION**
2. **SPATIAL REORGANISATION**
3. **DIFFERENT EMBODIED RELATION**
4. **PERSONAL COOLING**
5. **REDISTRIBUTING SKILLS**

Instead of focusing on preventing increases in energy demand 'while maintaining quality of life', these concepts raised questions around what is considered 'quality of life'. Even though they were meant as provocations and not solutions, they illustrate that the techno-hedonist scenario of artificially cooled spaces is but one of the possible futures that represents a 'good life'. Other types of 'good life' with considerably lower levels of resource intensity are possible.

Combined with the design opportunities from Phase 1, five design directions and one integration area have been identified to form the basis for the final phase of the project *(see next page)*.

SAMENVATTING

Door klimaatverandering zullen naar verwachting de frequentie, temperatuur en duur van hittegolven in Nederland toenemen en zal de hoeveelheid zoninstraling in woningen stijgen. Hoe Nederlandse huishoudens zich precies zullen aanpassen aan deze veranderingen ligt nog open. Wat al wel duidelijk is, is dat de consequenties van klimaatverandering, zoals nu al ervaren en geanticipeerd voor de toekomst, leiden tot een reeks ontwikkelingen die niet altijd even wenselijk zijn voor de lange termijn.

Dit rapport is onderdeel van een onderzoek naar de vraag of een ongezonde en energie-intensieve afhankelijkheid van actieve koeling te voorkomen is voor de Nederlandse context, en welke rol interactie ontwerpers hierin kunnen spelen. Het onderzoek bestaat uit drie fasen, die respectievelijk focussen op waarschijnlijke, mogelijke en wenselijke toekomsten. Dit rapport bevat de resultaten van Fase 2, waarin de nadruk lag op het uitbreiden van de verschillende manieren waarop Nederlandse huishoudens zouden kunnen omgaan met een opwarmend klimaat. Dit is gedaan door het ontwikkelen van provocatieve concepten in de vorm van zogenaamde 'ontwerpficties'.

Gedreven door de zelf-realiserende kracht die uit kan gaan van toekomstvisies, concentreerde deze fase zich op het generen van alternatieve visies voor toekomstig zomercomfort. Omdat veel bestaande visies uitgaan van een 'techno-hedonistisch' personage met een voorkeur voor geautomatiseerde, luxueuze ervaringen die weinig moeite kosten, werden provocatieve concepten gegenereerd die uitgegaan van mensen die wel bereid zijn tot het investeren van moeite, het leren van nieuwe kennis en vaardigheden, en het aanpassen van hun verwachtingen rond een 'normaal' leven gegeven het veranderende klimaat. Om deze visies te vormen, integreerde het project vier ontwerpmethoden: Practice-Oriented Design, Co-performance, Critical Design en Role Play.

Deze methoden en de opdracht tot het vormen van de provocatieve visies is geïmplementeerd in drie verschillende contexten: het kernteam van het project, een Industrial Design bachelorvak (ID Green), en een Industrial Design mastervak (Researching the Future Everyday). Hieruit zijn zestien concepten voortgekomen.

DRIE VERSCHILLENDE CONTEXTEN: 16 CONCEPTEN

Concepten uit het kernteam

Inside-Out	Een manier van leven waarbij hitte-genererende activiteiten zoals koken en douchen buitenshuis worden uitgevoerd
Living at Night	Een manier van leven waarbij men 's nachts wakker is en overdag slaapt
Collective Sleeping	Een manier van leven waarbij wordt geslapen in gedeelde ruimtes met koeling
Sweat Fashion	Een manier van kleden waarbij zweten wordt gevierd en gestimuleerd
E.VIE	Een dominante slimme digitale assistent die een laag energieverbruik nastreeft boven het comfort en gemak van bewoners

ID Green concepten

Dry Footbathing	Een manier van koel blijven met een voetenbad dat de voeten door middel van een membraan droog houdt
Holesome	Een gebruik van buitenshuis werken en studeren in ondiepe kuilen in parken en bossen
Indoor Grass Patch	Een gebruik rond het aanleggen en onderhouden van een grasmat binnenshuis om op af te koelen en te relaxen
Yoga Campaign	Een gebruik van collectieve yoga-momenten ontwikkelt om het lichaam koel te houden
Dutch Siesta Revolution	Een gebruik om een langere pauze te houden tijdens het warmste deel van de dag
HOTEAING	Een gebruik om het lichaam af te koelen door middel van pittige maaltijden, warme thee en yoga oefeningen
Living Shirt	Een manier van kleden waarbij planten geïntegreerd in het kledingstuk leven van het zweet van de drager

Researching the Future Everyday concepten

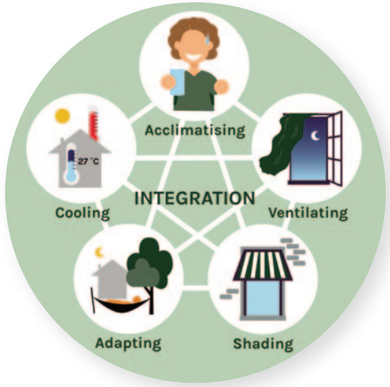
UrbiCamp	Een manier van leven waarbij yuppen tijdelijke werkplekken creëren in de publieke ruimte
Little Helper	Een energiezuinige vorm van zomercomfort voor ouderen gedirigeerd door een 'Little Helper'
Chilly Popper	Een toekomst waarin mensen draagbare 'poppers' gebruiken om tijdelijk de temperatuur in een ruimte te verlagen
Cooling Patch	Een toekomst waarin koelpleisters die het lichaam beter bestand maken tegen hitte gratis worden verstrekt door de overheid

Reflecties op deze serie concepten resulteerde in vijf alternatieve, aanvullende oplossingsruimtes voor toekomstig zomercomfort:

1. AANPASSINGEN IN LEVELSRITME EN TIJDSINDELING
2. AANPASSINGEN IN HET GEBRUIK VAN RUIMTE
3. EEN VERANDERENDE RELATIE MET HET LICHAAM
4. PERSOONLIJKE KOELING
5. HET HERVERDELEN VAN TAKEN TUSSEN MENSEN EN SYSTEMEN

In plaats van te focussen op het voorkomen van een toename in energieverbruik uitgaande van een gelijk blijvend dagelijks leven, werpen deze concepten vragen op rond de mate waarin het dagelijks leven zich zal (moeten) aanpassen aan de nieuwe omstandigheden. Hoewel ze niet bedoeld zijn als oplossingen, laten ze zien dat het techno-hedonistische scenario van (efficiënt) gekoelde ruimtes slechts een van de mogelijke toekomsten is voor zomercomfort in Nederlandse woningen. Andere, minder energie-intensieve en technologie-afhankelijke manieren van omgaan met het veranderende klimaat bieden ook perspectief.

In combinatie met de ontwerprichtingen die voortkwamen uit Fase 1 van het onderzoek leiden deze inzichten tot vijf ontwerprichtingen, zoals weergegeven in onderstaand figuur. Deze vormen de basis voor de derde en laatste fase van het project.



ACKNOWLEDGEMENTS

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I also want to thank the Dutch Organisation for Scientific Research (NWO) for funding the research, under grant number VENI17343, and the Future Everyday Group at Eindhoven University of Technology for hosting it. Special thanks goes to Brigitte van der Lugt for her research support, design inputs, and creating many of the visuals.

1

INTRODUCTION

When daytime temperatures rise above 25°C for five days in a row, with at least three of the five days reaching maximum temperatures above 30°C, the Royal Dutch Meteorological Institute (KNMI) declares a heatwave. In the Dutch context, these temperature patterns are considered extreme weather events that disrupt everyday life. In other words, it gets too warm for 'business as usual'.

Due to climate change, the frequencies, temperatures, and durations of heatwaves and levels of solar gain in the Netherlands are expected to increase (Klein-Tank et al. 2015). How Dutch households will deal with these new circumstances is still uncertain, but the experienced and anticipated consequences of climate change have set in motion a range of developments.

These developments are (re)shaping Dutch practices of summer comfort. A recent study by research institute TNO concluded that the use of active cooling in Dutch dwellings can lead to an increase in energy demand of between 15-25% per household (Rovers et al. 2021)[1]. This development could nullify efficiency gains made over the past ten years. Furthermore, to stay within the Paris Agreement of limiting the global average temperature to a maximum of 1.5°C, household energy demand should be reduced.

1
A low or even energy-positive form of cooling is ground-based heat pumps. Water-based cooling creates a side-effect of regenerating their source for winter hearing. This form of cooling requires considerable investments and extensive retrofit measures in existing buildings. While 20-25% of newly built dwellings are equipped with such systems (expert communication), so far, less than 2% of house-holds in the TNO study indicated the use of active cooling systems (Rovers et al. 2021).

Currently, approximately 1-in-5 Dutch households have artificial cooling in their homes (mostly split unit and mobile air-conditioning devices) and another 26% are considering to have cooling installed (Rovers et al. 2021). This raises concerns on multiple fronts. Besides the potential for increased CO2 emissions, heat island effects, and household energy costs, the broad adoption of artificial cooling can lead to lock-in in the form of a growing dependence on cooling (Kuijer 2021, Strengers and Maller 2011, Walker et al. 2014, Sahakian 2018).

This report is part of a case study that explores whether and how preventing lock-in into the unhealthy and energy-intensive dependence on artificial cooling is still possible for the Dutch context, and which role interaction design[2] could play in this. Guided by the Future Cone Model (Figure 1) this is approached in three phases. Phase 1 focused on Probable Futures and explored the directions in which practices of summer comfort in Dutch households are currently heading. This resulted in the first stakeholder report (Kuijer 2021). The current report contains the results of Phase 2, which aimed to extend the range of Possible Futures considered among stakeholders and the general public by developing a series of triggering concepts.

To achieve the aim of extending the boundaries of what is considered possible, these concepts are deliberately provocative. They are not intended as serious proposals for solutions.

The next and final phase, Phase 3, will converge towards more feasible concepts and scenarios for Preferable Futures of summer comfort in Dutch households.

2
Interaction Design refers to designing interfaces – in the broadest sense – between (complex) digital infrastructures and end-users.

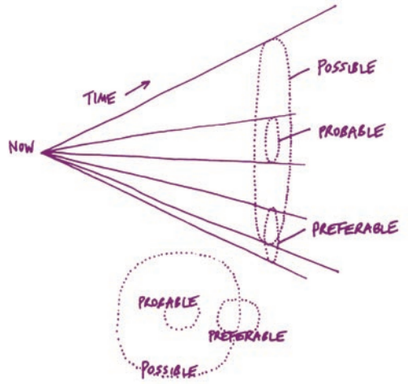


Figure 1: The "future cone"- adapted from Hancock and Bezold (1994) by Candy (2010)

The case study on summer comfort forms part of the VENI project 'Anticipating the Role of Smart Technologies in the Dynamics of Everyday Life' (2019-2024), funded by the Talent Scheme of the Dutch Research Council (NWO). It is conducted within the Future Everyday Group of Eindhoven University of Technology (TU/e). The overall aim of the project is to develop new design theory, methods, and tools to help interaction designers understand the changing role of 'smart' technologies in everyday life and to better anticipate future opportunities and risks during the design process. Since 'smart' technologies are equipped with sensors, processing power, and actuators, they are capable of semi-autonomous decision-making. As such, they increasingly play a role in shaping everyday life. Summer comfort forms an empirical case study through which this methodological knowledge is developed.

This report begins by explaining the motivations and theoretical foundations behind Phase 2, including a description of the approach taken in Chapter 2. An overview of the methods used to generate alternative, triggering concepts for summer comfort is offered in Chapter 3. The core of the report, Chapter 4, presents sixteen fictive, triggering concepts for alternative futures of summer comfort that were developed during this phase. Chapter 5 reflects on this set of concepts to draw lessons for further steps. The report closes in Chapter 6 with implications for the next phase, which focuses on designing preferable futures of summer comfort.

The intended audience for the series of reports on the future of summer comfort are decision-makers who play a role in shaping the future of domestic summer comfort. A range of key stakeholders was involved in the study as a User Committee[3]: Het Klimaatverbond, Royal Auping, Itho Daalderop, Havensteder Rotterdam, and Romazo. While the focus of the report is on the Netherlands, its outcomes may be relevant beyond this context, particularly in countries and regions where the use of artificial cooling is currently on the rise due to global warming.

3

These organisations are involved as advisors to the project. The study and researcher are financially independent from these parties.

2

BACKGROUND

The aim of Phase 2 was to extend the range of possible futures considered in the Dutch's responses to global warming. This section explains why and how this challenge was approached. Drawing on the results of Phase 1, it starts with a brief overview of the imagined and unfolding futures of summer comfort that are currently dominant in the context of Dutch households, and then offers an explanation as to why it is important to extend this range of imagined futures. The section closes with the 'how' question, offering an overview of the approaches used to generate the triggering concepts meant to extend these future imaginaries.

Probable futures of summer comfort

Phase 1 of this project involved in-depth interviews with a representative set of 21 Dutch households and 10 domain experts and provided insights into how Dutch households are currently responding to the warming climate, how they anticipate to do so in the near future, and how technological and other trends may invite or inhibit certain pathways. The study identified a wide range of circumstances, strategies, and responses to hot weather. However, various signals indicate a risk of convergence towards a dependence on energy-intensive forms of artificial cooling[4].

4
Artificial cooling in this report refers to forms of cooling that consume specifically allocated resources such as energy and water. It is used in this report instead of active cooling to make a clearer distinction between measures against overheating that are active or passive from a resident perspective, e.g. artificial cooling requires low-effort from residents and is therefore passive, while shading or adapting daily routines require active resident involvement.

One reason for this development is that low-energy forms of preventing overheating, such as shading and ventilating, face several barriers. One is the Dutch's historic friendship with the sun. This historically-shaped tendency to welcome sunlight and warmer weather into the home conflicts with practices of shading and summer night ventilation. Also, while bodily acclimatisation shows potential to reduce demand for cooling and contribute to wellbeing in warmer weather, the capacity of the body to adjust to higher temperatures is not actively used as a strategy. Sweating, a bodily strategy to deal with heat, is even considered negatively, leading to an increased frequency in showering and laundering during heat waves.

Another reason for the convergence towards dependency on artificial cooling that the study identified lies in the competitive relation between artificial cooling and these lower-energy strategies. Seeing as even well-equipped, highly skilled households in this study did not manage to maintain comfortable indoor temperatures during the August 2020 heatwave, it seemed likely that artificial cooling will make its way into many Dutch households in the coming decades. This is confirmed by the recent TNO study (Rovers et al. 2021).

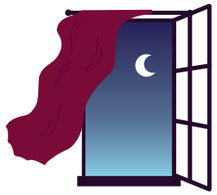
This penetration of artificial cooling can further hamper the development of acclimatisation, shading, and ventilating practices. The investment required to equip a dwelling with artificial cooling also competes with the relatively expensive installation of outdoor shading. Once installed, artificial cooling competes with summer night ventilation; cooling requires windows to be closed, so potentially cooler, freely available night air is not used. Finally, spending time in artificially cooled spaces hampers processes of bodily adjustment to heat over time. In heat waves, this can catalyse a process of locking people into climate-conditioned environments because spending time outside is experienced as increasingly uncomfortable. The TNO study (Rovers et al. 2021) found that households with artificial cooling tended to switch the cooling on during indoor temperatures above 25°C but, on average, set the temperature to 20°C. With temperatures of 30°C or more, the barrier to go outside becomes considerable. This in turn hampers physical activity and stimulates car use.

Of all the possible ways of dealing with hot weather, artificial cooling is the most passive in terms of human effort. For people who can afford installing and running it, artificial cooling provides a feeling of luxury. However, the costs and invasive aspects of artificial cooling lead to unequal access between households with higher and lower incomes, and homeowners and tenants (Jay et al. 2021). Artificial cooling is, in some cases, necessary to ensure liveable and safe indoor environments, particularly for vulnerable people for whom high indoor temperatures can be life-threatening (Jay et al. 2021). However, for the majority of Dutch (healthy, mainstream, middle to higher income) households, artificial cooling is (expected to be) primarily used to improve comfort with low effort to facilitate 'business as usual' during warmer weather.

This development involving practices of summer comfort converging towards artificially cooled environments kept at temperatures in the lower 20 degrees Celsius is not only energy demanding, it can also contribute to negative health effects such as locking people indoors due to large differences between indoor and outdoor temperatures and adverse health effects from homogeneous temperature environments (Ivanova et al. 2021). In line with these findings, the study identified three main opportunities for design:

Supporting and enhancing bodily acclimatisation

Promoting and developing shading and ventilating practices



Integrating shading and ventilating with artificial cooling practices

The Phase 1 results and these three opportunities formed the basis for the Possible Futures phase reported here. Before going into the methodological foundations of this second phase, this section reflects on several reasons to extend the range of possible futures.

Why extend the range of possible futures?

First, it is important to note that the types of futures that circulate in a society matter for the types of presents that eventually come about. Visions of desirable and undesirable futures inform decision-making in the present, such as which infrastructure is built, which systems are installed, and how budgets are allocated. This effect is also referred to as the performativity of future visions (Borup et al. 2006; Jasanoff and Kim 2015).

Within the context of summer comfort, expectations of disruptive climate change along with ideals of artificially cooled environments that enable a return to 'business as usual' with low effort are widely present and play a role in stimulating a growing demand for artificial cooling.

Examples of (future) visions related to summer comfort

While these types of prolific future visions form (implicit) dots on the horizon for a wide range of societal actors, their origins tend to be relatively narrow. Although other visions do circulate, large industry players with substantial marketing budgets tend to dominate the visionary space. These players naturally and understandably envision futures in which their interests—i.e., a sustained demand for their products and services—are best served. However, these dominant visions do not necessarily serve the longer-term interests of end-users, natural ecosystems, or future generations.

According to research by Dahlgren et al. (2021), future visions within the smart home and energy sector tend to dominantly serve what they refer to as a (fictive) 'techno-hedonist persona' (Dahlgren et al. 2021). This persona prefers customized, pleasurable aesthetic experiences requiring low effort. For example, the image on the left promoting the benefits of air-conditioning shows people in regular clothing and an absence of shading despite the implied hot weather, while the image on the right problematizes lower-energy options such as adjusted clothing, ventilation, and a slowdown of activity.

The probable scenario of growing dependency on artificial cooling emerging from the Phase 1 study fits this techno-hedonist vision of a 'good life'. As explained, this scenario is relatively energy- and resource-intensive and is not necessarily healthy or preferred from a general wellbeing perspective. In other words, techno-hedonism forms a particular vision of 'the good life' but is not necessarily the only or best future to pursue for everyone. For practices of summer comfort, there is a risk that centralising artificial cooling creates inequalities within future households because of access inequalities. Moreover, it risks overshadowing other, less resource-intensive and more adaptive ways of dealing with overheating.

As Light et al. argue 'narrow horizons lead others to tread uncritically the grooves we design for them' (Light et al. 2017). To serve the interests of other, less powerful, and less well-represented stakeholders, alternative future visions are needed. Urry (2016) refers to this as 'democratising the future'. This specific project focused on developing alternative future visions that challenge the techno-hedonist persona by decentralising

technological innovation. Such futures have the potential to be more equitable by preventing technological dependence, thereby shifting the power from technology developers to everyday people and preventing further increases in resource and energy intensity in everyday life.

In other words, to broaden the range of futures considered, the project focused on imagining futures in which people are assumed to be willing and able to learn new skills and to change their expectations of comfort and 'normal' living with a changing climate. This position is in line with historic evidence that shows that people learn new skills and adapt their expectations continuously (Kuijer and Watson 2017). However, innovation in everyday life that does not centralise technological innovation is not usually the type of innovation that interaction designers focus on or that design methods are developed for. Therefore, the project selected and developed a particular set of approaches.

How to extend the range of possible futures?

To explore novel ways of designing for such alternative futures, this project combined four related design approaches and concepts that distinctly refocus design attention away from techno-centric futures: Practices-Oriented Design, Co-performance, Critical Design, and Role Play. Within Phase 2, these different methods and methodologies were combined in various ways to generate a range of triggering concepts that challenge the boundaries of what is currently considered possible and acceptable in terms of dealing with hot weather in Dutch households.

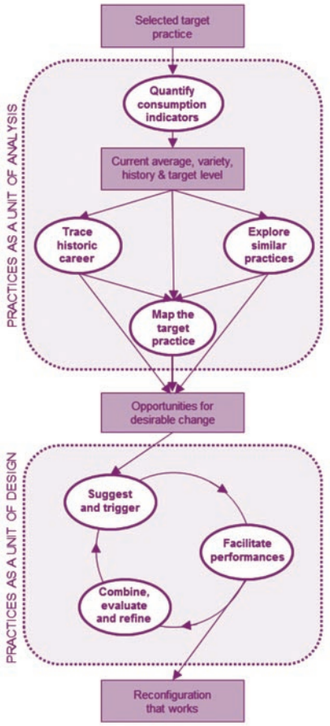


Figure 2: Overview of Practices-Oriented Design approach (Kuijer 2017)

Practices-oriented design

Practices-Oriented Design (Kuijer 2017) is a design approach that takes practices instead of technologies, behaviours, or interactions as its unit of design (Kuuti et al. 2014). It draws on certain strands of social practice theory (Shove et al. 2012, Reckwitz 2002, Schatzki 1996), a group of theories from sociology that take practices as their basic unit of social analysis. One of the conceptual tools developed by Shove and colleagues is the idea of practices as coherent configurations of elements. In this strand of practice theory, these elements are grouped as materials, competencies, and meanings (figure 2). Combined with the concept of social change as a process of practice reconfiguration in which elements can be added or removed and links between them made or broken, these tools enable a form of designing in which skills and meanings are included in the unit of design alongside technologies (Kuijer et al. 2013). For example, in a previous design project (Kuijer and De Jong 2012), practices around keeping warm at home were redesigned to shift from an idea of comfort based on heated spaces to one centred on fresh air and warm clothing.

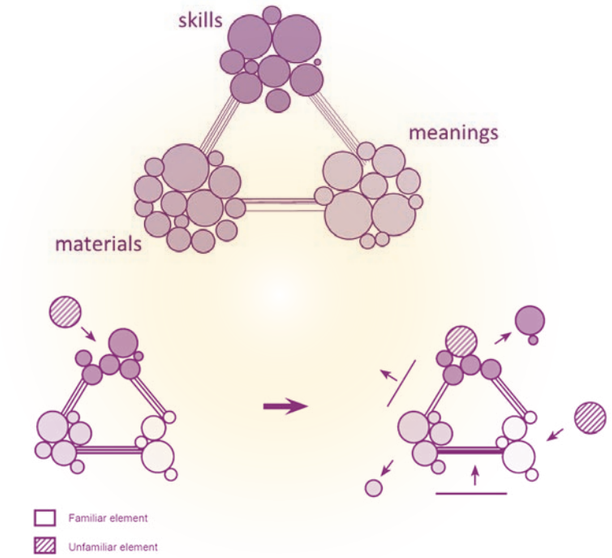


Figure 3: Practices as configurations of elements (top), reconfiguration (bottom)

Additionally, drawing on recent developments in social practice research, Practices-Oriented Design enables moving explicitly beyond a focus on single practices towards webs of practices (such as those surrounding summer comfort). It thereby draws in and takes inspiration from the ways in which practices are ordered in space and time (Southerton 2020, Hand et al. 2007). For example, earlier research into historic change in domestic heating (Kuijer and Watson 2017) showed that in co-evolution with the spreading of central heating, demand for heat has gradually spread over the home both in space and time—more rooms are heated for longer periods. The idea is that engagement with temporal and spatial patterns of practice can also be used to modify change in less energy-intensive directions.

Co-performance

Co-performance (Kuijer 2019; Kuijer and Giaccardi 2018) is a conceptual extension of Practices-Oriented Design that reconceptualises the role of smart technologies in everyday life. While practice theories focus on humas as performers of practices, smart technologies such as thermostats should be placed next to humans as co-performers because they take action in response to changing circumstances in a particular situation. This move highlights a range of novel opportunities and risks of automation in everyday life, particularly in the longer term.

By acknowledging the unique skills of human and artificial performers, questions arise with the delegation of socially complex skills and tasks to artefacts. For example, thermostats are unable to anticipate irregularities in people's schedules or sense how long a person entering a room will stay or how they are feeling. Delegating the socially complex task of deciding which temperature to maintain in a room to thermostats is therefore bound to lead to mistakes.

Co-performance also highlights how delegation of certain tasks to technologies does make sense when human and artificial skills can complement each other in fruitful collaboration. For example, thermostats are capable of precisely monitoring the temperature in a room twenty-four hours a day, seven days a week without complaining or losing focus.

For design, co-performance highlights the division of tasks between human and artificial performers as a playing field for design and offers some guidance on which tasks (socially complex or not) are potentially best performed by whom.

Critical design

Critical design (Dunne and Raby 2001) is a set of design approaches that question the status quo through and within design. This makes it a promising design practice to foster democratisation and anticipation of future everyday life within design (Kuijer 2020). Critical design explicitly distances itself from 'affirmative design', meaning that the results of critical design are deliberately not intended for sale in a consumer market. Rather, by developing proposals and artefacts that break the rules of conventional product design, critical design aims to stimulate debate and reflection, thus developing more nuanced visions of options and exploring the boundaries of what is acceptable.

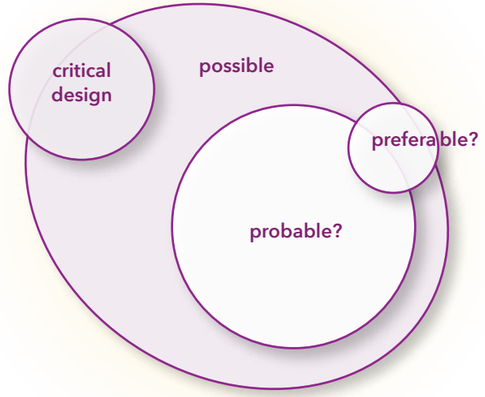


Figure 4: Critical Design aims to expand the space for possible futures questioning the position of probable and preferable futures within them (Kuijer 2020)

Within critical design, design fiction (Bleecker 2009) has emerged as a particular approach that explicitly engages with future everyday life beyond technologies. Design fictions focus on futures with changed socio-political context (Blythe and Encinas 2016), which are materialise in so called 'diegetic prototypes' (Kirby 2010). Design fiction can take a variety of forms (including narratives, films, scenarios, etc.). As such, design fiction is particularly suitable for the aim of envisioning futures in which technological innovation is decentralise and other aspects of change are included in the unit of design.

Role play

Role play is a method of designing that explicitly involves the human body in the design process (Foverskov and Binder 2010). Designing with the body brings a distinct type of knowledge into the design process that is related to embodied skills, knowledge, and experience. Moreover, by assigning roles, physical role play enables the development of scenarios in which different ideas of normality and different sets of knowledge and skills have become normal among 'future' people. Finally, by including improvisational elements (scenarios that are not 'pre-scripted' but emerge from the performance), the embodied performance is used in a generative rather than evaluative way (Kuijer et al. 2013).

3

GENERATING ALTERNATIVE FUTURES OF SUMMER COMFORT

The concepts for alternative, possible futures of summer comfort in Dutch households were generated in three different contexts:

1. Core project: design sessions and stakeholder workshop
2. ID Green: bachelor elective course
3. Researching the Future Everyday: master elective course

The Phase 1 report served as a basis for all three contexts. Each design context used a brief that directed the designers towards the generation of alternative practices that move away from the assumed future of 'business as usual' facilitated by artificial cooling. All contexts made use of one or more of the approaches described in Chapter 2.

Ethics approval for these studies was obtained from the TU/e Ethics Board under reference number ERB2020ID63 (collective application for 'Generative Sessions with Design Students and Staff') and specific modification ERB2021ID27. The students who participated in the courses ID Green and Researching the Future Everyday were informed that their projects could become part of the Summer Comfort research project and received an information sheet and consent form, which they were asked to sign after the course was concluded. In the consent form, the students could choose to be mentioned by name as the author of their projects or to be acknowledged anonymously.

Core project

Within the core project, concepts were created through a collaboration between the research assistant (Industrial Design Master student, Brigitte van der Lugt) and the project leader (myself) in a series of iterations between April and June 2021. In addition, a stakeholder workshop was organised in which a diversity of stakeholders was involved in discussing the concepts and generating additional ideas.

The first set of ideas was generated by the research assistant. She familiarized herself with Practices-Oriented Design (Kuijer 2017) and focused on developing 'non-technical' solutions and designing at the level of social systems for further futures. Through several meetings and iterations, the concepts were made more extreme and provocative, and less like feasible solutions. A total of five concepts were developed, four of which were translated into Concept Cards and one into a Day-in-the-Life Scenario.

The four Concept Cards and the Scenario were used as input for a three-hour stakeholder workshop held in the end of June 2021. In this online workshop, experts from a diversity of domains related to summer comfort were brought together. The group of eight participants included experts from climate policy, architecture, HVAC, sleep, shading technology, physiology, and fashion.

The workshop was entitled 'Prikkelende concepten voor zomercomfort' or 'Triggering Concepts for Summer Comfort'. Participants were informed that the aim of the workshop was to generate provocative concepts, not feasible solutions and were therefore invited to think out of the box and be open-minded towards strange and unacceptable solutions. Since participants were asked to step out of their comfort zones and engage in role play and out-of-the-box brainstorming activities, the workshop was not recorded and reporting was kept anonymous. Due to the sensitive nature of this workshop, the results were not included in this report.

ID Green

A group of 25 students took part in the TU/e Industrial Design bachelor elective course ID Green: Design Perspectives on Sustainability. This course contained three modules, a number of guest lectures, and a final reflection deliverable. The first module focused on Practices-Oriented Design, which contributed to this project.

The module consisted of two afternoons of guided workshops that were preceded by preparatory readings and followed by the delivery of a group report. COVID-19 measures at the time allowed for a physical presence, but several students participated online, eventually resulting in a hybrid format. Participants were divided into seven project groups comprised of three-to-four students.

Before the first session, the students were informed that the module would introduce them to Practices-Oriented Design 'a design approach that takes practices, instead of devices, behaviours, or interactions as its unit of design' and would be focused on creating less resource-intensive ways of living within the topic of summer comfort. Compulsory preparatory readings were Kuijer (2017) on Practices-Oriented Design and the Phase 1 stakeholder report.

The two module sessions followed a similar format, consisting of an interactive lecture and a practical group exercise, but had a different focus and set of main activities:

The first session on 22 April began with a 45-minute introduction of Practices-Oriented Design that discussed the theoretical background of the approach and the approach itself using examples on domestic heating. Then, the students set to work on the first part of the method, working from a focal practice towards opportunities for change using inspiration from different cultures. Supplementary to the Phase 1 report, they were offered a list of papers on summer comfort in other cultures (Appendix A). Their task was to generate ideas and condense them to three-to-four rough concepts for

alternative practices. Inspired by the introductory talk and readings, the students were encouraged to keep these concepts relatively low-tech and focused on different ways of living.

The second session focused on further developing one concept through a guided role-play exercise (Kuijer and Robbins 2022). Again, the session began with an introduction but this time it was focused on alternative forms of bathing. The students selected one concept and used this as the basis for the guided role-play, which revolved around a fictive interview with expert performers of the alternative practice. This resulted in a refined, more nuanced version of the alternative practice. On the basis of this enriched image, the students were then instructed to deliver two outputs: a future newspaper article (inspired by the work of Dr. Roy Bendor) and a museum catalogue page (inspired by the work of Dr. Jesse Hoffmann).

After the module, all seven student groups submitted a 3.000-word (maximum) report of describing their concepts, an impression of their role play exercise with the two outputs and a reflection on the methods used during the module.

Researching the Future Everyday

In the TU/e Industrial Design master elective course Researching the Future Everyday, three groups of three students worked on the Summer Comfort topic for ten weeks. The course involved two other topics on which other groups worked in parallel.

In the course, students created and deployed a so-called research artefact that materialises an alternative perspective on the role of technology in everyday life. This alternative perspective is based on an academic paper from Science and Technology Studies—a field of research that critically examines the roles of science and technology in societal change. This paper was referred to as the Core Reading. To work towards

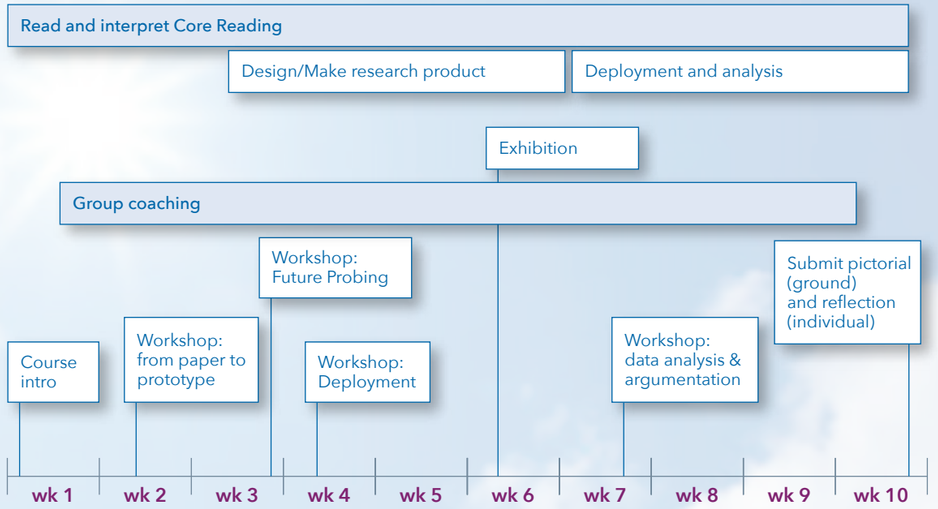


Figure 5: Researching the Future Everyday course set-up (Kuijer and Robbins 2022)

what Candy (2014) refers to as diegetic integrity, meant to place people into the imagined future everyday ('Storyworld' for Candy), students are were instructed to develop a scenario that 'holds together on its own terms: no gaps in logic, no clumsy flashing arrows' (Candy 2014). Figure 5 offers an overview of the structure of the course.

For the Summer Comfort theme, the Core Reading was Shove (2003), with an option to add Haarbosch et al. 2021. Shove (2003) critically questions the role of design in meeting pre-existing needs, arguing that design plays a role in creating new needs. Haarbosch et al. (2021) offers a critical perspective on the power imbalance between tenants and social housing providers in imagining future neighbourhoods, with a focus on the energy transition. The brief roughly framed the topic and focus, but gave students the freedom to choose their own direction.

At the end of the course, the students submitted a research paper as a group deliverable. For the Summer Comfort theme, three research papers were submitted containing four different concepts.

Data analysis and limitations

For this report, the sixteen concepts generated during these three sets of design projects were collected and summarized. Each concept contains a brief description of the inspiration used in the generation of the concept, an overview of the concept itself with visuals, and a short reflection on the implications of the project for everyday life, both in terms of more or less radical changes it would require and the potentially positive or negative side-effects of the these changes.

The range of concepts presented in this report is not an exhaustive set of all alternative futures of summer comfort that are possible. Apart from the concepts generated by the core project team, the report had no control over the types of concepts that were generated within the briefs offered to the students. The analysis of the concepts in Chapter 5 shows a wide range of diversity in both types of concepts and the types of domestic practices they focus on or impact. However, the designers involved in the projects were of a relatively homogeneous group in terms of age, educational focus, and background, which is not representative of the Dutch population.

With the exception of the Researching the Future Everyday concepts, none of the concepts were evaluated in real life settings. While it was initially planned to organise 'experiments in practice' around these alternative ways of dealing with hot weather in the summer of 2021, these had to be cancelled due to the COVID-19 situation. This means that considerations on the implications of the concepts are speculative.

4

OVERVIEW OF CONCEPTS

In this section, a total of sixteen concepts developed during Phase 2 are introduced. The concepts are grouped according to the three different contexts within which they were created: Core project, ID Green, and Researching the Future Everyday. Chapter 5 offers an overall reflection on the concepts, their implications for the summer comfort design space, and the methods used to generate them.

Together with the user committee, three concepts were selected and exhibited at Dutch Design Week 2021. These concepts were Living Shirt, UrbiCamp, and Cooling Patch. In preparation for the exhibition, the concepts and their related prototypes were developed further, resulting in higher quality visual materials for these particular concepts within this report.

Core project concepts

- Inside-Out
- Living at Night
- Collective Sleeping
- Sweat Fashion
- E.VIE

Background

This concept explores summer comfort in public space. It departs from the observation that with the increasing frequency of heatwaves in the Netherlands, citizens, particularly in cities, might be forced to seek summer comfort in air-conditioned indoor spaces. This future is not affordable for everyone and ultimately unsustainable. Inspired by the tendency of Dutch people to go outside to enjoy warm weather and the fact that appliances and people generate heat indoors, this project focused on making public space an area of shared investment and access that provides sustainable summer comfort to all. In this pursuit, the students sought inspiration from practices and experiences of the unhoused.

Inside-Out

A practice of performing heat-generating activities such as cooking and showering outside during hot weather

Concept

In the Inside-Out scenario, people reorganised their homes, gardens, shared spaces, and lives to perform heat-generating activities outdoors during times of hot weather. Individual and shared facilities have popped up everywhere, including outdoor cooking spaces and (underground) facilities for cooled food storage, outdoor bathing spaces, entertainment spaces, laundry stations, and workspaces. In areas with either small or no gardens, shared kitchens and bathhouses are set up in the neighbourhood. As such, homes that are fully shaded and closed up during the day stay optimally cool and serve as a refuge for rest and sleeping.

Implications

Many of the practices promoted in this scenario are already happening such as eating out, food deliveries, barbecuing, picnics, and camping. However, living outdoors during a regular work/school week with the idea of keeping the home as a cool refuge is not common practice and would mean a change in material organisation of homes and neighbourhoods, as well as a different perception of indoor climates and how they are achieved and used. Moving activities outside increases social interaction in the neighbourhood, but reduces privacy at the same time. Especially when facilities are shared, agreements need to be made on who can use them and when. A risk associated with this scenario is that duplicating facilities such as cookers, food storage, and bathrooms outdoors increases the resource intensity of households and are likely to be less water and energy efficient than their indoor equivalents. These additional appliances are only used for a limited amount of time, similar to camping equipment for example, and they may need additional maintenance or have shorter lifespans due to their exposure to the elements and shared ownership. Due to the costs involved in setting up and maintaining such facilities, there is a risk of accessibility issues. On the other hand, shifting towards shared facilities during a heat wave may form a stepping stone towards more shared use in general.

Background

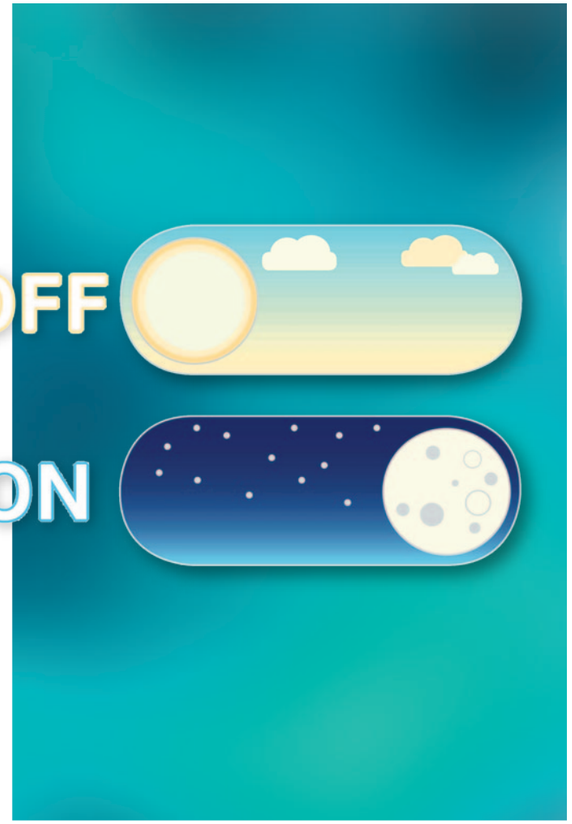
Living at Night began as a response to the love-hate relationship that Dutch people have with the sun as identified in the Phase 1 report. It found that, in the Netherlands, 'warm and sunny weather is associated with being outdoors and enjoying the light and warmth of the sun', and that 'in the spring, when days get longer and warmer, people open doors and windows to let fresh air in, extending their living spaces onto balconies and into gardens'. This tendency to welcome the sun into the home and onto the body has a risk of leading to overheating. But how can one change this culturally-embedded relationship?

Living at Night

A practice of living at night and sleeping during the day

Concept

In the Living at Night scenario, society has shifted most of their activities to night-time during the summer. At night, temperatures tend to be lower than during the day. Without the direct heat of the sun, being outdoors at night is more pleasant and healthier than during the day. At the approach of summer, the Ministry of Health together with the Dutch Royal Meteorological Institute would decide when the shift towards living at night is initiated. The transition will take two weeks and is maintained during the summer months. During summer, shops, restaurants, and offices are open at night, and schools, public transport, and the entertainment industry switch their schedules. During the day, people sleep and rest while the house is enclosed to keep the heat out. During the night, doors and windows are opened to make use of the cooler night air.



Implications

The concept of Living at Night requires extensive, collective change. To prevent a highly demanding 24-hour economy, society needs to be fully reorganised around a rhythm of being active during the night and sleeping during the day. This applies not only to the Netherlands but also in neighbouring countries and not only to residents but also visitors. Shifting sleep rhythms can lead to serious health issues due to jetlag and some people will be more sensitive to this than others, which leads to inequalities. Less energy is needed to keep buildings cool when people are active because outdoor air is cooler, but energy demand for artificial light increases in this scenario. While summer night ventilation is easier to achieve with people present to open and close windows and deter intruders, sleeping during the day may increase demand for cooling in the daytime because sleeping has relatively low temperature requirements despite the low body activity level. Daytime cooling demand is in sync with solar energy production but combining this with the 'Collective Sleeping' scenario (see next concept) may further reduce this demand.

Background

Collective sleeping began with the idea of energy saving through shared facilities. Sleep deprivation is a major factor of discomfort and stress during warmer weather and reduces physical and mental resilience to heat. The concept was inspired in part by cooling centres that are being set up in cities affected by severe heat waves as well as the concept of capsule hotels common in Japan. During heat waves, many homes become too hot for people to sleep comfortably. Installing cooling in individual bedrooms is too expensive and is both labour and energy intensive. What if cooled sleeping space is used collectively?

Collective Sleeping

A practice of sharing cooled spaces for sleeping

Concept

The concept of Collective Sleeping is placed in a future with major affordability inequalities, where the use of energy is too expensive for lower income households. To overcome this problem, cities started to create cooled sleeping facilities to help people living in overheated apartments to recuperate during the night. It began with the creation of sleeping facilities in public and office buildings that would otherwise be empty during the night. The centres are available on a neighbourhood scale, at walking distance from people's homes. Over time, different variants ranging from basic to high-end luxury wellness sleep centres and indoor and outdoor options started to emerge. Outdoor facilities are mainly developed in forested areas near shaded water bodies that naturally stay cooler. High quality insect nets protect customers from bugs. To achieve the desired shared and efficient use of cooling, the allocated space per person is limited in indoor facilities.

Implications

Safety, privacy, and serenity are important elements to sleep well. However, collective sleeping implies sleeping in shared spaces with multiple persons. This is likely to affect sleep quality and may lead to safety issues, particularly for women. Setting up designated facilities requires resources, particularly mobile mattresses, beds, and bedding, which need storage and may not be used outside of heatwaves. When used on a per-night basis, these facilities could incur large amounts of laundry or hygiene issues, unless people bring their own bedding. To increase efficiency, designated sleep centres may build in for flexibility of use by being open for working and studying during the day and offer sauna and bathing facilities like the Japanese capsule hotels.

Background

This concept began with insights from the Phase 1 report on the role of sweating in summer comfort and was inspired by the Japanese Cool Biz campaign. The study indicated that sweating has a negative image and is seen as something to hide and suppress, while it is actually an effective way of dealing with overheating. The taboo with sweating leads to a tendency for people to suppress sweating with deodorants, by limiting physical activity, and residing in cooled environments. While sweating is fairly accepted as part of doing sports, it is particularly taboo at the workplace or during formal occasions. These are also the places with the least heat-accommodating dress codes. What if sweating would become normalised and even welcomed in these situations?

Sweat Fashion

A practice of dressing in which sweating is celebrated and stimulated

Concept

In this scenario, sweating has become a celebrated bodily response to heat. Sweat Fashion rides on and strengthens this change of image. Through special weaving techniques, types of fabrics, cuts, and patterns the Sweat Fashion garments enhance the cooling capacities of sweating by spreading the fluids over the body. Moreover, sweat marks add to the aesthetic of the garment, so sweating is celebrated as an achievement. This encourages people to commute in an active way, such as on foot or by bicycle. Sweat Fashion was introduced through respected, innovative fashion brands and promoted by fashionable influencers and designed for formal and professional settings. Sweat Fashion collaborates with a trendy portable bottle brand to promote the combination of sweating and drinking enough water. During the night, doors and windows are opened to make use of the cooler night air.

Implications

Promoting sweating as something positive can reduce demand for cooling and make people more comfortable with being active in warm weather. A different image of sweat can also reduce showering and laundering frequencies since being sweaty was the main reason to shower and launder more during hot weather in the Phase 1 study. To prevent health issues, it is important to ensure sufficient fluid intake alongside sweating. It is also important to use materials and designs that facilitate sweat evaporation/ventilation and are not prone to smell. Merino wool is an example of such a material that has been proven to provide comfort in hot weather. However, wool requires specific forms of care to ensure durability. For woollen summer clothing to become a sustainable alternative, novel practices of clothing care and laundering need to be implemented as well.

Background

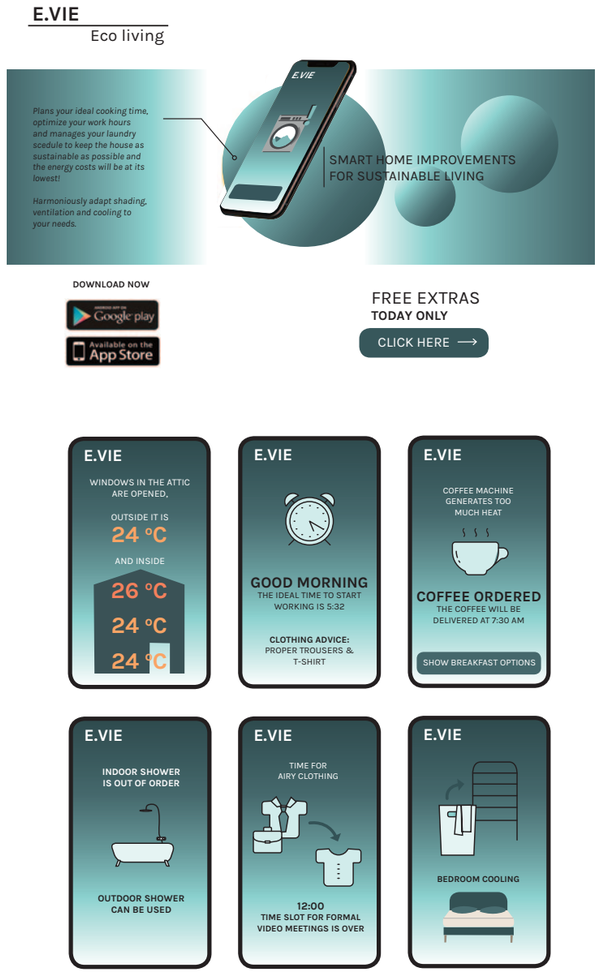
E.VIE focuses on the opportunity of integrating cooling, shading, and ventilating identified in Phase 1, but also draws in more elaborative adaptive strategies to minimize demand for cooling while maximizing health and comfort. Core to the concept is a definition of healthy comfort in which indoor temperatures move with outdoor temperatures, and cooling is only used to prevent indoor temperatures from rising above 27°C too quickly. As such, the concept aims to challenge emerging ideas of summer comfort that strive towards an indoor temperature in the lower 20°C range to support 'business as usual' domestic activities. While initially exploring two scenarios, one on human agency and one on artificial agency, the final concept focused on the latter to explore the boundaries of human-computer collaboration.

E.VIE

A dominant smart home assistant that prioritizes low-energy summer comfort

Concept

In this scenario, the household is controlled by a dominant smart home assistant called E.VIE, which stands for Ecological Living. E.VIE controls all systems and devices in the home and makes decisions on behalf of the residents based on available and required energy, the weather forecast, and (predicted) indoor temperatures. Decisions are directed towards low-energy summer comfort that implies a relatively radical reorganization of the household's daily schedules and use of space. For example, E.VIE sets the alarm at 5:20 (AM) for residents to make use of cooler, earlier times of the day for work. It makes recommendations on which rooms to work in and when and on what to wear. It orders coffee and lunch to be delivered to prevent heat generation indoors and locks devices such as televisions and stoves when temperatures are above a certain threshold. Residents are instructed to perform tasks that E.VIE cannot do, such as hanging the laundry in the bedroom so E.VIE can more easily extract heat from this room through evaporation.



Implications

E.VIE challenges the passive role that is often assumed for residents in maintaining indoor comfort and the pursuit of energy-intensive conditions that support 'business as usual'. While E.VIE is extreme and beyond acceptable, the scenario contains elements that may be implemented in adjusted form. Smart thermostats already exist, but they mostly operate behind the scenes in the service of residents without questioning or challenging their 'orders'. As a smart device, E.VIE is capable of monitoring and anticipating indoor and outdoor temperatures in and around the dwelling. It can therefore offer advice to residents such as when to open and close windows and shades, which rooms to use and when.

While thermostats are perceived and positioned as 'neutral' tools that serve the needs of residents, E.VIE also highlights the ideas about comfort embodied in their default settings and operation styles play a role in shaping certain ideas around comfort, such as striving to maintain a fixed temperature setting.

ID Green concepts

- Dry Footbathing
- Holesome
- Indoor Grass Patch
- Yoga Campaign
- Dutch Siesta Revolution
- HOTEAING
- Living Shirt

Background

This concept was inspired by practices of person-oriented heating in Japan, which require less energy compared to the space-oriented heating practices in the Netherlands (Kuijer and De Jong 2012). Taking person-oriented cooling a step further, the concept works with pulse points—key points on the body through which cooling can be achieved most effectively. Pulse points include your wrists, the insides of your knees and elbows and your forehead (Gordon, 2010). The cooling of specific body parts using cold water such as dipping your feet in cold water or putting a wet towel on your neck is already well known. However, when combined with working from home, water can be incompatible with deskwork and can leave a mess indoors.

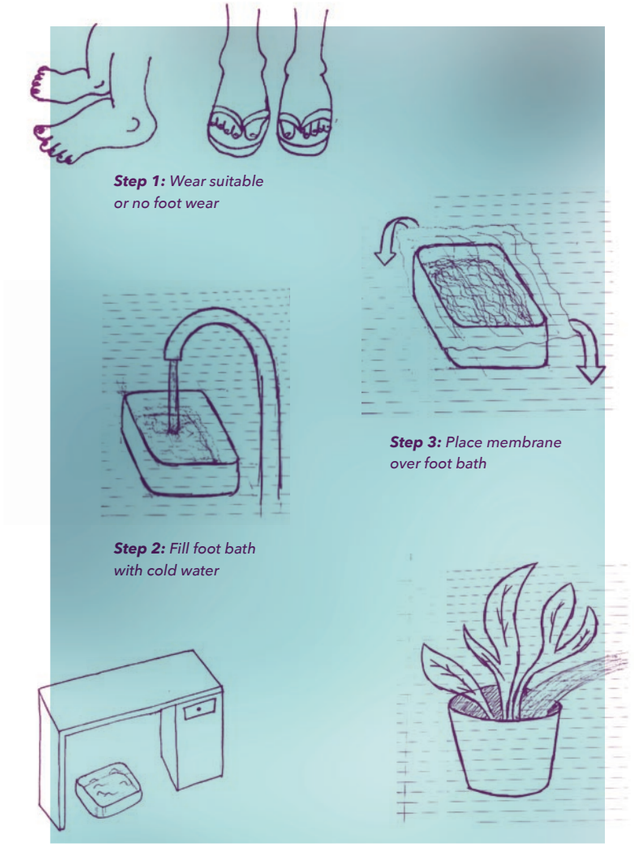
Dry Footbathing

A practice of keeping cool by keeping one's feet in a membraned foot bath

Concept

In Dry Footbathing, your feet are placed in a water-cooled basin. A thin membrane ensures that the coolness of the water reaches the feet without the feet actually getting wet. As such, the dry footbath helps to cool down the body without getting your clothes, workspace, or equipment wet. Over time, the water warms up, so the footbath has to be refilled with cool water on a regular basis. The warmed water is not discarded but used to water plants, which is facilitated by the design of the basin.

Concept by: three students



Step 1: *Wear suitable or no foot wear*

Step 2: *Fill foot bath with cold water*

Step 3: *Place membrane over foot bath*

Step 4: *Place foot bath in desired location and enjoy its coolling capabilities*

Step 5: *Recycle used water*

Implications

Adopting this practice is fairly low-key, but it does mean spending some time and effort carrying a footbath back and forth and finding a way to reuse the tepid water. While the task helps desk-workers stay active, it is questionable whether cooling just the feet is enough to be comfortable in a warm or hot space and whether a membrane would inhibit the transfer of heat away from the feet to the water. If the water is not reused, the practice requires extra water; a resource that is likely to become scarce in future Dutch summers.

Background

The idea for Holesome arose from existing practices of going into the forest during hot weather and finding cooling on shaded natural surfaces. This was combined with insights from the Phase 1 report that revealed that it is currently quite common to work and study indoors where it is possible to switch on a ventilator or air conditioner. However, once these cool places are created inside, it becomes less attractive to go outside to find relief from the heat (Kuijer, 2021). The concept aimed to prevent this development by creating attractive workspaces outdoors that make use of naturally cool outdoor spaces.

Holesome

A practice of working and studying outdoors in earth-cooled pits

Concept

Holesome is a concept of working, studying, and socializing outdoors in specially created pits in the ground to escape hot indoor spaces. The pits make use of the earth's naturally lower temperature. Some pits, on university campus for example, are large enough for small lectures. The pits support working on laptops by providing access to wifi and electrical power. While larger, more rural pits need to be reserved, there are also pits in city parks that can be used without a reservation. Due to their round shapes, the pits catalyse social interactions. Through the connected app and spontaneous app groups that emerged around the concept, friends let one another know they are going to a certain pit and meet there. But the open nature of these spaces also stimulates interactions with strangers. As such, Holesome turns nature into a place to not only occasionally relax in, but to work, study, and socialize during hot weather. Since people spend almost the entire day outside in the fresh air and with enough sunlight, windows, curtains, and shading at home are kept closed. Additionally, internal heat gain from human activity and device use is minimized, so the dwelling stays cooler for optimal rest at night.

Concept by: Gwen Eijmael, Aïcha Orsel, and two other students

Scenario storyboard

Implications

Working and studying outdoors can lead to a higher appreciation of nature and prevent loneliness for the growing number of single-person households working from home and facilitate the process of acclimatising to higher temperatures. It also presents challenges such as changing weather circumstances, insects, and dirt. Working in a public space could also lead to frictions around noise, disturbance, and cleanliness. Since the pits require investments in and maintenance of infrastructure, questions of costs and access arise that will result in different answers depending on private or public ownership of the pits. Moreover, the purpose of the pits is to cool down in the summer, but it is unclear what happens to them during the colder winter months when they may degrade because of their natural materials.

Indoor Grass Patch

A practice of keeping an indoor grass patch to cool down and relax on during hot weather

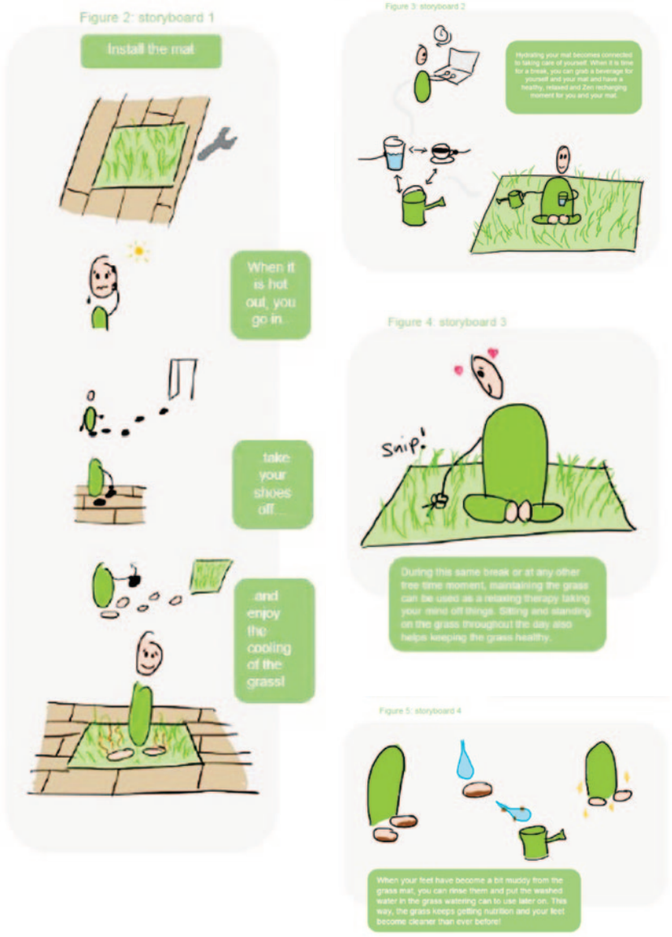
Background

This concept was inspired by the cooling effects of plants on roofs in India. It links to the experience of enjoying a summer holiday while lying on a shaded grassy area and connects this to the health-enhancing and cooling effects of house plants.

Concept

In this scenario, people have started cultivating indoor grass patches to improve their indoor environments and atmosphere. During hot weather, the indoor grass patch provides a cool place to sit or lie down on within the home and helps to cool the space through evaporation. It also provides a calming breaktime activity in the form of cutting and caring for the living grass and makes immersive interactions with nature accessible to households without gardens. Children can play on the patch and learn about nature and plant care in the process of maintaining it.

Concept by: Max de Jongh and two other students



Implications

Grass requires about 3.8 centimetres of water per week. Based on the area that this set-up occupies (with an assumption that the standard size of the patch is 1x1 meter) over a year, it would require approximately 1,970 litres of water over one year. If this water is a product of recycling from other domestic usage in the house, this concept will be optimally sustainable over time. However, one has to consider the infrastructure costs of recycling water within homes if it is not done by the respective municipalities. The grass might easily die from too little sunlight, so special lamps (requiring energy) may be needed to care for it. Placing it next to a window would offer more natural light but would require shades and curtains to be open for part of the time, which would warm up the room. The grass indoors may attract insects and the moisture could create mold as well as increase humidity indoors.

Background

This concept is grounded in research showing that Yoga offers some useful techniques and poses that can help the human body stay cool. Examples of special poses and breathing techniques for tackling warm temperatures are the Sitali breath and Pranayama breathing techniques (Achanta, 2019; Pizer, 2020). Since sweating is an effective bodily technique to keep cool, breaking a sweat through moderate exercise such as Yin Yoga—mostly involving deep floor stretches— or a slower flow version of Power Yoga (Finerty, n.d.) can lead to immediate relief from heat. Moreover, sweating is a bodily skill that can be trained through practice, making the body more resistant to heat overall.

Yoga Campaign

A practice of collective yoga moments designed to help the human body stay cool

Concept

The focus of the concept is on scaling up the use of existing yoga techniques to deal with heat. To get people into this practice, an extensive Yoga Campaign is set up to promote and support regular yoga practice for everyone during hot weather. The idea is to broadcast messages on multiple TV channels and radio stations, as well as streaming services and social media apps. These messages will give either auditory or visual instructions by a native Indian yoga practitioner on various Yoga and breathing techniques that can help a person stay cool. These broadcasts happen three times a day: at the end of the morning, during the afternoon, and before sunset. When most people have been doing it for a significant amount of time, tutorials are not necessary anymore and the activity becomes part of habit. Initially, people felt embarrassed to perform Yoga in public. Once their confidence during yoga has grown, people started to practice more in groups and learn from each other instead of a screen.

Concept by: three students

Implications

An extensive media campaign with all these screens turned on and broadcasting live requires a lot of energy. However, this demand lowers over time. The main goal of the campaign is to normalise the activity and teach people the basics of these yoga poses. The practice requires an integration into everyday routines, the accessibility of suitable space to perform the exercises (preferably outdoors), and appropriate attire. A possible side effect of the practice is a changed attitude towards working and being productive in the summer. As the yoga poses both cool the body down and have a positive influence on their mental health during the heatwave, it is likely that practitioners feel more energy during the rest of the day. This could lead to a change in work attitude, where it becomes normal to be active during summer days instead of relaxing on the beach or inside. In other words, the change in perception of warm weather and gained skill of controlling body temperatures through activity could lead to a pressure to be active.

Background

This concept focuses on reimagining daily work rhythms to avoid heat instead of combatting it with cooling. The siesta, originating from Spain, is a practice of napping or resting during the hottest part of the day and staying up longer and sleeping less during the night, thus utilising the cooler hours of the day to the full extent (Burgen, 2019). Depending on the region, siestas are often taken seriously, with businesses closing for several hours and children being kept inside to keep the streets quiet during the rest hours (Deshong, 2021). This practice is common within the warm Mediterranean climate, with Italy (Alger et al., 2019), Greece, Turkey (Foscolou et al., 2019), and Portugal (Tremlett, 2003) being examples of countries with similar business cultures. In the Netherlands, napping within the current 9-to-5 workday will likely be unappreciated by most employers. However, based on research showing advantages of napping for employee health and productivity (Dhand, 2006), napping is already implemented in some businesses (Hoffman, 2021).

Dutch Siesta Revolution

A practice of taking a long break at the hottest time of day

Concept

The Dutch Siesta Revolution scenario has two variants. One focuses on the office, the other on working from home. In the office setting, entire departments are shut down simultaneously for two hours during the hottest time of day, guiding all employees to take a siesta. This includes blinds closing, lights switching off, and cooling switched down, creating ideal circumstances for low-energy rest. Agendas are collectively blocked-off during the rest-hours. In the work-from-home scenario, the circumstances and settings are personalized. Sensors in the home, combined with learning algorithms predict the hottest time for each workday. Residents are notified of the siesta slot in their calendars and when the time approaches, lights and (if present) cooling are switched down or off. Optionally, calming music or sounds are played and residents are encouraged to change into comfortable clothing. At the end of the resting time, settings are reversed and the resident can get back to work refreshed.

Concept by: Lena Opheij, Sanne Korpel, and two other students

Implications

The concept highlights how everyday rhythms are not easily changed on an individual basis. Everyday life is a complex symphony of intertwined personal, informal, institutional, and natural rhythms. Changing work hours affects many other realms of life such as shopping, eating, childcare, etcetera. And even within rhythms of work, clashes are likely to occur when part of the workforce becomes unavailable in the middle of the workday. Moreover, since the siesta is meant to be temporary, it is not clear when it starts or stops. Having breaks in the middle of the day can lead to a stretching out of work hours in the morning and evening, lengthening the overall time in which people are expected to be working. This can lead to an anchoring of extended work times outside of heat waves.

Background

This group started out with a focus on sleeping, looking into the practice of taking a siesta (Koyfman, 2018), and found that, in the Middle Ages, people slept in cycles of four hours and were awake for a couple of hours in the middle of the night; a time in which they performed various tasks (Ekirch, 2006). However, their focus eventually shifted to dealing with heat through the body, in particular, through eating and drinking. Although, to many Northern Europeans, the thought of eating warm or spicy food during the summer may seem very unpleasant and uncomfortable, this is a common practice in many Asian cultures. This practice is supported by research in physiology. Studies have shown that spicy and warm foods actually help the body regulate its internal temperature and allow people to feel cooler in the warmer seasons because this type of food stimulates sweating (Thirunathan, 2019). Eventually, the concept was extended with yoga practice to create a package of practices that train the body and mind's capacities to deal with heat.

HOTEAING

A practice of cooling body and mind by eating spicy food, drinking hot tea, and performing yoga

Concept

Hoteaing includes the practice of making tea in a kettle powered directly by solar energy (similar to solar kettle concepts). While waiting for the water to come to a boil, the practitioner performs various yoga poses. After the tea is ready, the practitioner performs a combination of drinking the tea and continuing with yoga. This way, they become mindful about the idea and bodily experience of hot weather. To supplement this form of training, the practice also includes cooking spicy foods, which is supported by a cookbook with recipes designed for a warm weather diet.

Concept by: Julia Linnenkamp and two other students

Implications

Besides representing another relationship with hot weather and an unusual, low-tech strategy to deal with and gradually adjust to heat, this practice can reduce the use of high consumption appliances such as water kettles, the freezer or refrigerator. Since Asian food and drink recipes have become a trend in the Netherlands, the practice of eating more spicy food may ride the wave of current developments. The practice requires time to perform and a slowing of pace, which is challenging to fit into people's busy schedules.

Living Shirt

A practice of wearing clothing with integrated air-plants that live on the wearer's sweat

Background

Living Shirt emerged from a set of ideas centred on plants in the home. Plants have been promoted for their positive effect on healthy indoor climates, with Aloe Vera, Golden Pothos and Areca Palm cited as species that help keep the house cool (NurseryLife, 2016). An earlier idea focused on using plants as an indoor sun shield in the form of a plant curtain, but eventually the group focused on epiphyte clothing in which air-plants (plants that don't require soil) absorb sweat. Besides challenging ways of dressing in hot weather, this concept also aimed to shift perceptions of sweating. Living Shirt was one of the concepts selected for exhibition at Dutch Design Week 2021.

Concept

Living Shirt is a fictive garment containing air plants. It supports commuting to work by bicycle or on foot in hot weather. While the plants live on nutrients and water from the wearer's sweat, they provide cooling through shelter and evaporation. Unlike regular clothing, Living Shirt joins its owner for their weekly shower and hangs in the window when not worn. Wardrobes are slowly replaced by greenhouses with advanced moisturizing systems.

Concept by: Joost Buining, Serra van Santen en Luna Snelder

Living Shirt is a fictive garment containing air plants that is part of a fictive line of professional dress; representing a future where sweating as a response to hot weather is welcomed as a way to cool down.

While the plants live on nutrients and water from the wearer's sweat, the provide cooling through shelter and evaporation.

It supports commuting to work by bicyle or on foot in hot weather.

Unlike regular clothing, Living Shirt hangs in the window when not worn, ...

... and joins its owner for their weekly shower.

Drawings by Shams Hazim

Photos by bywirenet, shirt design by Marina Toeters (Fashion Tech Farm) and Brigitte van der Lught

Implications

As apparent in the scenario, changing ways of dressing affects other practices such as clothing care, personal cleanliness, working, and commuting. Dressing—in particular formal dress—is a practice where many implicit rules exist on what is and is not acceptable to wear. Once accepted, plant-based clothing may have other advantages such as the unique and changing character of each clothing garment, reducing the need to buy new items. In addition, the concept interferes in practices of personal cleanliness, which also contain many implicit but strict rules around social acceptability. In a practical sense, clothing with living plants in them would require different infrastructure and more space for clothing care overall. Plants require light, moisture, and careful nurturing. If not properly cared for, they wither and die, potentially leading to a higher turnaround of clothing items.

Researching the Future Everyday concepts

- UrbiCamp
- Little Helper
- Chilly Popper
- Cooling Patch

Background

This concept explores summer comfort in public space. It departs from the observation that, with the increasing frequency of heatwaves in the Netherlands, citizens, particularly in cities, might be forced to seek summer comfort in air-conditioned indoor spaces. This future is not affordable for everyone and is ultimately unsustainable. Inspired by the tendency of Dutch people to go outside to enjoy warm weather and the fact that appliances and people generate heat indoors, this project focused on making public space an area of shared investment and access that provides sustainable summer comfort to all. In this pursuit, the students sought inspiration from practices and experiences of the unhoused.

UrbiCamp

A practice of young urban people setting up their workspaces outdoors

Concept

Urbicamping is set in a future where urban twenty-somethings reprogram the public space as a living space. UrbiCamp is a fictive concept of a high-end kit that enables young urban people to set up their workspaces outdoors. The set includes magnetic hooks to apply to metal street furniture, a tarpaulin for blocking out the sun, bungee cords, a power strip, and a bag which can be repurposed as a mat. On hot days, city apartments easily overheat. To escape the heat and prevent their appliances from heating, these spaces open up further. Young workers revert to the ample, shaded green space that future cities provide. Here, they enjoy working on their laptops in a gentle breeze.

Concept by: Nina Boelsums, Tjeu van Bussel and Piet de Koning

"Meet the young people who flee into the city to avoid their hot houses"

Drawing by Shams Hazim

Implications

Urbicamping is about shifting laptop work from (home)offices and student rooms to urban public spaces. At the same time, it is about inequitable access to air-conditioned spaces and the roles of public space. The concept highlights the importance of anti-cipatory green space in cities, which needs time to grow before it offers substantial shelter from the sun. From the perspective of the urbicamper, current urban space can come across as hostile and desert-like. Through designing the concept and trying it out in Eindhoven, the students experienced how much of public (green) space is designed for passers-by and not for dwelling. In terms of everyday practices, urbicamping makes new links between camping (normally associated with going on holidays) and working, and challenges links between occupying public spaces and homelessness.

Elements in public spaces such as water taps, CCTV camera's, parking spaces, nooks, benches, trash, power supplies, and wifi take on a different meaning. For example, parking spaces turn out to 'prefer' cars over people, while the car itself could become a (workaround) mini-workspace in an urbi-camping scenario. Walls and fences become places to fix a hook or magnet. Moreover, the urbicampers' relation with the city and its people changes, potentially creating new bridges and conflicts between young urban people and the unhoused.

Background

This concept focuses on practices of the elderly during heat waves. Older people are more vulnerable to heat and heatwave lead to excessive deaths. In 2003, approximately 70,000 deaths were reported among the elderly in Europe that were attributed to high temperatures (Hermann & Sauerborn, 2018). Due to reduced mobility, heat waves also make the elderly more socially vulnerable (Cacioppo & Cacioppo, 2014), for example inhibiting their ability to get groceries and engage in social activities. In 2040, one-in-four people in the Netherlands will be 65 years old or older. While this is a major challenge, reverting to air-conditioning alone would lead to undesirable increases in energy demand. Inspired by Shove's (2003) conceptualization of comfort as a malleable construct and the Phase 1 conclusion that summer night ventilation and shading can help reduce demand for cooling, this project explored the extent to which the next generation of elderly are ready to stretch their boundaries of comfort and perception of future "normality" to reduce CO_2 emissions.

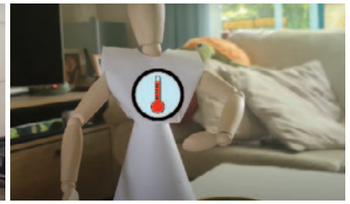
Little Helper

A low-energy practice of summer comfort for the elderly supported by a Little Helper

Concept

The scenario includes: (1) a macro level setting of climate change, extreme heat, and limited resources, (2) a mezzo level of strict government policy to combat climate change, and (3) a micro, everyday life level with a 'soft' and 'hard' variant. In the 'soft' scenario, the Little Helper robot plays the role of a digital friend that offers advice, but does not interfere in personal freedom and choices. The advice includes things like wearing a hat when going out, switching from air-conditioning to the fan, and to open a window when it gets cooler outside. It also educates users on the importance of hydration, monitors behaviour such as water intake and household energy use, and introduces a positive perception of warmth. In the 'hard' scenario, the Little Helper not only monitors routines, but also analyses these patterns and directly steers and controls everyday behaviour, for example, by preventing their owners to go outside when it is 'too hot', autonomously ordering drinks, switching off the air-conditioning, and opening windows.

Concept by: Deborah Cnossen, Elisa van de Schoot and one other student



Implications

When confronted with the two scenarios, the elderly participants showed willingness to adapt as long as their personal freedom was safe-guarded and the change was a societal commitment done by all. Their own health was an important motivation to accept some of the interventions from the 'hard' scenario such as requirements concerning their water intake, but they found it unacceptable if the device prevented them from going outside. When it came to measures focused on saving energy, they seemed less willing to accept a loss of autonomy, like when the device would switch off the air-conditioning. However, if the effort was collective, this would increase their willingness. Without buy-in, coercive methods are likely to lead to creative workarounds, rejection, and protest.

Background

This project explored a future in which heatwaves are the daily norm, but no resources are available to use energy-intensive cooling products. Within this scenario, the Chilly Popper was inspired by trends of adaptations of the living environment and artificial space cooling, as well as issues of inequality in access to air-conditioned environments.

Chilly Popper

A practice in which people use portable 'poppers' to temporarily cool down a space

Concept

Chilly Popper is a concept of a portable, disposable device that temporarily cools down a space when activated. It is set in a future where heatwaves have become the daily standard, and power outages are a common occurrence. The Chilly Popper is similar to what is known today as a 'party popper'. However, rather than emitting confetti, it emits a cooling agent. The Chilly Popper can be used indoors in a room up to 20 m2 for full effect. When the popper is opened, an endothermic reaction will take place. Due to this reaction, the heat in the environment will be absorbed and the temperature will be lowered to 20°C within 5 minutes, allowing people to enjoy a cool space. Within an hour, the temperature will have slowly returned to the original temperature of the room. The Chilly Popper can be bought at various stores and costs €20.00. Refills can be bought for €3.00 per unit and each refill can be used five times.

Concept by: Saskia van Hoeven, Sanne Metten and Shams Hazim

Implications

The relief of the Chilly Popper is only available to people who can afford it. Participants confronted with the concept imagined using it for daily activities such as cooking and cleaning in which higher activity levels require cooling down, parties to share the costs, and some help with falling asleep. They also imagined a scenario where public spaces, like trains, would be cooled with chilly poppers as a service. They were worried about the high cost, as well as the possible effects on the quality of the air in the cooled space. What kinds of chemicals are spread around, how do they affect people's health, and do they build up over time or disappear? Finally, they imagined bringing a sweater or jacket to a party where poppers might be used in fear of getting too cold from the sudden drop in temperature.

Background

Like the Chilly Popper, Cooling Patch is set in a future scenario of continuous heat waves and a scarcity of energy. Since not everyone is financially capable of or in the position to take measures to reduce energy demand, energy poverty among minority, lower income groups and tenants is anti-cipated to grow. The Cooling Patch was inspired by trends of altering natural processes of the body, as well as the trend of micro-needling in the field of drug and vaccine delivery (Gupta and Gupta 2020). Inspired by animals who are accustomed to extreme weather conditions such as the Pompeii worm and the Sahara desert ant (Williams 2010) and by studying the properties of their heat regulation systems and strategies for coping with heat, we could discover new ways of cooling that modify humans such as creating more skin surface for better respiration and cooling (Haines 2021).

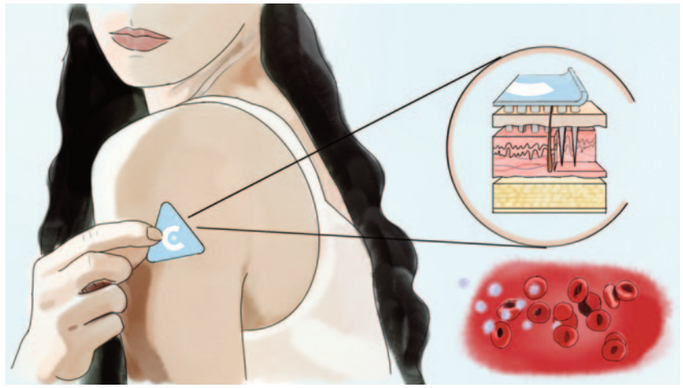
Cooling Patch

A future in which government-distributed cooling patches make bodies more heat resistant

Concept

In this scenario, free Cooling Patches are provided by the government. The Cooling Patch contains microneedles that painlessly release the patented KeepCool© technology into the body. KeepCool© makes the composition of the blood better resistant to heat and cools the body from the inside. The needles dissolve and release the active ingredients of the technology into the body. Every citizen will receive a yearly letter inviting them to make an appointment to pick up their free patches at the nearest pharmacy. Since it is available, government programmes offering cooled spaces during heat waves have been scaled down. One box contains 52 Cooling Patches, which have an effect for a maximum of one week. Citizens can place the patch on their upper arm and replace it with a new one every week for full effectiveness or choose to use them less frequently. The patch can have some side effects: stiffness, tense muscles, shivering, tingling or numbness of certain body parts such as the legs, feet, or hands, nausea, bruising, and a change of skin tone.

Concept by: Saskia van Hoeven, Sanne Metten and Shams Hazim



Implications

Cooling Patch takes person-oriented forms of cooling to the extreme. While body-focused, it does not involve acclimatising or adaptation. Rather, the technology supports 'business as usual' despite climate change, but without a dependence on energy-intensive space cooling. Whether this invasive techno-fix is a desirable solution is clearly up for debate. What the concept also high-lights are power dynamics. Once available, Cooling Patch may reduce incentives to ensure accessibility to cooled environments, thereby cornering people with no other way to stay cool into using it. The focus group study indicated that the invasive character and side-effects might be cast aside for the need to escape the heat. Some participants would even plan their days around the side effects, for example by stretching regularly to prevent stiffness. Society might adapt to the side effects with physiotherapy programmes and exercise regimes to minimize them.

5

REFLECTIONS ON THE CONCEPTS

In this phase of the project, the aim was to extend the design space for summer comfort in Dutch households with possibilities that do not centralize technological innovation. By deliberately seeking and crossing the boundaries of acceptable or feasible solutions, these provocative concepts aimed to stretch the design space towards innovations in collective knowledge, skills, rhythms, and ideas of normality. This section reflects on the concepts and presents five additional design spaces that emerged from this broader exploration of possible futures of summer comfort. Before going into these spaces however, it briefly reflects on the diversity of the series of concepts developed during this phase.

Diversity of the concepts

Society is diverse and is subject to change on an endless number of dimensions. It is impossible to consider all possible frictions and opportunities related to the diversity of situations a concept could end up in. To offer some perspective on the actual and potential design space, this section briefly reflects on dimensions of diversity and how they were or were not considered in the set of concepts.

Analysis of the concepts shows that the practices addressed with the concepts cover the entire spectrum of practices studied in Phase 1 (Figure 6). (Home) working in hot weather was addressed most frequently, along with practices of ventilating, shading, and cooling. Only one concept (E.VIE) explicitly involved cleaning, while only Living Shirt explicitly addresses mobility—a practice that was not included as a separate practice in the Phase 1 study.

Furthermore, only one concept, Indoor Grass Patch, explicitly considered children and only Little Helper focused on the elderly. None of the concepts focused explicitly on rural areas, while a couple focused specifically on the city, such as Collective Sleeping and UrbiCamp. Lower income households are considered in several concepts and were involved in a focus group discussion centred on the concepts of Chilly Popper and Cooling Patch. None of the concepts considered mental or physical disabilities, illness, menopause, or menstrual cycles and only one, Collective Sleeping, briefly touches on gender issues related to safety.

Bearing in mind these limitations, the section below goes deeper into the ways in which the design space for summer comfort was extended through the generation of and reflection on the triggering concepts.

PRACTICES-ORIENTED DESIGN APPROACH

	Cooking & eating	Personal care & clothing	Laundering & cleaning	(Home) working	Free time & socializing	Sleeping	Ventilating, shading & cooling	Mobility
Inside-Out	X	X	X		X	X	X	
Living at Night	X	X	X	X	X	X	X	
Collective Sleeping						X	X	
Sweat Fashion		X						
E.VIE	X	X	X	X	X	X	X	
Dry Footbathing				X			X	
Holesome				X	X		X	
Indoor Grass Patch				X				
Yoga Campaign				X				
Dutch Siesta Revolution				X		X		
Hoteaing	X			X				
Living Shirt		X	X	X				X
UrbiCamp				X				
Chilly Popper					X		X	
Cooling Path							X	
Little Helper	X	X					X	

Figure 6: Overview of Practices-Oriented Design approach (Kuijer 2017)

Extending possible futures of summer comfort

Reflecting on the sixteen concepts, five novel design spaces emerged that extend the range of possible futures of summer comfort:

1. **Temporal reorganisation**
2. **Spatial reorganisation**
3. **Different embodied relation**
4. **Personal cooling**
5. **Redistributing skills**

By focusing on low-energy comfort and innovations in everyday practices, these additional design spaces diversify the range of possible futures considered, thereby exploring, challenging, and pushing the boundaries of what is considered acceptable and desirable, while de-emphasizing technological innovation as the only or best pathway for households to deal with hot weather.

Through creating and engaging with these alternative futures, insights are generated on their possible pros and cons for achieving or maintaining low-energy, healthy summer comfort in Dutch households. Moreover, they function as vehicles to facilitate reflection and discussion on the desirability of current developments, perceptions, and imaginaries. Below, each design space is discussed in more detail with reflections on their risks and opportunities. Some of the concepts cover several of these spaces.

Temporal reorganisation

- **Living at Night**
- **Indoor Grass Patch**
- **Yoga Campaign**
- **Siesta Revolution**
- **Hoteaing**

Reflecting on the concepts that engage with temporal reorganisation, two main dimensions of this design space emerge. One is shifting activities to other times of day, the other is generally slowing down. Looking at the implications of these dimensions, they both require a relatively high level of collective adoption. This is because living rhythms of people within a society are closely intertwined due to the many connections between people.

For example, living at night leads to issues with shop opening times and office and school hours. To make such a strategy work, a significant number of people would have to adopt the practice and work at night to cater to the many services that people require while active. This could lead to issues if a significant portion of people stick to a ‘living during the day’ schedule.

For a siesta type of configuration, the time-shift is somewhat less impactful. However, as one of the participants in the Phase 1 report indicated, temporarily shifting one’s work hours to later and earlier in the day can lead to risks of spreading out work hours also in other times of the year.

With a general slowing down, there is another issue that arises, which is acceptance of a lower level of productivity. However, some of the student groups suggest that slowing down might not necessarily lead to lower productivity if the work time is used more effectively due to a more balanced mind. Here, concepts also emphasized the collective character of taking breaks, which could reduce issues with conflicting schedules.

Changes in societal rhythms are not unprecedented. For example, over the past centuries, work and school hours have reduced and shop opening hours have extended over time. Moreover, in 'extremely warm' summer weather, Dutch schools are allowed to shift to a 'Tropenrooster'[5] – a tropical timetable. This means they can temporarily choose to shorten lectures and workdays. While there is no mention of shifting workhours to cooler times of the day, the protocol could be adjusted in the future to become more flexible when extremely hot weather becomes more frequent.

Spatial reorganisation

- **Inside-Out**
- **Collective Sleeping**
- **Holesome**
- **UrbiCamp**

Spatial reorganisation also has two main purposes in the concepts. One is to take heat-generating activities outside and thus keep the home cool for rest and sleep. The other is to make efficient and inclusive use of cooled spaces by using them collectively. While the collective use of space and facilities can potentially use resources more efficiently, material multiplication is a risk associated with these types of concepts. Activities generally need 'stuff' to perform them. If moved to another location, this 'stuff' can either be carried along as portables such as in UrbiCamp or duplicated in another location. Either option needs additional materials on top of the things people already use to perform the activity in its 'normal' location. What is done with this 'stuff' and the necessary infrastructure outside of periods of hot weather is not always clear. Also, it is unclear whether the impact of these additional materials are worth the possible energy savings from the reduced cooling demand.

Moving the location of activities is not historically unprecedented either, but mostly, this movement has been from collective spaces to domestic ones. For example, public bathing houses have slowly turned into private bathrooms, (grocery) shopping is increasingly done from the couch at home, and even office work is moving into private spaces of the home. The practice of camping, also possible within or near most cities, is in fact a practice of spatial reorganisation that happens in times of warmer weather. However, when looking at types of accommodations that people choose during holidays, only 16% is in a tent or caravan (CBS 2020). Finally, Collective Sleeping could be imagined on a smaller scale of sharing cooled spaces within the privacy of the home.

Different embodied relation

- **Sweat Fashion**
- **Living Shirt**
- **Yoga Campaign**
- **Hoteaing**
- **Cooling Patch**

Since acclimatising was one of the focal points in the report, many of the ideas emerging in Phase 2 focused on the embodied relation of people with heat. Two of these were focused on sweat and dressing, three involved yoga or mindfulness, two included relations with nature and plants, and one included eating and drinking habits.

All these concepts addressed ideas of normality. Two focused on images of sweating and three on ideas of availability, productivity, and levels of activity considered normal for a working day.

Yoga Campaign makes explicit how a change of norms requires a level of shared, collective change. Moreover, Yoga Campaign pays specific attention to learning a new skill and the change over time that happens through this learning. In any novel practices, when people move from novices to experts, their behaviour and role can be expected to change.

5
https://www.rijksoverheid.nl/onderwerpen/schooltijden-en-onderwijstijd/vraag-en-antwoord/wanneer-krijgen-scholen-een-tropenrooster

Embodied relations with temperature have gained some attention over the past years through the popularity of the Wim Hof method, also known as Ice Man[6]. The problematization of body odour and wet sweat spots goes back decades and has become deeply embedded in current Western culture, but questioning this suppression of natural bodily states and processes fits within current trends around body positivity[7]. Also, the popularity of yoga practice has been growing in the Netherlands[8].

Personal cooling

- **Indoor Grass Patch**
- **Dry Footbathing**
- **Cooling Patch**
- **Chilly Popper**

These four concepts all offer some form of person-oriented cooling, with Dry Footbathing as one of the most passive, least impactful concepts in the set and Chilly Popper being the most space-oriented and active of the four. What distinguishes Chilly Popper from state-of-the-art cooling technologies is the idea of boosts of cooling instead of maintaining a room at a single, pre-set temperature level. This changes the dynamic of peoples social relations and perception of indoor climates.

Indoor Grass Patch is, in a way, opposite to the spatial shift of moving activities outdoors such as suggested in UrbiCamp and Inside Out. In this concept, the outdoors is brought in. In essence, this is done to bring in the natural cooling effect of lying on the grass.

Cooling Patch and Chilly Popper were developed as a set of concepts where one was more hedonistic and expensive and the other was more controversial and free. The purpose of presenting these two ideas together was to feed into debates around the inequalities in people's abilities to deal with the warming climate.

6 https://www.wimhofmethod.com/iceman-wim-hof

7 https://en.wikipedia.org/wiki/Body_positivity

8 https://www.rtlnieuws.nl/gezondheid/artikel/44366/yoga-populairder-dan-ooit-ons-hectische-bestaan-moeten-we-ergens-rust

Personal cooling solutions are relatively low threshold as well as relatively tech-centred ways of dealing with hot weather. Cooling scarves and vests were promoted during the 2020 heat wave in the Netherlands[8] and available in an abundance of types and styles in Japan (add image). Passive cooling with a fan is more space directed but also falls within this category. Most of these options imply additional artefacts and the use of water, but resource use and environmental impact reduction are relatively effective because they cool people directly and do not require cooling agents.

Distributing skills

- **E.VIE**
- **Little Helper**

While the concept of co-performance in combination with a decentralized role for technologies would expectedly lead to a delegation of skills from appliances to people, both Little Helper and E.VIE contain roles for technologies that are more active than their 'regular' counterparts. Instead of servicing residents while remaining in the background as much as possible, the smart home systems in these scenarios seek interaction with residents and are explicit about their normative position in relation to energy consuming domestic practices. They thereby justify their position by offering arguments and information that regular systems do not tend to provide, even though it can be argued that these systems are also normative.

Moreover, particularly E.VIE uses people as part of its system in places where human bodies are particularly capable to perform a task, for example, to hang the laundry. This is, in a way, controversial. On the other hand, many devices do this implicitly. For example, robot vacuum cleaners can only do their job if people clear their spaces of clutter and obstacles. Washing machines and dishwashers can only run if they are filled with garments or dishes first.

9 https://nos.nl/artikel/2343235-sjaals-planten-en-kledinglabels-moeten-ouderen-tegen-hitte-beschermen

6

CONCLUSIONS AND NEXT STEPS

The aim of this phase was to extend the range of possible futures considered for Dutch households in their ways of dealing with global warming. During the phase, a range of sixteen concepts was generated using a diversity of methods. These concepts were not meant to form solutions but represented triggering fictions that helped to explore the boundaries of what is considered acceptable and desirable.

The phase opened several additional design spaces focused on non-technological types of responses that require people to learn new skills and change their ideas of what is normal and acceptable. Historic research shows that this is what people already do as a matter of routine in everyday life.

In fact, upon reflection, the strategies designed in this phase already exist in some form. Within the Phase 1 study, many households were making efforts to reduce overheating in their homes through low-energy means and adapting their lifestyles to hot weather where possible. This group is not well-served by technologies that aim to take all possible effort out of their hands while pursuing a 'business as usual' lifestyle in spite of climate change.

Instead of focusing on preventing increases in energy demand 'while maintaining quality of life', these concepts raise questions around what is considered quality of life. They illustrate that the techno-hedonist scenario of artificially cooled spaces is but one of the possible futures that represents a 'good life'. Other types of 'good life', with considerably lower levels of resource intensity, are possible. For example, ways of living with more body-positive engagements with sweat, different expectations of indoor climates, and an extended flexibility in where, when, and at what pace activities are performed during warmer weather.

Eventually, the idea of this phase is not to design technology out of everyday life, but rather, to acknowledge people as skilful agents with a willingness to invest effort and capabilities to learn and adapt, which technologies might support and complement.

Five design directions

This 'preferable' future will be developed in the next and final phase of the project. Based on insights from the first two phases, it will expound on this preferred future in five related design directions that focus on the touch points of humans and technology in everyday life.

These five directions build on the directions identified in the first phase, while incorporating the additional design spaces generated in the second phase. A sixth design direction is focused on integrating the five design directions into a coherent, yet diverse probable future vision of summer comfort in Dutch households.

Temporal and spatial reorganisation is brought together in the newly added 'adaptation' direction. The insights from embodied relations with heat extend the design space within the 'acclimatisation' direction. Personal cooling is grouped together with a general focus on cooling practices that was added in response to recent research showing the extent in which Dutch households already have cooling installed and the opportunities revealed by insights in the ways in which these are currently used. Finally, distributing skills is a design space that is relevant for each direction (Figure 7).

Figure 7: five design directions for healthy, low-energy future practices of summer comfort

	MEANINGS	HUMAN SKILLS	ARTIFICIAL SKILLS
Shading	normalising a shaded home in specified circumstances	practical guidelines on when to shade and what to expect from it	support/automate effective shading routines
Ventilating	normalising a different pattern of opening and closing windows, and introducing a novel role for mechanical ventilation, redefining 'fresh air'	practical guidelines on when and where to open and close windows and what to expect from it	supportive mechanical ventilation protocols, support effective ventilating routines with reminders and automation, checking indoor and outdoor temperatures
Acclimatising	a different conception of the body and its relation to heat	practical guidelines on how to acclimatise one's body	where relevant, thermostats that support an acclimatisation process
Cooling	normalising higher and varying temperature settings for cooling, normalising collaboration with shading, ventilating and acclimatising	understanding the health, financial and environmental advantages of higher temp settings, learning to adapt to higher indoor temperatures, learning to adjust indoor temperatures to outdoor temperatures, adjusting temperature to suit the type of activity	adjusting indoor temperature to outdoor temperature, increasing indoor temperature over time, anticipating types of activities and their desired temperatures, support acclimatisation processes, assume integration with shading and ventilating
Adapting	normalising the idea of adapting lifestyles, expectations of productivity and conceptions of comfort to climate and weather change, adapting fashion norms	flexibility in use of space and time, creativity in the face of changing weather circumstances, novel skills of dressing, proficiency in low-carbon forms of summer comfort	support anticipating temperature changes into (collective?) scheduling, support flexibility in use of space, support personalised comfort?

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APPENDIX

Cross cultural comparisons summer comfort reading list – ID Green module

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- Outcault, Sarah, Western Cooling Efficiency Center, Marco Pritoni, Kristin Heinemeier, and Energy Efficiency Center. "Can You Take the Heat? A Cross-National Comparison of Thermal Comfort Strategies and Energy-Saving Field Experiments." In Conference Proceeding Paper. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. 2016. (US and Japan)
- Thermal comfort comparison and evaluation in different climates: http://www.meteo.fr/icuc9/LongAbstracts/bph5-1-1841163_a.pdf(Germany and Brazil)
- Comparing perceived effects of climate-related environmental change and adaptation strategies for the Pacific small island states of Tuvalu, Samoa, and Tongahttps://islandstudies.ca/sites/default/files/ISJBeyerletalEffectsClimateTongSamoaTuvalu.pdf
- A curiosity driven approach to air-conditioning on the Arabian Peninsula: Comparing the accounts of three resident groups in Qatarhttps://www.sciencedirect.com/science/article/pii/S001671852030066X?casa_token=JrrJLzR2kqUAAAAA:boKJZQm0q7ilAoxruxA9t2QuXcBxRci32BbcZULG4NcjNM5EqPOGSJA4051B1awGhlSWfCU8pA
- Active cooling and low carbon comfort (mentions Singapore, Dubai, China, US, Japan and Indonesia) https://www.tandfonline.com/doi/full/10.1080/13602365.2016.1180631?casa_token=fYTJmMn4EmsAAAAA%3Awps17GubW3amNozPiDNPNy0WUWGHKoz-zd1UoIn_mQFJHChKD0j0xNU4qJclGz_c2d6z7elSm_HU
- Human activities at the frontiers of ambient climate control: Learning from how UKshoppers and sport spectators currently talk about air-conditioning, Hitchings https://www.sciencedirect.com/science/article/pii/S0016718514000864?casa_token=tbT_GzzKZzIAAAAA:Qj68HEuCNHW9hQzSIwnU6o4Sz2inGmOBGPZcn1r5_3syi48dR8okJrmO0mXbDKyejddUWVIATg
- Urban sustainability in the Arabian Gulf: Air conditioning and its alternatives https://journals.sagepub.com/doi/full/10.1177/0042098015608782?casa_token=FCprRPWsUkEAAAAA%3AFbj5-v893zG7BChuNFx2svOwHpJznCsLM34HRNh_5e6somjHJthjr8ey8QRZPQ-rIwabzb-28E5h

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