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Energy consumption in the comfortable home

Practices, perceptions and conventions

Madsen, Line Valdorff

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AUTHOR CV

Line Valdorff Madsen has a background in social sciences with a master's degree in Geography and Planning Studies (cand. soc) from Roskilde University. Her methodological expertise is in qualitative methods such as field studies and interviews. Her work has revolved around housing and local communities, urban, suburban and provincial, with a focus on inhabitants and citizens and their everyday life and engagement in their local area. Her master's thesis engaged with communal housing and the Danish housing sector through field studies of different types of communal housing. The study focused on how communities were produced and reproduced as social and practical through everyday life in the communities. Her interest in everyday life and living environments has also influenced her PhD research on comfort and energy consumption in housing, as the thesis engage with everyday practices and meanings of home to outline perspectives on how comfort can be understood and why energy is used in housing. The PhD forms part of the UserTEC project funded by Innovation Fond Denmark.

ENGLISH SUMMARY

The use of energy for residential purposes is ever rising in the Western world, while the building structures that make up housing environments and the technologies that sustain buildings with energy are increasingly energy efficient. This schism calls for a deeper understanding of how, and for what purpose, energy is used in housing. Comfort is a widely used concept in regard to characterising indoor environments, and building regulations generally aim at achieving healthy and comfortable dwellings in the most energy-efficient manner. Comfort has often been researched as thermal comfort related to a physiological understanding of comfortable temperatures. The research of this thesis contributes by broadening the understanding of comfort within a theoretical framework that considers social practices, senses, everyday life and the home. This underlines cultural, social and bodily meanings of comfort that can take the form of different comfort aspects as well as figure in a variety of everyday practices. Moreover, the study sheds light on how material structures and technologies form both energy use and notions of comfort, together with social conventions. The aim of this PhD thesis is to investigate how comfort is perceived by residents as part of everyday practices in the home and how this relates to energy consumption and the material structures of a house. The thesis qualitatively examines sensations, perceptions and practices related to everyday residential comfort on the basis of a field study comprising in-depth interviews and photo-elicitation. The thesis scrutinises how comfort can be understood as both material, bodily and social through senses and practices; that is, how comfort is formed by material structures, sensations and social conventions and what this means for the consumption of energy, especially heating, in daily life in housing.

The qualitative research shows that comfort is both bodily sensed and socially interpreted in everyday practices, as domestic comfort is constituted from social and material elements that are sensed and perceived. The empirical analysis shows that comfort is related to different aspects of daily life in homes: warmth and cold, air, light and material stuff. The different aspects of comfort are related in different ways to a variety of everyday practices. The analysis also shows that the concepts of comfort and homeliness are closely interrelated at the same time as these concepts can be seen to have different meanings in relation to different everyday practices and the spaces of a house. The study

further shows how the relation between the social and the material in houses-as-homes creates and sustains comfort. This means that both social ideas and the materiality of a house and its technologies influence the perceived comfort of residents. Comfort is materialised in the structures of housing through standards such as building regulations and through norms of an appropriate home and ways of living. At the same time, comfort is interpreted and reproduced in an on-going process of social everyday practices. Consequently, residential comfort cannot be understood without taking the social ideas of home into account and comfort has a central role in understanding our daily energy consumption in housing. Ideas of comfort are strongly enmeshed in both standards and norms of modern everyday life; therefore, technologies alone cannot change residential energy consumption radically, as energy is used through everyday practices and ways of living.

The thesis is based on three articles submitted to peer-reviewed journals which, on the basis of the qualitative study, address: 1) comfort as sensorial and social in everyday practices, 2) the relation between notions of comfort and notions of home in practices of homemaking, and 3) conventions of comfort as materialised and normalised in housing structures. Overall, the papers address how perceptions of comfort are related to different everyday practices enmeshed in a nexus of social and material structures of home.

DANSK RESUME

Energiforbrug i boliger er stigende i den vestlige verden, imens bygningsstrukturer og teknologier i boligbyggerier, som sørger for bygningernes energitilførsel, i stigende grad er energieffektive. Dette skisma nødvendiggør en mere dybdegående forståelse af hvordan, og til hvilke formål, energi bliver brugt i boliger. Komfort er et begreb, som i stor udstrækning bruges til at definere indemiljøer, og bygningsreglementer sigter generelt mod at opnå sunde og komfortable boliger på den mest energieffektive måde. Komfort er ofte blevet undersøgt som termisk komfort i relation til fysiologiske forståelser af komfortable temperaturer. Denne ph.d.-afhandling bidrager med en bredere forståelse af komfort, indenfor en teoretisk ramme som ser på sociale praksisser, sanser, hverdagsliv og hjem. Dette understreger kulturelle, sociale og kropslige forståelser af komfort, som kan tage form af forskellige typer komfortaspekter og indgå i mangfoldige hverdagspraksisser. Herudover kaster forskningen lys på, hvordan materielle strukturer og teknologier former både energiforbrug og ideer om komfort sammen med sociale konventioner. Formålet med ph.d.-afhandlingen er at undersøge, hvordan komfort opfattes af beboere, som en del af deres hverdagspraksisser i hjemmet, og hvordan dette relaterer sig til energiforbrug og de materielle strukturer, som udgør en bolig. Afhandlingen undersøger kvalitativt sansninger, oplevelser og praksisser relateret til hverdagens boligkomfort, på baggrund af et feltstudie, der inkluderer dybdegående interview og fotostudier. Afhandlingen analyserer, hvordan komfort kan forstås som materiel, kropslig og social igennem sanser og praksisser; det vil sige, hvordan komfort formes af materielle strukturer, sansninger og sociale konventioner, og hvad dette betyder for energiforbrug, særligt varmeforbrug, i hverdagslivet i boliger.

Den kvalitative forskning viser, at komfort er både kropsligt sanset og socialt fortolket igennem hverdagspraksisser, idet hjemlig komfort udgøres af både sociale og materielle elementer, som bliver sanset og oplevet. Den empiriske analyse viser, at komfort er relateret til forskellige aspekter af hverdagslivet i boliger: varme og kulde, luft, lys og materielle ting. De forskellige aspekter af komfort er på forskellige måder relateret til en mangfoldighed af hverdagspraksisser. Analysen viser, at begreberne komfort og hjemlighed er tæt forbundet samtidig med, at begreberne indebærer forskellige meninger i relation til forskellige hverdagspraksisser og rum i boligen. Endvidere viser studiet, hvordan relationen mellem det sociale og det materielle, i boligen som hjem, skaber og opretholder komfort. Dette betyder, at både sociale forståelser

og husets materialitet samt teknologier influerer på beboernes oplevede komfort. Komfort er materialiseret i boligers struktur, igennem standarder som bygningsreglementet og igennem sociale normer for livsformer og det gode hjem. På samme tid bliver komfort fortolket og reproduceret igennem hverdagspraksisser i en fortløbende proces. Derfor er det ikke muligt at forstå komfort som begreb uden at inddrage sociale forståelser af hjemmet, samtidig med at komfort spiller en central rolle i at forstå det daglige energiforbrug i boliger. Forståelser af komfort er i høj grad indlejret i både boligstandarder og normer for det moderne hverdagsliv, og derfor kan teknologier i sig selv ikke ændre energiforbruget i boliger radikalt, idet energi forbruges gennem hverdagspraksisser og livsformer.

Afhandlingen er baseret på tre peer-reviewed artikler, som på basis af det kvalitative studie adresserer: 1) komfort som sensorisk og socialt i hverdagspraksisser, 2) relationen mellem ideer om komfort og ideer om hjem i hjemskabelsespraksisser og 3) komfortnormer som materialiseret og normaliseret i boligstrukturer. Samlet set adresserer artiklerne, hvordan opfattelser af komfort er relateret til forskellige hverdagspraksisser, som er indlejret i et nexus af hjemmets sociale og materielle strukturer.

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The writing of this thesis has been an immensely challenging but also rewarding journey of accomplishing a contribution to social energy research. While the subject was new to me at the beginning of this work, the subject of energy and resource use in everyday life has definitely intrigued me and I have found myself more and more committed to the agenda of sustainability and energy consumption. Many people have inspired, helped and challenged me on the way for which I would like to express my sincere thanks.

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LIST OF PAPERS

1. Madsen, L. V. & Gram-Hanssen, K. Re-thinking comfort: understanding senses and social practices. Invited for 2. revise and resubmit in Energy Research & Social Science.

2. Madsen, L. V. The comfortable home and energy consumption. Invited for 2. revise and resubmit in Housing, Theory & Society.

3. Madsen, L. V. Materialities shape practices and ideas of comfort in everyday life. Resubmitted to Building, Research & Information.

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1. INTRODUCTION

1.1. ENERGY CONSUMPTION AND SUSTAINABILITY IN HOUSING

With scholars announcing the geological shift from the age of the Holocene to the age of the Anthropocene (Crutzen 2002), human influence on the changing climate of the planet has, even if not already, been clearly stated. Consumption of goods and energy is ever rising and is challenging the human response to on-going climate changes and the need to reduce carbon emissions and our dependency on fossil fuels. A great part of this consumption takes place in the everyday life of citizens in the Western world through performing activities in dwellings, enmeshed in socio-technical systems, as noted by Shove and colleagues:

> "(...) the bulk of consumption is embedded in relatively inconspicuous routines occasioned by the characteristically mundane socio-technical systems of everyday life" (Shove et al. 2007, 10).

This 'ordinary consumption' (Gronow and Warde 2001) implies a great amount of energy consumed through daily routines. Energy consumption is thus seen as the consumption of energy through practices to provide heat, cooling and light, for example, as well to the services provided by the wealth of household appliances that are used to sustain daily life in homes (Warde 2005; Shove and Walker 2014). As one type of answer to this, are the many visions of the future smart everyday life: living in smart homes, driving smart cars and using smart gadgets to control the everyday lives of citizens including their daily energy consumption. Such visions often rely on smart technologies that can control, for example, the heating or cooling of houses, and furthermore on a technologically capable and rational consumer (Strengers 2013; Wilhite 2016). Yolande Strengers uses the term 'resource man' to depict the standardised, imagined, energy user: this 'perfect' user is a man, more often than a woman, thinking rationally and economically, technically able and interested, reacting positively towards information and eager to save money on the energy bill. This energy user will adjust his consumption patterns in accordance with information about consumption and price (Strengers 2013).

These types of vision, and policy approaches to reducing energy consumption, build on an individualistic approach, broadly rooted in either a technology focus of engineering, or in economics and behavioural psychology, which understands energy consumption as individual actions and decisions that can be changed through, for example, economic incentives or 'nudging'. Elisabeth Shove (2010) put forward a critique of this ABC (Attitude, Behaviour, Choice) paradigm as dominant within energy and climate change policy and argued instead for a social practice perspective as being better suited to comprehend the dynamics and possibilities of social change. The dominating approaches are criticised for ultimately sustaining the status quo of energy consumption, as ways of living are not debated, while the aim is rather to reduce energy consumption without changing expectations of, for instance, comfort and convenience (Shove 2003, 2010; Strengers 2011, 2013). Therefore, viewing the consumer as a 'resource man' as is common in energy research and industry, is not necessarily leading a sustainable pathway. Rather, understanding practices of residential comfort and energy consumption is a question of looking at everyday life and the societal conventions that take part in structuring how we go about this.

Sustainability in the built environment and the excessive use of natural resources needs to be understood as an equally social and technical challenge and aim, and this is also why a study of heating and comfort in housing needs to be placed into the broader context of how to use resources and live a future sustainable everyday life. As Egmose writes, sustainability problems are social environmental problems that cut across scientific and disciplinary divides:

> "(…) between explaining the laws of nature and understanding social dynamics, they are also highly correlated to the socio-technical dynamics which follow the development of the modern society" (Egmose 2015, 1).

Following the quest for reducing energy consumption in buildings, there has been considerable research within energy efficiency, although this has been dominated by technical and economical strands that have focused on developing the efficiency of technologies and the efficiency of markets, reducing the consumer to either a passive user of a technology or autonomous and rational economic actors (Wilhite 2011). However, daily energy consumption is not solely about the use of technologies or economic rational decisions of users on cutting down energy consumption for economic gains. Daily energy consumption is enmeshed in a variety of everyday practices that consume

energy in the home; that is, maintaining a home and an everyday life. Therefore, energy is not used for its own sake (Shove and Walker 2014) but rather to accomplish conspicuous and inconspicuous consumption related to everyday practices and creating comfort and homeliness.

1.2. THE CONCEPT OF COMFORT

> "A deeper understanding of how cultural factors mediate sensory experiences and practices is believed by some to be crucial for the development of sustainability-driven policies, especially in light of the common discourse on climate change and energy security" (Vannini and Taggart 2014, 62).

This quote, together with the above introduction, indicates that energy consumption should be understood more in-depth by applying social and cultural theories, and this deeper understanding of daily energy consumption through practices is important in order to develop policies for a sustainable everyday life. Comfort is a central concept in this regard, as well as in research on buildings and energy efficiency. The concept of comfort is interesting to explore because it is central to how we use our home, how we practice everyday life and thereby how we consume energy at home. The dwelling is where we practice a large part of our everyday life, and thereby it is a space for an endless amount of sensory experiences and expectations, i.e. bodily sensations and social perceptions of comfort and homeliness. Ways of living in homes are intimately bound with energy-consuming everyday practices related to comfort. These everyday practices are shared but performed in varied ways in space and time, and practices such as cooking, relaxing, eating, sleeping and decorating influence our comfort differently. At the same time, we perceive comfort in different ways and the technologies surrounding us influence, sustain and change activities and routines, as well as our understanding of comfort.

The concept of comfort is often taken for granted, both in research and in other areas such as policy and marketing. Comfort is crucial in discussions and research on energy-efficient buildings, most often inscribed as thermal comfort. As such, the meaning of the word comfort is implicit in energy research as are the implications of comfort for energy consumption, particularly in technical literature, which does not regard comfort as a social concept, nor sufficiently

explore the underlying reasons for expectations and levels of comfort. For the most part, this research explores how technologies can provide (thermal) comfort in more energy-efficient ways, without compromising expected standards and levels of comfort. The emphasis is thus on how to make 'users' adapt and use more efficient technologies in the 'right' energy-efficient way. Such scholarship seldom deals with how to adapt technologies to a sustainable everyday life, or questions *what comfort is* and how it influences sustainability. It seems that the limitations of existing technical research perpetuate a common belief in a technological fix that has not yet proven to be able to turn around the high levels of energy consumption. This reflects the research, which has traditionally had a strong focus on behavioural theory and individualised agency, as has already been highlighted in sociological energy research (Gram-Hanssen 2010, 2014; Shove 2003, 2010; Strengers 2011, 2013). Elisabeth Shove notes that:

> "Expectations of the indoor environment are evolving and apparently converging around the globe and around a concept of comfort that is immensely demanding to maintain and reproduce" (Shove 2003, 21).

Therefore, it is important to scrutinise what comfort is and how it is attained within the built environment. In English, the word comfort has different meanings. In accordance to Oxford English Dictionary[1], comfort, as a noun, can briefly be understood as:

1. Strengthening, encouragement, incitement, aid, succour, support, countenance; one who or that which strengthens or supports
2. Physical refreshment or sustenance, refreshing or invigorating influence
3. Pleasure, enjoyment, delight, gladness
4. Relief or aid in want, pain, sickness
5. Relief or support in mental distress or affliction, consolation, solace, soothing; the feeling of consolation or mental relief, the state of being consoled; a person or thing that affords consolation, a source or means of comfort; a cause or matter of satisfaction or relief

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[1] http://www.oed.com/ (Accessed through AUB library, 24.01.2017)

6. A state of physical and material well-being, with freedom from pain and trouble, and satisfaction of bodily needs, the condition of being comfortable; the conditions which produce or promote such a state, the quality of being comfortable
7. A thing that produces or ministers to enjoyment and content

This dictionary list reveals varied meanings of comfort that can be traced in the everyday life of residents in housing; the list suggests that meanings of comfort can both be related to social and material aspects. In a historical review on how the notion of comfort evolved, Crowley (1999) showed that, from the seventeenth century through to the nineteenth century, comfort developed from addressing luxurious amenities to basics of living in dwellings. Through these centuries, comfort came to represent standards of living and housing. Comfort became the achievement of physical comfort; satisfaction with the relationship between one's body and its physical environment. Expectations to comfort, designs and personal imperatives therefore became closely related to Western consumption patterns and ideals of home (Crowley 1999,780). As Crowley writes: *"Desires for comfort now legitimised popular consumption"* (Crowley 1999, 776). Before this, comfort had represented moral, emotional, spiritual and political support (Crowley 1999, 751). Accordingly, comfort became related to material culture but also to the traditional notion of comfort as a moral and social issue. Furthermore, comfort was seen as culturally progressive rather than physically natural as comfort, to a high degree, came to signify Western domesticity (Crowley 1999, 780).

In a study on the 'home' Rybczynski (1988) explicitly relates comfort and home through dedicating a chapter to comfort and well-being. In this text, comfort is closely related to domesticity and such domestic well-being is seen as a human need. Comfort is further seen as a cultural idea manifested in various forms of domesticity through domestic interior reflecting intimacy and homeliness. However, these expressions of domesticity through décor styles are not necessarily expressions of comfort at specific time-spaces in history, Rybczynski argues, but might rather be expressions of fashion and other socio-cultural phenomena such as everyday behaviour and gender roles at points in historical time. Comfort has changed with developments in technologies and infrastructure and has become a mass commodity at the same time as being accessible to most people, at least in the Westernised parts of the world. Through examples of the modern home, comfort is related to several different aspects such as cosiness, relaxation, privacy, convenience and physical ease;

different layers added to each other through societal, cultural and technological developments in history (Rybczynski 1988).

Comfort is central in the field of residential energy consumption yet is, at the same time, a contested concept from a socio-technical perspective, arguing that comfort is not universal and rational, but rather contextual and related to different social and cultural structures, materialities and time-spaces. Thus, this introduction to the meanings of 'comfort' and how this is related to residential energy consumption asks for an in-depth scrutiny of comfort.

1.3. STRUCTURE OF THE THESIS: AIMS AND RESEARCH QUESTIONS

Through a qualitative field study, this thesis examines residents' everyday practices and perceptions of comfort, home and energy consumption, to outline perspectives on how and why we use energy, amongst other uses, to heat our dwellings. The study engages with the concept of comfort and how to understand this as an everyday life aspect and an element in social practices, as opposed to technical definitions of thermal comfort. This thesis provides an alternative study to the dominating focus on technologies that have held the prominent role in securing lower energy consumption in housing. Technologies alone cannot secure a sufficient decrease in the energy consumption, which has already been established within socio-technical research. Furthermore, it has been documented that theoretical calculations of energy consumption are not equivalent to the actual consumption when houses are being used by their residents (Majcen et al. 2013; Gram-Hanssen and Hansen 2016). Therefore, there is a gap in explaining what happens in the homes, what is meaningful for the residents, and why energy is used the way it is in daily life in housing.

The aim of this thesis is to investigate and shed light on how comfort is perceived and practised in the home and what this means for residential energy consumption, especially for heating. Comfort contains many different meanings and can be related to different everyday practices and uses of a home. Therefore, I explore comfort as part of daily homemaking. In this way, comfort is further investigated partly as individual sensations and perceptions and partly as a social understanding in practices. Both of these aspects influence how comfort is practiced and perceived. In addition, the thesis aims to explore

the link between comfort and energy consumption through this redeveloped understanding of comfort.

Research questions

How is comfort perceived and practised through daily life in Danish detached houses?

1. How can comfort be understood as sensed and perceived within everyday practices in the home?
2. How are notions of comfort and notions of home related and intertwined in daily home-making practices?
3. How do technologies and material structures of housing form routines of everyday practices and norms of comfort?

Structure of the thesis

The thesis consists of three papers that scrutinise comfort from different angles. This introduction locates the study within the research field of social practices, comfort and energy consumption in socio-technical, sociological and anthropological studies. Chapter 2 presents the methodology; the field study and the qualitative methods, and further it reflects on the abductive research approach and presents the analytical strategy. Chapter 3, on theory, introduces the literature of the research field in which this thesis is placed: firstly, a review on comfort literature, focusing on social science research on comfort, this is followed by outlining the relevant theoretical perspectives in a nexus of senses, everyday life, home and social practices. The analysis falls in three parts that answer the research questions through the three papers: chapter 4 presents the papers and their key findings. The three papers form the analysis part of the thesis, as it is in the papers that the empirical analyses of comfort are unfolded. The papers follow the structure of the research questions as paper 1 seeks to answer how comfort is sensed by the residents through their social practices. Paper 2 scrutinises the question of how comfort and home are related as concepts to arrive at a notion of the 'comfortable home'. Paper 3 aims to exemplify how material structures, including technologies, of housing shape practices and notions of comfort in more or less unsustainable ways. The full-length papers are enclosed after the references that end this extended

introduction. The introduction of the papers in chapter 4 is followed by a discussion of the findings in chapter 5. Following this, the last chapter concludes on the thesis as a whole.

2. METHODOLOGY

2.1. RESEARCH APPROACH: PHENOMENOLOGY, SENSES AND PRACTICES

In phenomenology, the emphasis is on the lifeworld of individuals and a *"non-dualist ontology of the body and its environment"* (Simonsen 2013). The phenomenological thinking of, for example, Husserl, Heidegger and Merleau-Ponty transcends the distinction, or dualism, of body and mind (Rendtorff 2004). This means that the world is perceived through the body and meaning is created in the space between body and mind. Therefore, in phenomenology, the intentional subject is tied to its environment and perception is a reflected and intentional involvement with this environment (Hansen and Simonsen 2004). Merleau-Ponty stresses the bodily involvement with the world as central to creating meaning in our life worlds and terms intentionality (adopted from Husserl) as a bodily perception of the world, and further he stresses sensations as central for this bodily involvement as well as human perception (Pink 2009). The life world is both perception and practice and this is the basis of experience of the world, in which meaning and materiality are interwoven (Simonsen 2013). From this follows that, in phenomenology, ontologically the 'lived experience' of humans can be said to be placed in a space between the mind and the body, constituting an intersubjective space of body and perception. It is understood that we perceive with both our mind and our body and these two dimensions are integrated and inseparable in embodied experiences and practices (Hansen and Simonsen 2004, Pink 2009). As such, the ontological focus is on mental-bodily perceptions of the life world that are based in practice and our relation to the surrounding world. The life world is, in this sense, the pre-scientific, pre-reflective, taken-for-granted part of human experience (Hansen and Simonsen 2004). From this, it follows that a phenomenological approach has a rather subjective focus looking for meaning in the practices and perceptions of humans. Phenomenology thus focuses on individual subjects; however, this is significantly distinct from the individual focus of rational behaviour as seen in the ABC approaches introduced above.

Epistemologically, phenomenology relies on analysing the qualitative elements of concrete perceptions of the life world as it is experienced in a given context. These qualitative experiences cannot be reduced to quantitative generalisations, yet the intentionality of mental-bodily perception creates

meaningful structures and it is therefore possible to study subjective conditions as expressions of a common human experience (Rendtorff 2004). In this way, the qualitative study of a particular lived experience can produce knowledge of specific meaning structures that are, however, context dependent. Social conditions are informed by contextual meaning of history and culture, expressed through the life world of which they are part. From this standpoint, the ontological position of this thesis is that meaning is created in the bodily-mental perceptions of the life world. However, as Kirsten Simonsen has argued, this can be combined with a 'social ontology of practice' prioritising human practices over, for example, consciousness, structures or discourses as well as focusing on mundane everyday activities (Simonsen 2007, 168). This approach built on Schatzki, among other practice theorists; theories of practice will be elaborated on in chapter 3. Thus, by adopting a practice theory approach to the empirical study of this thesis, social practices are the ontological focus.

The present study combines a point of departure in phenomenology, and the understanding of lived experience as a bodily involvement, with a practice theory approach that transcends the dualisms of object and subject, actor and structure, by focusing on social practices that are shared across space and time, but performed by individuals. A practice theory approach enables an epistemological focus on social practices as being *"entangled in webs of social reproduction and changes"* (Halkier and Jensen 2011, 102) and investigating social phenomena such as comfort as an aspect of multiple and shared social practices across space and time. The methodology of sensory ethnography as outlined by Sarah Pink (2009) is useful as inspiration for investigating practices as individual and social bodily involvements; that is, approaching embodiment as a process integrating the relation between human beings and their surrounding environment (Pink 2009). The approach is concerned with a nexus of perception, place, knowing, memory and imagination (Pink 2009, 23), as sensory ethnographies attend to the experiential, individual and contextual nature of research participants' sensory practices and, at the same time, seek to comprehend culturally specific categories, conventions, moralities and knowledge that inform how people understand their experiences. Consequently, a relation between social and spatial enquiries is central to this methodology while recognising both the contextual importance of ethnographic studies and the embedded ethnographer as taking part in creating reflexive knowledge of a field (Pink 2009). Pink notes that the sensory ethnography approach does not necessarily aim at identifying the specific senses in use, but rather the aim is to understand everyday practices through examining and interpreting sensory meanings in practice (Pink 2009). She further argues for

an understanding of senses that does not privilege the vision, but rather understands all of the human senses as interconnected and interrelated, for example, she writes about the sensory home that *"(…) in the modern western home, one might feel dirt, smell the landlord's neglect and hear the sounds of being at home"* (Pink 2004, 9). The empirical study of this thesis uses this approach to investigate the different ways in which comfort can be sensed by residents in a home.

2.2. METHODS AND RESEARCH PROCESS

This thesis has been carried out as qualitative ethnographic research comprising several methods in a field study. Qualitative research, as broadly based within an interpretative tradition seeking understandings rather than explanations, allows for an in-depth investigation of specific everyday life experiences in the context of their social worlds. Qualitative research acknowledges knowledge as situated and context-dependent and understands the social world as complex and multi-layered, while it looks for social meanings, practices and relations between these. As Mason (2002) writes, qualitative research can be used to explore:

> "(…) a wide array of dimensions of the social world, including the texture and weave of everyday life, the understanding, experiences and imaginings of our research participants, the ways that social processes, institutions, discourses or relationships work, and the significance of the meanings that they generate" (Mason 2002, 1).

The research process has been abductive through an on-going discourse between empirical data and theoretical perspectives, and between empirical analyses, reflecting an iterative process also between the analyses of the different papers of the thesis. The research strategy took a point of departure in the field aiming for understanding how comfort is perceived and practised in the everyday life of residents. Blaikie writes that, for the research approach of abduction:

> "The starting point is the social world of the social actors being investigated. The aim is to discover theory constructions of

reality, their ways of conceptualising and giving meaning to their
social world, their tacit knowledge" (Blaikie 2007, 10).

As such, qualitative research looks for the perceptions of specific phenomena in
the social world, comprising social relations and situations of the research
participants. The empirical analysis of this data is then interpreted with social
theory related to the field of study, paving the way for reliability and
generalisation of the study. Thus, this strategy is well-suited to understanding
everyday concepts and meanings (Blaikie 2007). Moreover, O'Reilly (2009)
defines ethnographic research as iterative-inductive, which describes well how
the empirical study of this thesis was inductive in its exploratory approach, as I
went to the field as early and as open-mindedly as possible. However, as
Cerwonka and Malkki note: *"one always reads empirical details in the field
through theory"* (2007, 4). It is not possible to begin field research with a
completely blank page, as theory will always have manifested itself through
work and readings accomplished beforehand. Therefore, the empirical and
theoretical study is an iterative process, where one informs the other, and
several phases of both studying theory and the empirical field unfold. As such, I
brought theoretical and common knowledge with me into the field study,
although this was different knowledge than what could be expected within the
research field of energy consumption, and what could be expected by the
participants. With a background in geography and social sciences, I had no
more knowledge about heating technologies and housing construction than my
participants, and instead brought in a social interest. I therefore based the
interviews and field visits on social theoretical knowledge of relations between
social and material structures as well as between everyday practices and social
structures of society. The participants often expected that I knew about their
heating technologies and that I would be able to answer any technical questions
they might have about them. From the beginning of the visits, I explained that I
did not have a technical background and was not very familiar with heating
technologies and suppliers, which was why I would instead like them to explain
to me exactly how they used the technologies and any reflections they had in
relation to their heating of the home.

2.2.1. FIELDWORK AND PRESENTATION OF CASE

Ethnographic approaches examine how people do, perceive, sense and use, or
in other words, how we perform everyday practices. It is through our practices

that we identify with places, for instance homes, and that places make sense to us. Fieldwork is *"a means of gathering data that involves the researcher in direct engagement with the material world"* (Gregory et al. 2009, 251). Fieldwork such as ethnographic research produces situated and context-dependent knowledge about people, social processes and places as well as the relationships between these, based on a range of different methods, similar to case studies (as described by Stake 2005; Flyvbjerg 2006). This field study aimed for in-depth and context-dependent knowledge by applying qualitative interviews and visual methods on the site of the participants' dwellings in suburban Denmark. Fieldwork necessitates and acknowledges the researcher's participation in the field and the active construction of knowledge in the encounter between researcher and research participants. Further, fieldwork can be seen as an embodied research practice engaging in visits, conversations and observations in the field, including all of the human senses, and therefore the research is validated by an encompassed reflexivity of the researcher. This reflexivity of the fieldwork, as well as the research process as a whole, has been obtained through an iterative process prompted by on-going analytical reflections on theory and data.

The first round of fieldwork was carried out from February to April 2014. This was quite early in the research process, since I felt an urge to get out into the field to gain a sense with what was going on out there: How did people's everyday lives mirror their energy consumption; were the inhabitants aware of their energy consumption; what influenced the way they heated their homes; how did they understand 'comfort' and could they even relate to that word? I aimed to reach 10-20 participants living in single-family housing in the greater area of Aarhus[2], which is the second largest city in Denmark. Therefore, it represents an urban environment, although the areas with detached housing, where the participants lived, were located in the suburbs and the outskirts which predominately consist of detached housing. I chose three categories of detached houses relating to the building year, as a physical characteristic of the houses: 1) houses built in the 1960-70s, 2) houses built around 2000, and 3) houses built in 2012-13 (see table 1). These three groups reflect changes in the Danish Building Regulations including differences in, for example, heating systems, insulation and ventilation although, from the outside, the houses are

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[2] Aarhus was a case area for the interdisciplinary research project UserTEC, of which the PhD study was part. This gave me access to consumption data on customers in the utility company of AffaldVarme Aarhus, through the participants' consent. However, eventually I did not use this data for the empirical analyses.

quite similar. Danish single-family houses are typically one-storey brick houses with a garden and often surrounded by a hedge, and a large percentage of these houses were built from 1960 to 1980. In this period, around 450.000 houses were built and the overall housing stock was nearly doubled. Single-family housing formed half of the housing built during this period. Following this, the owner-occupied housing later became more than half of the housing stock, while most detached houses in Denmark are owner-occupied. The housing sector became, during this time period, highly industrialised, which is why many standard houses from this time and onwards came to be built from prefabricated elements and standard designs. After the great boom in the building sector and single-family housing stock, political and economic reforms led to a decrease in newly built detached houses in the 1980s and into the 1990s. Standard houses built from this period and onwards do not differ a great deal from earlier detached houses in the general design, which reflects conventions of building techniques and aesthetics, although the energy crisis of the 1970s caused a new preoccupation with insulation in order for the houses to be more heat-efficient, reducing energy costs (Lind and Møller, 1996). As of 2015, 40% of detached houses are heated by district heating, as this has been the prevailing supply of energy for heating since the 1980s (Statistics Denmark, 2016).

It was a somewhat long and difficult process to get through to the participants; private persons that were requested to talk about their everyday life by a researcher with whom they did not have any relationship. I started with identifying suburban areas that would contain single-family housing (by conferring with a colleague and looking at a map) and then checked the building years in the Danish Building and Dwelling Register (BBR). As I was also interested in the consumption data on my participants, I needed to check if they were registered as customers with the local district heating supplier (see footnote above). Finally, I had to check on Krak[3] for personal information about the inhabitants, as I could not access the address if I did not have the contact details. I then sent out 'formal' letters (app. 50), that explained about the project and my interest. Following this, I contacted those same people by phone, explained about the project again and asked if they would be willing to help me. For the last category of housing, 2012-2013, I had contact details, including email, on respondents in a survey on low-energy housing conducted by a colleague. A number of these respondents were living in the suburbs of

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[3] Danish map and information service

Aarhus who I then contacted by email. In total, I ended up with 14 participants spread over the different groups of housing. However, in three interviews both partners of the household participated in the interview, which is why the actual number of participants was 17. I sought to have varieties in gender, age and family types, although this was quite difficult, as I did not have access to any personal data, except from the contact details on Krak. I could thus only guess gender and age from names and how many people were registered at the same address. The participants were couples living together, with or without children, and one participant was a widow with grown-up children. The aim was not to produce a representative study, but I considered that a varied group in relation to gender and age might give a more varied picture of the everyday lives, consumption and comfort practices. I did not have any socio-economic information beforehand either, and I ended up with a rather homogeneous group which could be characterised as lower to upper middle class. This fits well with the criteria that they were all (except one tenant) house owners in an urban area where house prices were somewhat high.

I found that it would be complicated to perform participant observation in people's homes, as Pink also notes, there are *"environments where it would be impractical and inappropriate for researchers to go and live for long periods with research participants, for instance, in a modern western home"* (Pink 2009, 9). It is very difficult, if not impossible, for a researcher to not interfere strongly with the everyday activities of research participants in the intimate space of a home. I instead decided to use in-depth interviews, home tours and photography to examine the everyday practices related to comfort and energy consumption in the homes of the participants. In addition to the field visits, I found that the home tours gave me the opportunity of performing some observations in the field while carrying out the interview. It has further been stated by for example Atkinson and Coffey, that there should not necessarily be clear distinctions between observing and interviewing, as:

> "actions (…) are understandable because they can be talked about. Equally, accounts – including those derived from interview – are actions. Social life is performed and narrated, and we need to recognize the performative qualities of social life and talk" (Atkinson and Coffey 2001, 1).

This approach argues that actions are meaningful only through social understandings and therefore actions are meaningful when talked about, furthermore, interview data are not only symbolic meanings but also bodily

and social performances. Therefore, the qualitative methods of interviews and (participant) observation often go hand in hand which points to a research process that does not set strict divisions between 'what people do' and 'what people say' (Atkinson and Coffee 2001). Hitchings (2012) has further argued for the relevance of interviews to study habitual practices, as these can actually prompt reflections from respondents about mundane practices that are not necessarily discussed, or considered, much during daily life. The study of this thesis has not aimed at revealing actual 'doings' in the everyday practices of the participants, but rather the research participants' own accounts of their everyday practices related to comfort.

Table 1. Participants in field study.

Participants	Ownership	House type by year	Heating technology	Gender	Age	Household type
Helene	Rented housing	1969-1979	Radiators, underfloor heating, wood stove, heat pumps	Female	40s	Couple, no children at home
Birte & Peter	Owner-occupied	1969-1979	Radiators, underfloor heating	Female & male	60s	Couple, no children at home
Maria	Owner-occupied	1969-1979	Radiators, underfloor heating, wood stoves	Female	50s	Couple, 2 children at home
Sarah	Owner-occupied	1969-1979	Radiators, underfloor heating, wood stove	Female	40s	Couple, 2 children at home
Marianne	Owner-occupied	1997-2001	Underfloor heating	Female	60s	Widow, no children at home
Claus	Owner-occupied	1997-2001	Underfloor heating	Male	40s	Couple, 2 children at home
Pernille	Owner-occupied	1997-2001	Underfloor heating, wood stove	Female	30s	Couple, no children yet
Camilla & Behram	Owner-occupied	1997-2001	Underfloor heating	Female & male	30s & 40s	Couple, 1 child at home

Birgitte	Owner-occupied	1997-2001	Underfloor heating	Female	50s	Couple, 1 child at home
Linda	Owner-occupied	1997-2001	Underfloor heating	Female	40s	Couple, 3 children at home
Jacob	Owner-occupied	2012-2013	Underfloor heating	Male	40s	Couple, 4 children at home
Kasper	Owner-occupied	2012-2013	Underfloor heating	Male	30s	Couple, 2 children at home
Tilde	Owner-occupied	2012-2013	Underfloor heating	Female	30s	Couple, 2 children at home
Karen & Erik	Owner-occupied	2012-2013	Underfloor heating	Female & male	60s	Couple, no children at home

2.2.2. IN-DEPTH INTERVIEWS

"The qualitative research interview attempts to understand the world from the subjects' point of view, to unfold the meaning of their experiences, to uncover their lived world prior to scientific explanations" (Kvale and Brinkmann 2007).

The main part of the data in this thesis stems from in-depth interviews carried out in the residences of the participants. The visits included a home tour, either at the beginning or end of the interview, while we discussed the layout, architecture and energy technologies that supplied heating, ventilation, lighting, etc. The participants showed me around the house while explaining their everyday practices related to energy consumption, such as how they regulated their heating system. I was inspired by the go-along interview method (Kusenbach 2003) and found that carrying out the interview in the residence would make it easier for the participants to talk about their everyday practices as this was where they take place. The home tour was often used as an 'ice-breaker' where we had a more informal talk about their use of the technologies and the home. The aim of the qualitative interviews was to gain knowledge of the life world and practices of the participants, while the qualitative interview is an interactional process between interviewer and interviewee, producing situated knowledge and supplying an in-depth understanding of an individual's everyday life (Kristensen 2007; Mason 2010;

McDowell 2010). Following Pink, interviews can also produce knowledge on sensory and embodied aspects:

> "(...) when research participants use words to describe their experiences, they are placing verbal definitions on sensory embodied experiences, and in doing so allocating these experiences to culturally specific sensory categories" (Pink 2009, 86).

In this way, interviews can be characterised as social and sensorial encounters producing knowledge through the verbal definitions of sensory experiences, through embodied ways of knowing that are introduced by the participants, and through the sensory sociality of the interview process and material context itself (Pink 2009, 86). The interview strategy consisted of a semi-structured question guide (see appendix A and B) to frame the interview, but which allowed for each interview process to follow the concrete interaction of myself as the interviewer and the interviewees' experiences and perceptions; as such, the interviews had a flexible thematic structure (Kristensen 2007; Kvale & Brinkmann 2009). When visiting and interviewing the participants, I strove to ensure an informal, trusting and open atmosphere. This included having coffee and home-baked goods offered by the participants, small talk, explaining openly about my project and purpose[4], as well as showing interest in their house, family and general daily life. The interview guide was framed by theories of social practices and literature on the home; however, each question was not explicitly formulated according to theory, but rather on the grounds of sensible themes dealing with energy consumption and comfort in everyday life and asking about both activities and meaning. The semi-structured interview guide consisted of, firstly, descriptive questions (Spradley 1979) and secondly questions regarding meanings and experiences. As such, the themes of the first interview dealt with the everyday life of the participants as well as how they thought about comfort, their home and energy consumption. In summing up the interview questions, they firstly asked about everyday activities of the participants during a normal day, for example the regulation of heating technologies and ventilation, working, cooking and taking care of children. Secondly, there were questions asking how the participants felt about the temperature and indoor climate and what this meant to them. Thirdly, there were questions concerning how they used the house and the different rooms in

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[4] However, this explanation involved being careful to not reveal too much regarding how I expected them to answer the interview questions.

their everyday lives, for instance according to activities, seasons and family members. Lastly, there were questions relating to how they felt comfortable and what this meant to them along with further questions regarding homeliness, asking how they felt at home and what a home meant to them. Moreover, questions about the participants' experiences of their energy consumption were asked.

Interviews were conducted in Danish where the word 'comfort' translates into 'komfort', or 'tilpas' which is the feeling of being comfortable and more in everyday use. The interview questions related to comfort were posed differently, such as: What does comfort mean to you? How do you perceive comfort? How, when and where do you feel comfortable in your dwelling? This was to approach the question of what could be considered comfort in a broad sense. The interview quotes have been translated from Danish to English and therefore changed slightly. I have been careful to come as close to the original words and word order as well as the terminology in the transcriptions. However, I have also changed the sentences slightly in order to make the best possible sense in this representation.

Inspired by Kvale and Brinkmann (2009), the interview material was condensed into aspects of comfort and related perspectives of everyday life, homes and materiality through an iterative coding process of reading and rereading the transcribed manuscripts[5]. Coffey and Atkinson describe the process of coding as *"condensing the bulk of our data sets into analyzeable units by creating categories with and from our data"* (Coffey and Atkinson 1996, 26). The coding process identified key themes, such as aspects of comfort and how these were related to senses, materialities and social norms as well as themes of everyday practices, ideas of home, and energy consumption. This qualitative analysis process was used to identify patterns across the data, establishing links and pointing to similarities, for instance in sensing comfort and use of the home. The presented interview quotes are expressions of individual stories but, at the same time, they represent patterns of similarity between these individual expressions that through theoretical analysis can explain, on a more general level, how we practise and perceive comfort in our dwellings.

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[5] A qualitative data analysis software, Nvivo, was used for coding the data.

2.2.3. PHOTO-ELICITATION

To document observations and the material structures of the dwellings and technologies, I asked the participants if I could take photographs in their home. I also photographed the houses from the outside and the areas I visited. I found that photographs would, in addition, be a way to discuss these mundane experiences that are not often talked about, and therefore carried out a photo-elicitation study with a smaller part of the participants from the first interview round. As Pink notes: *"Using visual methods allows us to extend our research to incorporate knowledge that is not accessible verbally"* (Pink 2007, 361). The photo-elicitation study was inspired by Blinn & Harrist (1991) in Rose (2007) and consisted of the participants complying with a small task of taking photographs, which we later discussed in a follow-up interview. This was to capture the relation between the material environments of the homes of the participants and their personal meanings (Pink 2013). Rose also notes that photographs are valuable, among other reasons because they are a way for the research participants to reflect on aspects of their everyday life to which they do not generally give a great deal of thought. In this way photo-elicitation, in comparison with the 'ordinary' interview, can prompt further talk on subjects of interest. In addition, photographs are good at capturing the texture or the 'feel' of a place (Rose 2007).

Initially, five participants consented to the task, however, only three carried through with it. One of them used a disposable camera which I had sent, while the other two preferred to use their own camera or smartphone and send the photographs digitally. I sent them a small task (see appendix C and D) regarding what kind of photos I would like them to take and gave them approximately ten days before they should return the camera or email their photos to me. I then visited the participants again carrying out interviews, where we discussed the photos and how they related to comfort and homeliness. I used both the interviews and the photos as empirical material, most explicitly for the analysis in paper two where the photos are included. The second round of interviews has also been used together with the first round of interviews as a comprehensive interview material.

Figure 1. Photos by researcher and participants
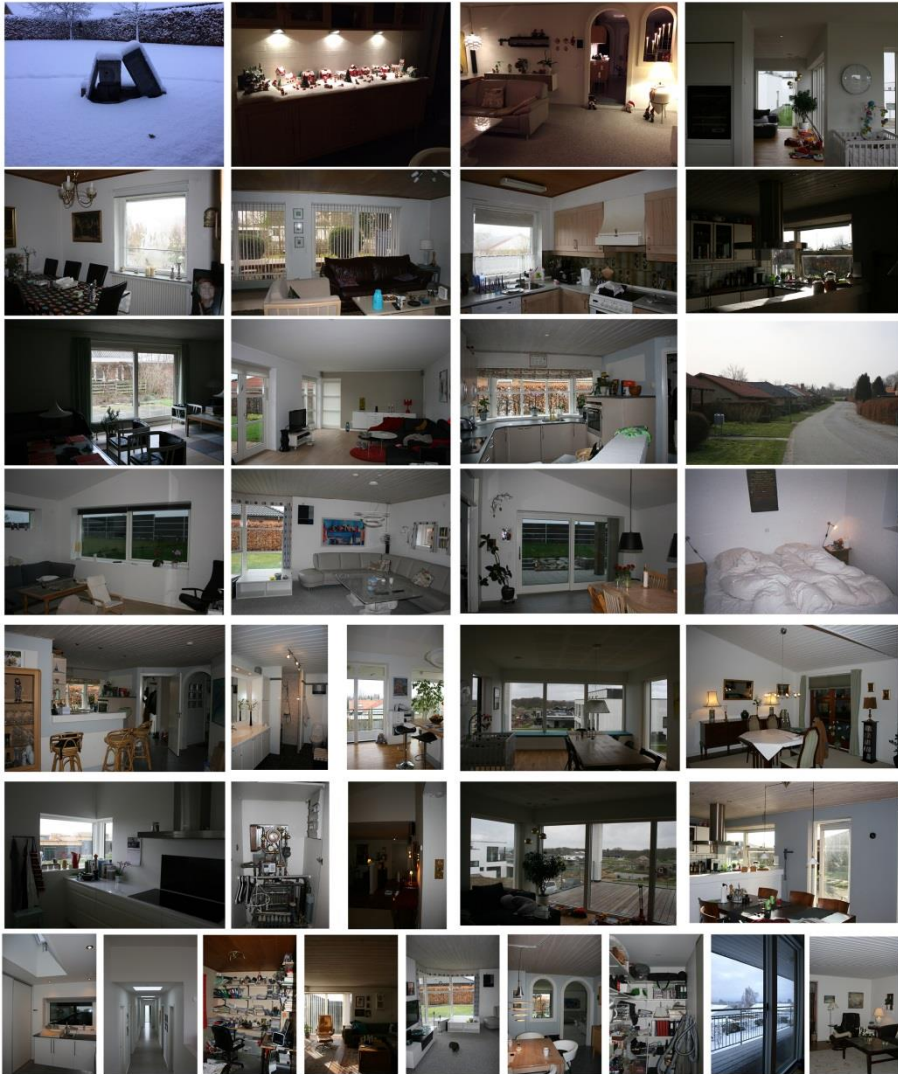
2.2.4. RESEARCH AND ANALYSIS PROCESS

The abductive research process was initiated with the broad question 'what is comfort?', which led to both theoretical and empirical routes of investigation of questions such as:

- What can comfort be seen to be constituted of?
- How is comfort perceived?
- How is comfort sensed?
- How are sensations related to comfort as part of practices?
- How do social conventions and material structures influence comfort?
- Why is comfort important to understand heat-related energy consumption?

These questions initially manifested themselves in a shorter literature study on comfort literature and, soon after, into an urge to go out into the field and talk to everyday practitioners to start the knowledge collection and development. As described above, these questions were addressed, in more subtle ways, in the interview guide and further guided the empirical analysis. The three papers of the thesis are all empirically based and reflect a basic interest in understanding comfort as a concept and why this has such an important impact on residential energy consumption.

The first paper turned out to be quite difficult to write as I wished to answer several questions. First of all, the question of what comfort is, where my interviews showed that, for the participants, comfort as such was related to many different aspects of everyday life within the home in both physical and social ways: the house, furniture and decorations, heating and ventilation technologies, family and identity, privacy and safety, homeliness and cosiness, the seasons and the weather, and even Christmas as a very specific tradition imaging the essence of comfort, homeliness and cosiness. However, these many aspects related to comfort by the participants also pointed to the sensorial ways of perceiving comfort in the different social practices that could be related to these everyday life aspects. The second paper built on the photo-elicitation study to scrutinise the relation between comfort and the home to focus on both the material and social aspects of a dwelling that are related to comfort and, specifically, how feelings of homeliness and cosiness are also related to feeling comfortable. The analysis process of the photos and follow-up interviews from this part of the study involved following the photos through a 'route' around the houses in drawing how comfort and homeliness were related to the

different rooms and practices of a house. The third paper predominantly used the interview data in exploring how the material differences between the three categories of housing influence practices related to comfort, according to the three types of detached houses, and what this means for the experience of comfort, tracking the analysis back to the material structures and technologies, represented in regulating policy such as the Danish Building Regulations.

3. THEORY

To investigate how comfort is perceived and practised in the everyday life in homes, different theoretical perspectives are needed. This theoretical chapter firstly outlines literature that has engaged with comfort from different positions. Following this, perspectives on senses, the body and affect are introduced as alternative approaches to understand the perception of comfort in practices. Hereafter, understandings of the notions of atmosphere, home and everyday life are presented and, lastly, there is an introduction to theories of social practices. This practice theory approach has been guiding much of the research process as a basic understanding of how everyday life unfolds through social practices, which involve considerations of embodied habits, social and cultural meanings and material structures and objects. However, as I will elaborate through this chapter, I found that further theoretical aspects were needed to understand the concept of comfort set in the frame of the home and everyday life.

3.1. COMFORT AS MATERIAL, SOCIAL AND SENSED

3.1.1. TECHNICAL APPROACH

Fanger's model of thermal comfort has been widely acknowledged and distributed, since 1970, in the technical research and building engineering practice, for example through the ASHRAE standards, that have prescribed a narrow band of comfortable temperatures which are uniformly applicable across building types, climate zones and populations (de Dear and Brager 1998; Shove 2003). This model is used to predict levels of thermal comfort in buildings all over world, relying on physiological responses of test subjects in climate chambers and their satisfaction with the environmental conditions (de Dear and Brager 2001; de Dear et al. 2013). The model suggests comfort to be understood, and predicted, by means of measureable parameters of the indoor climate and views occupants as passive recipients of thermal stimuli. This model has been criticised as ignoring contextual dimensions of comfort such as factors related to climate, culture and society (de Dear and Brager 1998, 2001). The model has further been contested by the adaptive model as proposed by Humphreys and Nicol, who argued for looking at a relationship between 'comfortable' temperatures (neutral), mean temperatures inside a

building as well as a mean monthly outdoor temperature (de Dear et al. 2013). This regards occupants as active participants in creating thermal preferences and includes contextual factors as well as the individual's thermal history. Satisfaction with indoor climate is understood as a match between actual thermal conditions and one's thermal expectations in the same context (de Dear and Brager 1998, 2). During the last 20 years, the adaptive approach to comfort has gained impact, recognising differences in the relation between ranges of indoor and outdoor temperatures, naturally ventilated buildings and buildings centrally controlled with HVAC (Heating, Ventilation and Air Conditioning) systems: how these aspects affect the occupant, while also recognising the impact of the occupants' interactions with buildings, and how individual possibilities for control of thermal comfort affect occupant satisfaction positively (de Dear et al. 2013). The adaptive approach links people's votes on a comfort scale (comfort temperature) to their actions and the context in which they are situated, for example concerning the building and the outdoor environment. Furthermore, the approach recognises that people will act and adapt to obtain comfort if they feel discomfort (Nicol and Humphreys 2002).

More recent developments of building energy simulation and thermal performance tools comprise a broader definition of personal comfort that includes both building occupancy and behaviour, reflecting a growing recognition of occupant interaction with the building as significant for the thermal performance of a building, together with the building envelope and HVAC systems (de Dear et al. 2013). It has also been recognised that the energy balance between occupants and their thermal environment is rarely a steady-state condition. There are complex interactions between the building envelope, weather, HVAC systems and the occupants and their activities. The methods used have primarily been climate chamber studies or field studies in real buildings to attempt models of indoor environments and how this is perceived by human subjects, or occupants. A newer and increasingly popular method is comfort simulation, which does not involve human subjects in evaluating actual thermal environments, but instead uses simulation tools to produce indoor climate data applied to a thermal comfort model (de Dear et al. 2013).

Frontczak and Wargocki (2011) carried out a literature survey on different factors that constitute comfort and a satisfying indoor environment for building occupants. The standardised factors comprised thermal comfort, visual comfort, acoustic comfort and factors that are not usually related to the evaluation of comfort in the literature, such as individual characteristics of

occupants, factors related to the building and the outdoor climate. Thermal comfort had the highest influence on the condition of comfort. It was concluded that universal comfort solutions are not always satisfying and the control of indoor environmental conditions needs case-by-case solutions. Thermal comfort was also influenced by building type as well as outdoor climate and seasonal changes. Occupants in naturally ventilated buildings had a broader tolerance of indoor thermal conditions, as they accepted higher indoor temperatures in summer and lower in winter, as well as a wider temperature range (in line with the adaptive model), thus providing occupants the possibility of controlling indoor environment improves comfort and satisfaction (Frontczak and Wargocki 2011).

The technical approach to comfort has focused on physiological responses to environmental parameters in determining a mean comfort level in buildings, and further to optimise indoor comfort, physiologically, by means of technical developments and devices (Hinton 2010). In the field of building research, the focus has been on a measureable and standardised notion of comfort where comfort has been perceived as an attribute of the built environment (Shove 2003). In contrast, the adaptive approach has pointed to the significance of thermal context for understanding comfort as well as the interaction between humans and buildings in creating comfortable environments; that is, comfort parameters are not universally applicable and comfort is rather an adaptation between building features and human activities (de Dear and Brager 2001). This status is further described by Nicol and Stevenson:

> "No longer is [thermal comfort] seen as a function just of the physical and physiological state of the human body; it is also a function of the ways buildings are heated and ventilated, the opportunities the building affords for its inhabitants to control it, the form(s) of energy inhabitants use to fit the building to their needs" (Nicol and Stevenson 2013, 255).

3.1.2. SOCIO-TECHNICAL APPROACH

As shown above, a physical or physiological paradigm has been dominant within comfort studies, which has advocated universal standards of comfort (Shove 2003). In the last 10-15 years, this technical approach has been challenged by socio-technical studies emphasising social and cultural meanings

of comfort. Following Elisabeth Shove, conventions of comfort have, especially through the last part of the twentieth century, become highly standardised, as for example, seen in the widespread use of air-conditioning in all kinds of climate. In the book 'Comfort, cleanliness and convenience – the social organization of normality' she argues for a socio-technical scrutiny of comfort, as well as cleanliness and convenience, stating that these concepts are:

> " (...) complexes of practice [that] appear to change in ways that challenge established theories of consumption and technology (...) there is some evidence to support the view that comfort and cleanliness are subject to distinctive forms of escalation and standardization. Escalation here refers to the ratcheting up of demand, for instance levels of comfort or for degrees of cleanliness. Standardization implies that the reach of what counts as normal is more and more encompassing. Conventions once confined to particular cultures seem to be extending (and eroding) in ways that suggest convergence in both technology and practice" (Shove 2003, 3).

Shove further argues that comfort, cleanliness and convenience are the 'environmental hotspots of consumption' (2003, 3), and her study focuses on how conventions of these have co-evolved through history in a dialectic relationship between technological development, policy and legislation, marketing and everyday life. The examples related to comfort focus on indoor climate and air-conditioning and the study scrutinises the term as cutting across and encompassing diverse interlinked conventions and habits, establishing comfort as a socially shared understanding. In an article from 2005, Chappells and Shove further bring forward the perspective that comfort is both an idea and a material reality; and significantly that it is a negotiable socio-cultural construct (Chappells and Shove, 2005).

In a special issue of Building Research & Information, 'Comfort in a Lower Carbon Society', scholars comment on various socio-technical approaches to comfort and new ways of conceptualising comfort in relation to indoor and outdoor climates. This focuses on meanings and definitions of comfort as changing, on the conditions and concept of comfort as reproduced globally, and on demand and supply as always connected. The editorial by Shove and colleagues (2008) underlines how approaches to comfort are necessary to debate in relation to sustainable consumption of energy and a future low-carbon society and argues for an understanding of comfort in a nexus of

political agendas, development of technologies, conventions of everyday life, social practices and weather. It is also stated that solely developing more efficient technologies for the heating and cooling of buildings is not enough to face the problem of escalating energy consumption and climate changes, if current standards of comfort are followed globally and not taken into account (Shove et al. 2008):

> "Existing and emergent technological strategies – from natural ventilation to high-technology control – are sure to be important in this equation, but there is already widespread agreement that adopting more efficient methods of heating and cooling buildings to current standards is unlikely to be enough" (ibid., 307).

Healy (2008) scrutinises how technical definitions of thermal comfort and standards form social norms about comfort and lifestyles from a Foucauldian perspective on air conditioners as a governing technology. This has resulted in a thermal monotony that has subsumed the varied, cultural and symbolic, thermal sensibilities of cultures and regions and reduced the diversity in practices related to thermal comfort (ibid.). Cole et al. (2008) revisits the notion of comfort in the vein of dynamic, integrated and participatory aspects of interaction with buildings, especially at the collective level of building inhabitants in commercial buildings and their engagement in achieving comfort. The paper concludes that passive design strategies, integrated design, performance assessments etc. can provide a context for redefining notions of comfort in buildings, including a focus on feedback, dialogue and adaptation. This should support a broadening of the concept of comfort as an interactive concept (ibid.). Brown and Walker (2008) underline the adaptive issue of comfort, such as clothing, eating and drinking, low-technology ventilation and cooling, and how this is essential for dealing with heat wave vulnerability. Cooper (2008) further underlines adaptive strategies that include residential gardens, in opposition to air-conditioning systems, and argues for an adaptive use across the boundaries of indoor and outdoor (private) areas to avoid overheating by using natural cooling strategies. The main point is that comfort should be focused on the individual body rather than the house, for example in cooling the body instead of the house (ibid.). Strengers (2008) scrutinises the relation between normalised comfort expectations and demand-management strategies aiming at managing consumer electricity demand and consumption, with a focus on the increasing reliance on air-conditioners. It is concluded that comfort is overall considered a basic and non-negotiable right that cannot be

compromised, even though comfort levels are rising, and that demand-management strategies influences such expectations of comfort (ibid.).

Several researchers have approached the concept of comfort within the practice theory framework to understand social practices related to energy consumption as habitual ways of performing the everyday. These studies have focused on 'comfort practices' as related to thermal comfort and have therefore often been concerned with heating, cooling and indoor climate regulation, as these are practices that are clearly related to energy consumption. Within this bulk of research, Gram-Hanssen used practice theory to understand differences in residential heat consumption by analysing everyday knowhow and attitudes related to heating and airing. The study showed that differences in the technologies available, knowledge of using them, the individual habits and ideas of comfortable temperatures and indoor air constitute differences between householders' energy consumption in similar houses (Gram-Hanssen 2010). Strengers has questioned comfort norms in relation to energy demand and feedback on energy consumption. She studied cooling practices related to air-conditioning and comfort, as well as feedback and demand-management strategies, and whether these engage or disengage consumers in adapting energy consumption to the increasing peak demand challenge (Strengers 2008, 2010, 2011). She argues that feedback has a limited influence on energy consumption practices, as the feedback may prompt residents to turn off the air conditioner during peak-periods, do laundry in cold water or turn off standby-products, but it does not question the actual practices of heating or laundering, or conventions of cleanliness and comfort, nor does it offer alternative ways of practising daily routines (Strengers 2011, 2013). Strengers and Maller (2011) studied how public policies concerning heat waves are contradictory to the everyday life of householders and their strategies for adapting to hot weather. The analysis identifies adaptive strategies as a practical knowledge of cooling practices: for example in using fans and windows, changing clothing and diet, showering, and moving activities around or outside the house. It also identifies common understandings of air-conditioning as a general necessity, in policies, where householders' understandings were more affected by 'folk theories' and personal experiences and sensations. Finally, it identifies how the material infrastructure and technologies are also influenced by the other elements of the practice of cooling; that is knowhow and rules of how to use the air-conditioner, common understandings of comfortable and healthy indoor environments, and further, how the material design of a house promotes some ways of practising cooling while others do not.

Hitchings (2011) examined office workers' daily practices in relation to indoor and outdoor environments and how, in this respect, thermal comfort is tied to work culture, clothing and office building complexes. The focus is on air-conditioned environments as taken-for-granted ambient comfort and the context in which the everyday working practices are situated. Hitchings investigated the office workers' perceptions of comfort as habitual actions within this specific context understood as a reproduction of social practices. He talks here about the interaction between three elements; embodied sensibilities (clothing), physical infrastructure (ambient environments) and habitual modes of thought (social contexts) which are all part of constituting the daily comfort of the office workers. These are also possible aspects of intervention to support a change to lower energy consumption related to air-conditioning in offices (Hitchings 2011). In another article, Hitchings advocates for qualitative studies approaching comfort as a cultural phenomenon bound by geographical contexts and as varying between different social groups, to add to the statistical and physiologically oriented comfort studies (Hitchings 2007). Hitchings has further focused on practices related to comfort as shared in communities, that is practices *"involved in keeping human bodies sufficiently warm or cold"* (Hitchings 2013, 104). He points to differences and diversities in understandings, procedures and engagements in practices and to varieties in how these are performed. These practices related to comfort, or how humans keep themselves comfortable indoors, can include a bodily adaptation such as activities and clothing and the control of temperatures, such as heating and cooling. By focusing on how individuals do, or do not, engage in communities of practices – sharing ideas about how to adapt to thermal ambience – he identifies possibilities of deliberate intervention in communities of practice to encourage shared conventions of less energy-intensive ways of coping with heat or cold, or the emergence of new communities that organise around alternative ways of practising indoor comfort (Hitchings 2013). Day and Hitchings (2011) further examined the elderly's practices in winter to keep warm at home, focusing on the bodily changes related to age and ideas about identity, which demonstrated how the elderly participants were concerned about an elderly identity that was related to certain types of clothes and objects used in keeping warm. Heating practices in winter have also been studied by Jalas and Rinkinen (2013), focusing on wood heating as a visible heating technology that requires daily activities. In accordance to this, wood-based heating is understood as a distinct practice related to everyday comfort that reflects daily and annual cycles as well as social negotiations of comfort expectations (Jalas and Rinkinen 2013).

3.1.3. SOCIAL, CULTURAL AND SENSORIAL COMFORT

The above review of comfort literature shows that socio-technical research has been influential in specifying how comfort should be understood within the context of societal, cultural and historical developments together with developments in technology and industry. It has also demonstrated that comfort is by no means solely a universal feature of buildings. Along this line, it has also been stated that comfort, in relation to residential energy consumption, is entangled in practices of everyday life. This everyday life is historically and culturally specific, and ideas of comfort are attached to such social contexts. For example, Wilhite and colleagues (1996) performed a cultural and social analysis of residential energy consumption, comparing the consumption practices in residences in Japan and Norway, finding significant differences in practices of heating, lighting, bathing, dish washing etc. relating to different social and cultural notions of for example cosiness and comfort.

Hitchings and colleagues (2014) also followed in the vein of understanding comfort as a cultural matter as well as variances in how comfort is desired and achieved within different social groups. The article questions the focus on thermal comfort to understand climate control in a broader sense; that is, in regard to activities and the environmental conditions surrounding them. The aim is to understand climate control, not as a technology to attain physiological comfort, but rather as a cultural feature of, for instance, shopping and sports spectatorship. The respondents in the study did not focus much on their own physiological comfort or discomfort in such situations, as these activities were related to some contact with the outdoors and thereby also a personal adaptation to the climate. Climate control and the notion of comfort were rather related to social change, such as status, customer care, technological progress and event management.

Ethnographic studies have further focused in-depth on individual perceptions of comfort that are enmeshed in social and cultural norms. In their ethnographic research on off-grid homes, Vannini and Taggart (2013) focus on different types of sensuous comfort in such 'alternative' living environments and socio-technical assemblages of comfort:

> "Comfort, it turns out, is not a uniform experience. Off-gridders'
> domestic practices show vividly what it means to achieve comfort

differently – in variable intensities and through different technologies" (Vannini and Taggart 2013, 1078).

Off-grid homes demand that inhabitants are very engaged, corporeally and in terms of time in, for example, heating and lighting the home compared to other modern Western dwellings. At the same time, off-grid homes can be said to be 'compromising' – and also challenging – in regards to the high comfort standards in the built environment (Vannini and Taggart 2015). However, the many participants they visited and interviewed did not feel that they compromised on comfort; they simply achieved comfort differently to dwellers in conventional modern housing. This makes an interesting point in the debate on comfort norms and standards. Vannini and Taggart write that physical comfort is situated in time and space, as it is an evaluation of one's sensory experience at a particular time and place, and further comfort is attributed to the surrounding material environment, i.e. whether these structures and objects provide comfort. Following Bissel (2008), comfort is understood as an embodied and affective sensibility, and thus comfort can be seen as an affective dimension as it is *"an outcome of the capacities of individuals to configure sensations and material objects"* (Vannini and Taggart 2013, 1078). Consequently, comfort is individualised as sensing material structures. This physical characterisation resonates with the above technical approach to comfort, though underlining the contextual dimension of feeling comfortable. However, Vannini and Taggart instead define comfort as being attributed to sensations, emotions and objects in a broader sense, namely, that comfort can be both bodily and mental, corporeal and emotional. Comfort is then understood as a bodily sensibility, which is an affective involvement with the surrounding environment. This bodily sensibility, or capacity, of comfort varies in relation to skills, technologies, materials and cultural notions of lifestyles; that is, cultural characteristics shape different notions of domestic comfort (Vannini and Taggart 2013, 1079). In this way, Vannini and Taggart talk of human and non-human assemblages of comfort, ways of, for example, lighting and heating, that are close to the practice theoretical understanding of comfort in relation to heating practices. However, with Vannini and Taggart, it is underlined how comfort is bodily and socio-cultural as well as situated in time and space.

As mentioned above, the literature on comfort and energy consumption has predominately focused on thermal comfort, i.e. keeping bodies at a comfortable temperature. Heating and cooling account for a significant proportion of energy consumption in housing and adequate temperatures are an important

dimension in feeling comfortable in a house. From a sensorial perspective, this relates to the sense of thermoception, which allows humans to feel heat and cold (Vannini 2011). However, feeling comfortable in a home is not solely related to temperatures, as other senses are also in play in feeling comfortable, for instance touch and smell. Following Vannini and Taggart (2014), senses can be understood as interfaces; as a skill, a sensibility and an orientation. In this vein, Royston (2014) has also demonstrated how several human senses, and different sensory perceptions of temperatures are used in the heat management of homes to define whether a home is sufficiently warm or too cold. In this way, she argues that the knowhow of heat management practices is embodied, but at the same time, it is related to material arrangements, social conventions and life courses.

Senses are related to affect, which is a body's capacity to both move and be moved, or affected, by people and things. Senses as affect can be understood *"as a nexus of intersecting practices and experiences through which different actors become entangled in the lifeworld"* (Vannini and Taggart 2014, 66). This perspective is similar to Simonsen's phenomenological interpretation, which states that the 'flesh' of our bodies is intertwined with the 'flesh of the world', underlining the bodily involvement with the surrounding environment (Simonsen 2007, 172). Further, Wallenborn and Wilhite point to the importance of (reintroducing) the body in understanding household consumption, as they state that:

> "In mainstream theorizing about energy consumption, body is collapsed into mind and the demand for goods is both disembodied and decontextualized from social and material worlds" (Wallenborn and Wilhite 2014, 56).

This approach to energy consumption in households then follows the line of phenomenological and practice theoretical thinking that seeks to transgress the dichotomy of body and mind, object and subject, material and social. Wallenborn and Wilhite also note that our knowledge of the world is embedded in bodies influencing how we consume, which resonates well with the assumption of this thesis that our bodily and mental perceptions of comfort are crucial to energy consumption in homes. Furthermore, these perceptions of comfort change with bodily changes, and the body and its capacities are reshaped through escalating perceptions of comfort (Wallenborn and Wilhite 2014, 56). Changes in material structures are inherently changing perceptions of comfort, and thereby consumption practices. This also means that spaces,

and thus atmospheres, are perceived through the (moving) body, which makes the body and embodied practices central to understanding atmospheres and how these are characterised as comfortable and homely.

3.2. ATMOSPHERES OF HOME

Residential comfort is essentially about the relation between the body and social and material structures of the surrounding environment which, in this case, is the home. Atmosphere can designate this feeling of a homely – comfortable – environment: *"Atmospheres denote exactly the affective mood which spatial arrangements stir in the sensual bodies of their users"* (Reckwitz 2012, 254). In this way, the atmosphere of a comfortable home can be seen as an affective and sensorial condition. Böhme further explains how this relation between the body, the mind and the environment signifies an atmosphere:

> "Atmosphere is the common reality of the perceiver and the perceived. It is the reality of the perceived as the sphere of its presence and the reality of the perceiver, insofar as in sensing the atmosphere s/he is bodily present in a certain way" (Böhme 1993, 122).

As such, an atmosphere is something that is perceived at a specific time and place and perceiving an atmosphere presupposes a bodily presence in a room or some other kind of space, constructed or natural, indoors or outdoors. As Mikkel Bille notes, following Böhme, the notion of atmosphere *"captures the co-presence of things, bodies and experiences"* (Bille 2015, 57) and further atmospheres are felt through multiple senses. In their special issue introduction, Bille and colleagues discuss atmosphere as a basic human and social dimension of daily life:

> "(…) atmosphere constitutes a fundamental aspect of the human experience of the world and (…) it thus is an important part of the identities and conceptualisations of landscapes, architecture and homes" (Bille et al. 2015, 31).

Atmosphere 'fills' the spaces of our everyday life and is part of our inhabiting of a place. Atmosphere can then be understood as located in-between experiences and environments. In this way, atmosphere denotes the interaction and co-

presence of humans and places, subjects and objects that are shown through sensory experiences. As such, atmospheres are perceived and sensed in an on-going process, and atmospheres are therefore not stable (Bille et al. 2015).

The notion of atmosphere has been used to show how home spaces are constructed through everyday practices that consume energy, such as lighting and heating, by for example Daniels (2015) and Bille (2015). In this context, atmospheres are seen as temporarily changing with changes in material structures and objects as well as values and cultural notions: *"(…) atmospheres emerge as multi-temporal tensions: they are at the same time a product of the past and the future"* (Bille et al. 2015, 34). Bille looked into how 'cosy' atmospheres are understood and created in and beyond Danish homes, through lighting practices, where atmosphere is understood as a bodily involvement influenced by a 'culturally-shaped sensorium' (Bille 2015, 58). This means that, for example, social norms and events are also shaping atmospheres, as sensed and perceived. Daniels studied how atmospheres are ascribed as being homely or unhomely in Japan through lived everyday experiences in homes. This also focuses on the use of light and how this relates to cultural notions of the (modern) home and the intimacy of family relations (Daniels 2015). Pink and Mackley study how lighting is used *"to make, maintain and improvise atmospheres of home"* focusing on night-time routines (2014, 2). The study of atmospheres is seen as a way to study the relationship between people, things and environments and, as such, also a way to study the habitual consumption of energy in homes. The point is that the atmosphere of home is continuously adjusted through the sensed involvement with the home and everyday routines when one moves around, switching lights on and off according to the routine and purpose in each room of the house. In this perspective light, experienced both sensorially and affectively, is part of knowing and making home atmospheres. Atmospheres of home are then

> "(…) understood as emergent from the improvisory everyday processes of making that householders go about as they move through homes undertaking habitual, often unspoken about routines" (Pink and Mackley 2014, 10).

3.3. HOME AND THE EVERYDAY LIFE

The literature on thermal comfort has primarily related to studying houses as physical structures that provide comfort in interaction with the residents. However, for the study of residential comfort, the home should be recognised as a place for everyday practices related to comfort. Therefore, an understanding of the house-as-home is needed, as has also been stated by Ellsworth-Krebs et al. (2015). Research on atmosphere, as presented above, has dealt with how atmospheres can be described as both comfortable and homely. To understand residential comfort in a matrix of the material, social and sensorial, necessitates precisely an understanding of the home as material structure, social idea and sensory perception. Shelley Mallet writes that:

> "Home is a place but it is also a space inhabited by family, people, things and belongings – a familiar, if not comfortable space where particular activities and relationships are lived" (Mallet 2004, 63).

In recent geographical and sociological thinking, the concept of home is spatialised and contextual. These approaches to home place focus on space and place, scale, identity, power and social relations, and thereby a home is seen as a socio-spatial system (Blunt and Dowling 2006). This means that 'home' is a site where we live, in the meaning of a physical shelter, but besides this home is as much an idea or an image, i.e. a social construct imbued with a set of feelings or meanings (Blunt and Dowling 2006, 2). This perspective is opposed to the one-dimensional thinking of equating home with house. As such, 'home' is not necessarily connected to a physical house and a physical house does not always provide a home, although 'house' and 'home' have often been conflated (Blunt and Dowling 2006; Mallet 2004). A home is produced through home-making processes that relate the social and the physical, and therefore home is neither merely a physical structure nor merely a social construct, it is a relational concept that merges between social and material realms. Blunt and Dowling explain that:

> "(…) the material form of home is dependent on what home is imagined to be, and imaginaries of home are influenced by the physical forms of dwellings" (Blunt and Dowling 2006, 22).

A home is, at one and the same time, a physical structure and a social construct. It is thus a relational concept as a home is produced and reproduced in an on-going process through homemaking practices. Through daily homemaking

practices, houses are appropriated and made into homes. A Danish study has demonstrated these processes, stating stages of homeliness as being fourfold: 1) the home as idea, 2) the home, 3) to feel at home, and 4) 'to do home' [my translation[6]] (Winther 2006). 'The home as idea' denotes an abstract and normative notion or conception. 'The home' is the concrete space of a home, which is sensorial, physical and practical; the space of everyday routines. 'To feel at home' is a feeling, or an atmosphere, which can both point to a specific space or to people. 'To do home' is the tactical (adopted from de Certeau) use of a house that makes it homely; this is about practising homely activities that change a dwelling into a homely place (Winther 2006). This approach to understanding how homeliness is produced and reproduced is similar to the line of practice theoretical approaches of understanding how comfort is created and energy consumed in houses through homemaking practices. The distinctions between the different aspects of 'home' are useful in illustrating how a home is both a social idea, or image, a physical space, a feeling and something that can be practised through everyday routines. Such daily routines produce homely atmospheres encompassing the social and the physical, the affective and sensorial. As described by Pink and Mackley:

> "(…) routines and improvisory practices are constituted, lived out and contribute to the making of everyday environments and can therefore be thought of as productive of affective atmospheres of home. Routines therefore are not simply performed in homes, but are part of the ongoing processes through which a home, its atmosphere and the living of everyday domestic life are constituted and experienced" (Pink Mackley 2014, 7).

Thus homes are affective environments created through homemaking practices. To become attuned to the more sensory elements of everyday practice and home-making, Pink's concept of the 'sensory home' is useful. In this perspective, everyday practices in the home are integrated with sensory perception and embodied experience and all the human senses are at play in homemaking:

> "The idea of the sensory home refers to home as a domain composed of different sensory elements (smell, touch, taste, vision, sound) that is simultaneously understood and created

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[6] Translated from Danish: 1) hjemmet som ide, 2) hjem, 3) hjemlighed, 4) at hjemme den (Winther 2006).

through the sensory experience and manipulation of these elements" (Pink 2003, 48).

Homemaking practices are seen as embodied actions through which individuals engage with the sensory environments of their home, for example by cleaning, airing or cooking. Thus, the concepts of home and everyday life are closely entwined and residential comfort and energy consumption are practised within this sphere of everyday homemaking. As a consequence, the home is a central anchor point in everyday life, as this is where daily activities are carried out, anchoring lifestyles and identities. An everyday life perspective is centred on social relations and experiences of daily life at the micro level, as described by Bech-Jørgensen: *"Everyday life can be described as the life we recreate and reproduce every day"* (1994, 291). She argues that to ascribe meaning to the home is also to ascribe meaning to the everyday life, and further writes that:

> "(…) daily activities are not only situated in time, but also in space, primarily in the homely space, but also in the space of the residential area and the city. Thus, the home is reproduced as a material order inside the material structures of society, but it is reproduced as a symbolic order of taken-for-granted positions and the relations of gender and age as well. The symbolic order of the home is continually changing. The changes are externally determined for instance by unemployment, consumption, social security. And they are internally determined by the ways in which these conditions are handled" (Bech-Jørgensen 1994, 293).

This everyday perspective understands and describes society from below, as everyday life is also understood to hold predispositions for the systemic society on a macro level and thus practices on the micro and the macro level are tied together (Gullestad 1989). In this perspective, the modern individual creates their own centre of the world through choosing lifestyle and producing identity and, for this purpose, the everyday life and the home is a haven providing privacy and meaning as opposed to the institutions of society; it is through the knitting together of everyday activities that identity is created in the life world of individuals. Löfgren (2014) further describes the everyday life as a cohabitation of objects, people, feelings and activities in the setting of the home. The everyday life perspective has become highly engaged with the materiality surrounding daily life and the home, from housing structures to the objects and technologies within them. It has also been stated that these objects of everyday life, such as kitchen appliances, afford or encourage particular ways of

practicing everyday life and restrict others. This means that things, people and practices interact and are mutually constitutive (Shove et al. 2007).

3.4. THEORIES OF SOCIAL PRACTICES: FROM INDIVIDUALS TO SOCIAL PRACTICES AND BACK

Socio-technical research on energy consumption and the everyday has often, increasingly through the last decade, used a practice theoretical approach. This research has studied habitual and mundane practices of everyday life and understands energy consumption as the outcome of such practices, thus energy is not used for its own sake, but rather as part of accomplishing practices and sustaining an everyday life (Shove and Walker 2014). This thesis uses a practice theory approach to look into how different everyday practices are related to comfort, and how comfort can be understood as part of different everyday practices in the house-as-home. In this vein, Rinkinen and Jalas note that: *"(…) houses (as material artefacts) become part of the accomplishment of the various tasks and activities of living and housing"* (Rinkinen and Jalas 2016). The house and its technologies are but one component in constituting comfort in homes, as these material structures are combined with bodily knowhow and social meanings of accomplishing practices related to comfort. This will be elaborated in the following section.

Theories of social practice can be traced back to social thinkers such as Pierre Bourdieu (1990), Anthony Giddens (1984), Judith Butler (1990) and Bruno Latour (1993). More recently, Theodore Schatzki (1996) and Andreas Reckwitz (2002b) have been prominent in outlining approaches to practice theory. As such, the practice approach is not a unified theory but rather an approach containing varied empirical and theoretical implications according to different scholars (Schatzki 2001; Reckwitz 2002b; Gram-Hanssen 2011). It is commonly agreed that the ontological implication of practice theory is to understand the social world as being made up of practices and, therefore, practices are at the centre of understanding social life, as proposed by Schatzki (1996, 2001) in arguing for a practice theoretical turn in social thought. Further, daily energy-consuming practices are commonly considered to be habitual and embodied, which has become a central statement in socio-technical energy research, understanding energy consumption from an everyday life perspective. As stated above, this means that energy consumption is seen as part of socially

shared ways of doing everyday life activities, rather than as rational and individual decisions (Shove 2014, Strengers 2011, 2013).

Practice theory bridges classical sociological dualisms such as between actor and structure, and between the social and material, although the emphasis in these spheres is placed differently by various scholars and is continuously discussed in research debates. Practices are shared as collective entities, such as ways of heating and cooling, and performed by individuals, or practitioners. In this way, practices are social in that understandings are shared between individuals in time and space (Schatzki 1996). Schatzki (1996) further identifies two aspects of practices: practice-as-entity and practice-as-performance. Practice-as-performance is the actual carrying out of a practice, which can differ according to the material surroundings and the practical understandings of individuals when performing a practice. This means that there are individual differences within the same social practice.

Following Schatzki, practices can be characterised as *"embodied, materially mediated arrays of human activity centrally organized around shared practical understandings"* Schatzki (2001). The elements of which practices are constituted have been variously characterised by scholars within the field. In Schatzki's (1996, 2002) account, practices are constituted by rules, teleoaffective structures (e.g. purposes, beliefs, emotions) as well as general and practical understandings. Here, knowhow is described as practical understandings, which means that practices are learned, remembered and performed routinely as embodied habits. Materials are not included as an element in practices, but instead, as noted above, surround social practices as practices are mediated by material structures. Shove et al. characterise the practice elements as materials, meanings and competences, where materials feature things, technologies, tangible physical entities, infrastructures and also the body; meanings encompass social and symbolic meanings, ideas and aspirations; and competences are skills, knowhow and practical understandings (Shove et al. 2012). Thus, material and social structures are both integrated in practices. There is no specified emphasis on bodily sensations or emotions, though emotions figure in Schatzki's definition of teleoaffective structures and are also regarded as part of the elements of meanings. Thereby, the body is included as a material and as necessary for performing the habitual, rather than as a sensory competence that may guide how practices are performed. Reckwitz also incorporates materiality and technologies along with the body, knowhow and states of emotion into a practice. He outlines a practice as:

> ”(…) a routinised type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge” (Reckwitz 2002b, 249).

Practice entities, or blocks as Reckwitz terms them, then depend on the interconnectedness of these elements. These practice entities are realised, sustained and reproduced through the performance of practices (Reckwitz 2002, Schatzki 1996, Warde 2005). Reckwitz further describes the individual as a carrier of practices, which means that the practitioners carry practices as routinised and embodied ways of understanding and knowing, both bodily and mentally (Reckwitz 2002b).

3.4.1. PRACTICES AND THE BODY

> ”A social practice is a regular bodily activity held together by a socially standardized way of understanding and knowing” (Reckwitz 2002b, 211).

As stated above, Reckwitz includes the body in practices. Schatzki does not explicitly include the body; however, he explains how practices are embodied. In this vein, practices are embodied ways of handling everyday activities, as habitual, which build on knowhow of how to conduct them in a socially acknowledged way. Moreover, Schatzki writes that practices are materially mediated, meaning that the routinised ways of practising everyday life are interacting with the material structures that surround them. Practices also rely on shared skills and understandings, or embodied knowhow, which places 'the skilled body' at the centre of mind and activity (Schatzki 2001, 12). Thus, as practices are embodied, human activity is entwined with the body and thereby bodies and practices constitute each other. Wallenborn and Wilhite also state that: "*Practices require skilled bodies, and bodies are shaped by practices"* (2014, 57). Hence, practices will not exist if bodies do not perform them. Bodies interact with other objects in performing practices, and practices are formed in this continuous relationship between the body of the practitioner and the objects that are involved in a practice (Wallenborn and Wilhite 2014).

The body and the senses have not been predominant in the versions of practice theory mentioned, although Reckwitz explicitly incorporates the body as an element in practice. Scholars using the practice theory approach to understand energy consumption in households have, however, not placed much focus on understanding the role of the body, human senses and emotions in practices. In the article 'Affective spaces: a praxeological outlook', Reckwitz (2012) traces this back to the dichotomy of culture and nature in social theory and proposes a need to understand emotions and space as components of sociality and as material and cultural at the same time, for which theories of practice are well suited, he argues. As practices are embodied habits, the body is, at the same time, active in the performance of practices and anchors practices materially. Both the body and non-human artefacts are material anchors of practices. Reckwitz (2012) argues that social practices involve both an affective-perceptive structuration and an artefact-space structuration and that these are interrelated as affects, can be directed at objects, and, further, are structured by spatial structures. This means that, as practices are inherently bodily, they are also inherently sensorial, and performing practices implies using all of the human senses. As such, both sensations and perceptions, and related emotions, form part of practices in both bodily and mental ways, and this includes affectivity into the framework as there is a close connection between senses, perceptions and affects:

> "The bodied agents of the social-practice-approach (…) are sensual-perceptive agents (…) this allows for their being affected in a practice-specific way by other objects or subjects, which are in turn affected by them" (Reckwitz 2012, 249).

3.4.2. PRACTICES AND MATERIALITY

> "A practice is thus a routinized way in which bodies are moved, objects are handled, subjects are treated, things are described and the world is understood" (Reckwitz 2002b, 250)

As described above, the body can be seen as a material element in practices as well as being a means of individual interpretation of practices through sensations. Overall, practices are materially anchored, in bodies and other material elements and, at the same time, practices modify their material surroundings (Reckwitz 2012). Consequently, there is a mutual relation

between practices and materialities that influence and modify each other. In the quote above, Reckwitz includes materials as an element in practices in the form of 'things and their use'. The material aspect of practices is elaborated in another article from 2002, in which he discusses the work of Latour and Schatzki. Reckwitz regards materials, or objects, as integral to practices as most practices cannot exist without objects that are handled and interpreted:

> "(…) certain things or artefacts provide more than just objects of knowledge, but necessary, irreplaceable components of certain social practices, that their social significance does not only consist in their being 'interpreted' in certain ways, but also in their being 'handled' in certain ways and in being constitutive, effective elements of social practices" (Reckwitz 2002a, 210).

Artefacts are handled and interpreted in performing practices and they are integrated in practices through a 'practical understanding', or knowhow, of how to use such objects. Thus, objects are material, physical, elements in practices, but they are also interpreted within cultural and social codes by practitioners knowing how to handle objects according to a practice (Reckwitz 2002a). This understanding or knowhow is embodied, again stressing the role of the body in social practices. However, this understanding is also materially embedded in objects. Accordingly, both humans and non-humans are components of practices:

> "(…) not only human beings participate in practices, but also non-human artefacts form components of practices. The things handled in a social practice must be treated as necessary components for a practice to be 'practiced'. In fact, one can say that both the human bodies/minds and the artefacts provide 'requirements' or components necessary to a practice. Certain things act so to speak, as 'resources' which enable and constrain the specificity of a practice" (Reckwitz 2002a, 212)

As mentioned above, the outline of practice elements by Shove and colleagues include materials as an element in practice, together with meaning and competences. In another article, Shove, Watson and Spurling (2015) discuss how material structures relate to practices on two levels: the material elements that are integrated in practices and the infrastructures that figure more in the background of social practices. These are connective, multiple and collective as they often link and sustain different practices as well as being obdurate, or

durable, existing over a long time span and, in this way, also historically carrying ideas about ways of living between generations (Shove et al. 2015). Thereby a distinction within materials in practices can be made between those that are directly used objects, such as a chair, a television or a shower, and those that are more in the background, such as the infrastructure of heat supply or electricity grids.

3.5. SUMMARY

This theory section has reviewed how comfort has been studied within different fields of scholarship focusing on *thermal comfort*. Comfort research has, to a large degree, focused on building technologies and, furthermore, on the relation between humans and technologies in creating comfort in buildings. The socio-technical literature has stated that comfort should be understood as a socio-cultural construct, which means that the meaning of comfort is not universal and cannot be taken for granted. Overall, quite extensive research has been conducted on thermal comfort, as this is very closely related to daily energy consumption and the development of energy technologies. However, some literature within the field also points to other types of comfort, both physical and social. Sociological and ethnographic studies have emphasised comfort in both its social and cultural meanings, as situated in time and space, and as bodily sensations. It has been stated that, both in relation to comfort and energy consumption, the body is a crucial factor to understanding how we perceive comfort and consume energy. Literature concerned with the senses and the body has not been predominant within the socio-technical research field concerned with comfort and energy consumption.

The concept of atmospheres has been used to research comfort in relation to the home and cultural notions of homeliness and cosiness. The perspective is useful in examining comfort as an affective relationship between people and their everyday practices and objects and material environments that are part of this daily production and reproduction of comfort in homes. Considerable research on comfort has studied the house as a physical structure, including technologies that produce comfort and consume energy. However, the understanding of the house as a home, which implies an interaction between social and material structures – the physical building and socio-cultural construct of the meaning of home – has not been sufficiently integrated. For the purpose of this thesis, the concept of home should be understood as relational

and socio-spatial, as it is both a material structure and a social idea. Moreover, a home is produced and reproduced through daily homemaking practices. In relation to understanding residential comfort and energy-consumption, it is crucial to look at the house-as-home, encompassing both social and material structures. This perspective is complemented by the sensory home approach to underline the affective and sensorial aspects of everyday practices related to perceiving and creating comfort – or atmospheres of comfortable homes. The everyday life perspective reveals the micro scale of society, where the everyday life is practised in homes, although it is also important to understand the practices of the micro level as being closely tied to the practices on the macro level of the systemic society. The everyday life perspective has further put focus on the cohabitation of people and objects, the social and material structures, as is also important in understanding social practices as proposed by practice theoretical scholars. Theories of social practices have placed focus on the collective and habitual aspects of performing everyday life, through which energy is consumed. Practices are both socially shared and individually sensed and interpreted, as these everyday practices are embodied and routinised, but also performed in a relationship with material objects and structures as well as social ideas and meanings that are culturally and historically dependent.

This PhD thesis investigates comfort as both bodily sensed and socially shared in a variety of everyday practices. It situates comfort, and the related energy-consuming practices, within the material and social framework of the home. The three papers all build on a social practice perspective, although different foci have been applied and different theoretical lenses added. Therefore, this chapter has unified and presented the theoretical perspectives needed for a study of the practices and perceptions of comfortable homes. The first paper in the thesis deals with how the body and the senses can be thought of more thoroughly in relation to social practices, from a sensorial perspective and in regards to understanding different everyday practices that are related to comfort. The second paper scrutinises how the concept of home should be taken into account when researching residential comfort, and further how practices related to comfort are also practices of homemaking. The third paper focuses on the material aspect and how materialities take part in producing and reproducing practices related to comfort, which implies a further discussion of the relation between practices and materiality.

4. PRESENTATION OF PAPERS AND KEY INSIGHTS

The three papers of the thesis engage with the relation between comfort, everyday practices and the material and social structures of daily life in homes from different angles. The first paper scrutinises how different aspects of comfort can be seen as sensorial elements of social practices. The second paper investigates the relation between comfort and the home in a variety of energy-consuming homemaking practices. The third paper draws attention to how the materiality of houses and technologies structures social practices related to comfort in everyday life. Together, the papers provide an answer to the question of how comfort is sensed and perceived within the home and thereby provide new perspectives as to how we create comfortable homes in more sustainable ways.

4.1. PAPER I. RETHINKING COMFORT: UNDERSTANDING SENSES AND SOCIAL PRACTICES

The first paper of the thesis was co-authored with Kirsten Gram-Hanssen and set out to understand comfort in social practices by incorporating a sensory perspective. The paper is based on empirical analysis and the four aspects of comfort investigated were drawn from empirical condensations of the interviews. The outset for this first analysis part of the thesis was an assumption that feeling comfortable could be related to aspects other than temperature and indoor climate, as have most frequently been the focus of research on comfort in relation to residential energy consumption. Comfort has often been taken for granted in research and this paper set out to investigate the different meanings of comfort, and to look into how these have different implications for energy consumption. Comfort was investigated in a broad frame that included materials, social relations and bodily senses as well as social practices. Theoretically, the aim was to include bodily sensations more explicitly in practices and to explore how meanings could broadly include social relations, norms and interpretations of comfort as well as other aspects related to this. As such, the primary purpose of the article was to answer research

question one: *How can comfort be understood as sensed and perceived within everyday practices in the home?* This included an empirical analysis of various aspects of comfort which emerged as central for the research participants, and how, together, these constituted comfort in homes in material, social and sensorial ways.

The aspects of comfort that showed as central to the participants in their home were: 1) warmth and coolness, 2) air, 3) light, and 4) material stuff. These aspects of comfort figured in many different everyday practices, either as an element in the practices or as a background to practices. The ways that these comfort aspects are perceived were examined by applying a sensorial perspective, which showed that several of the human senses were involved and interrelated when perceiving comfort through practices. The sense of thermoception, sensing warm and cold, is particularly prominent in relation to comfort, together with the sense of touch; however, vision, sound and olfaction were also shown to be involved in sensing comfort. The sensations of comfort are further varied according to the different everyday practices performed in the home, of which they form part. This also means that the comfort aspects were sensed and perceived in relation to the social meanings, materialities and embodied knowhow related to the social practices and the material structures of the houses. As such, sensations of comfort mediate between notions of comfort as social meanings and the materialisations of these in furniture, ceiling, walls, windows, and energy technologies. In terms of social practices then, senses can be understood to translate between practice elements of meanings and materials. These translations are then again interpreted in terms of the social and material structures of the surrounding environment in the performance of practices, and influences how comfort is perceived. Comfort is then understood as sensed individually, but at the same time perceived in relation to shared social practices that entail certain notions of comfort and material predispositions of performing practices according to conventions of comfort.

4.2. PAPER II. THE COMFORTABLE HOME AND ENERGY CONSUMPTION

The second paper of the thesis aimed at a better understanding of residential comfort and energy consumption by investigating the relation between 'comfort' and 'home' as concepts. The assumption was that feeling comfortable

in a house could be closely related to feeling at home, and therefore understanding residential comfort could be qualified by a better understanding of how this was related to the home as a social and material concept. Empirically, the paper built on the fieldwork's photo-elicitation study using both the residents' photographs and the follow-up interviews. The analysis investigated how the meanings of comfort and homeliness are related and how these meanings are tied to everyday practices and different rooms of a house, tracing the participants' tour around their houses through their photographs. The theoretical contribution focused on the social aspects of a home, and how these are related to the material aspects of the *house* through practices of daily homemaking that constitute comfort. Hence, paper II sought to answer research question two: *How are notions of comfort and notions of home related and intertwined in daily home-making practices?*

The paper concluded that the notion of home was important in understanding residential comfort and the related energy consumption, as the conceptions of home and comfort are interrelated in homemaking practices. However, these notions also differ according to different everyday practices and the use of the house. For the participants, comfort was more closely related to material structures of the home, including furniture, and thereby to bodily sensations, while homeliness was related more to the social relations of family and norms of, for example, cosiness. In regards to the everyday practices of homemaking, comfort was primarily related to practices of relaxation and other leisure activities, whereas homeliness was related to both practices of caring and spending time with the family and to daily housework such as cooking or doing the laundry. Daily homemaking practices, overall, were shown to be both about creating comfort as bodily sensations and social conventions, and about sustaining a home and daily family life. The relation between the notions of comfort and of home was further shown to have implications for how the home was used, and thereby how energy was consumed within the home. This way of looking at comfort connected elements of embodied knowhow, bodily sensations, social meanings and materialities in the framework of the home and homemaking practices and, in so doing, contributed with a reframing of residential comfort aiming instead for researching 'comfortable homes' that takes these elements into account.

4.3. PAPER III. MATERIALITIES SHAPE PRACTICES AND IDEAS OF COMFORT IN EVERYDAY LIFE

The purpose of the third paper of the thesis was to scrutinise the relation between material and social structures related to houses and everyday life, to understand how norms of comfort are manifested in the material structures of housing and technologies, and how these materialities form how comfort is practiced and perceived in the daily life in homes. Paper III sought to answer the third research question: *How do technologies and material structures of housing form routines of everyday practices and norms of comfort?* The paper set out to examine this as a relation between the physical building structure of houses that represent forms of comfort and the practices of everyday life that are related to comfort. The empirical analysis used the interviews from the three different categories of housing to scrutinise how the differences between the houses, as differences ascribed to the development in the building regulations, influenced the sensations and perceptions of comfort of the participants.

The analysis revealed some clear differences in perceptions of comfort related to heating and airing practices that were connected to the development in technologies and building types. These differences were further related to the use of the rooms of a house and to the changing seasons of the Scandinavian climate. In addition, the perceptions of warmth and coolness also changed with the differences in materialities of the houses. Lastly, the analysis showed that the energy technologies of the low-energy houses influenced the bodily sensations of warmth and coolness, as the temperatures were read and compared to the individual sensations. From this, it was concluded that material structures of houses, including heating technologies, form and change the residents' heating practices and perceptions of comfort. Differences in heating technologies between the housing types influenced how the residents sensed and perceived comfort as well as their everyday practices related to this. Thereby, building regulations and policy materialised in the houses influenced everyday practices of comfort, expressed through the knowhow, embodied habits and bodily sensations of the residents. Social norms concerning comfort and homes, tied to social structures of, for example family life, are thus influential both as manifested in the material structures of housing and in the performance of social practices related to comfort and other energy-consuming everyday practices.

5. DISCUSSION

5.1. PERSPECTIVES ON COMFORT

The three papers of this thesis set out to investigate the concept of comfort from different angles, focusing on the perceptions and sensations of comfort in everyday life in homes. Comfort has primarily been researched as *thermal comfort*, while this thesis examined several aspects of comfort as related to a variety of everyday practices. On the background of the empirical fieldwork, the first paper analysed four aspects of comfort in homes – warmth and coolness, air, light and material stuff. These aspects of comfort were important to the residents in detached houses as sensed bodily in everyday practices as well as socially and culturally meaningful. Warmth was, for example, both sensed as a bodily comfort and interpreted as important towards a proper family life. Fresh air was also sensed as important to a comfortable indoor environment, just as much as it was socially important to avoid bad odours. Light was important to create cosy environments and, in this way, ascribed to comfort, while natural daylight was sensed as an important aspect of feeling comfortable in a home. Material stuff such as soft furniture was perceived as comfortable and, furthermore, material structures of the houses were used for determining the thermal comfort of houses, for example in relation to draught from windows or cool walls and floors. These were the comfort aspects that appeared as the most important throughout the data, as the majority of the participants discussed them. There were also other aspects mentioned, such as noise, for example the importance of the dishwasher to not be loud, or choosing a quiet residential area.

The comfortable home is created through homemaking practices that encompass the social and material structures of homes. The aspects of comfort form part of these practices in different ways. Some everyday practices are more related to feeling comfortable while others are more related to feeling at home, but the important part is that these are closely intertwined. What is also interesting is that comfort and homeliness are related differently to the different rooms of a house, which means that different practices are performed in different rooms. From an energy consumption perspective, this is important, because practices are related to different types and levels of comfort. The comfort aspects formed part of many everyday practices, sometimes as a

specific material element used in performing a practice, and sometimes more as a background to performing practices. This encompass materialities such as furniture, technologies, walls and floors, but also the materiality of energy that flows through the houses. This divide mimics a divide of the material aspect of social practices, recently brought forward in the research debate, which I will return to in the following section.

The papers used a practice theoretical framework, as the focus was on understanding comfort in relation to energy-consuming everyday practices in the home. Paper I combined the practice theory framework with a sensory approach to comfort, to examine how comfort is both bodily sensed and socially interpreted through everyday practices. Paper II combined the practice theory framework with perspectives on 'home' as a material and social concept, to examine how the feeling of homeliness is closely intertwined with the feeling of comfort, as well as underlining that residential comfort is both physical and social. Paper III explored the relation between practices and materiality, examining how the material structures of houses are both influenced by social ideas of comfort and, in turn, influence how comfort is sensed, perceived and practised in everyday life.

5.2. THEORETICAL CONSIDERATIONS

The analysis of paper I incorporated a sensorial perspective into the understanding of aspects of comfort and the practices to which they were related. This necessitates a focus on the body, which has not been prominent within theories of social practices, although practices are agreed to be embodied. The focus on the sensing body can, in some ways, be said to oppose the ontology of social practice theory focusing on the social as consisting of shared practices. However, there can also be differences in the performance of practices between individuals and between social groups (Hitchings 2013). This, for example, reflects an individual sensibility of comfort. Paper I demonstrated how comfort can be understood as both individually sensed and socially interpreted. The social practices related to comfort are then inherently bodily but also influenced by social conventions. The analysis showed how several senses were involved in creating and feeling comfortable at home, for example touch in sensing soft furniture, smell in relation to fresh air, vision in relation to light and thermoception in sensing the warm shower or the cold floor. Pink and colleagues (2013) apply this stronger individual focus in arguing

for a sensory ethnography approach to examining practices related to energy consumption. This implies that, although studying energy-consuming social practices, the analytical focus is on an individual level of sensations and experiences of both social phenomena and the material environment. The individual focus is, in this sense, based in the phenomenological approach of studying the lived experiences of individuals. Therefore, it is distinct from the individual behaviour approach mentioned in the introduction, understanding the individual as a rational actor. Pink et al. note that, in following Warde (2005), the understanding of energy consumption is accessible empirically and analytically in studying everyday practices (2013, 25:2). The same argument can be used for analysing comfort in practices; this paper showed how comfort is part of practices and can be analysed as sensed in individual performances of practices, but is also shared and interpreted through social relations and ideas of comfort as related to different practices.

Another theoretical discussion, as initiated above, is on how materials figure in practices related to comfort. The analysis in the papers showed how materials were part of practices related to the different comfort aspects as well as being a specific comfort aspect. Materials were used in creating comfortable homes and to determine whether the home was comfortable. Materials, in this sense, are the objects in a home such as furniture or heating technologies, the physical structure of the house including walls, floors and windows and the flows of energy such as heat and light that permeate the homes in the background of most homemaking practices. Strengers and Maller (2012) have conceptualised how resources such as energy and water, can be seen as a material element that constitutes social practices, together with artefacts and technologies that make the use of energy necessary and possible. This approach emphasises that resources can be more or less visible and thereby appear as immaterial or material in everyday practices of householders, and this presence influences the householders' competences and meanings of reducing energy consumption in practices (Strengers and Maller 2012). This perspective underlines how materialities of the comfortable home can be both visible and material, such as a couch or a light bulb or invisible and immaterial, such as flows of heat or fresh air. As introduced in the theory section, Shove and colleagues discussed how materials could both figure as an element *in* practices or as a material structure that surround practices or figure in the background of practices. This perspective exemplifies how the material aspects of comfort can be seen both as part of the practices such as a television in watching tv or in the background of this practice as warmth that ensure a comfortable room in which to watch it. In another article, Shove et al. (2014) further discusses air – for example in the

sense of indoor thermal energy – as *"an object-like entity that has specifiable qualities or that is given meaning and that matters as the medium and context of social practice"* (2014, 115). This is a way of understanding flows of energy such as heat or light as a background element of some everyday practices in the home, while they figure more directly in other practices.

5.3. COMFORT, ENERGY CONSUMPTION AND SUSTAINABLE EVERYDAY LIFE

> "The challenges of sustainability confronting modern societies do not only emerge from the inherently interrelated nature of societal and environmental dynamics. They involve a true paradox of modernity: that scientific thought is not only offering solutions to, but evidently making up an inherent part of the socio-technological dynamics constituting present states of unsustainability" (Egmose 2015, 1).

This quote highlights the paradox of technologies, as also presented in the introduction. Energy research has been heavily reliant on assumptions about the rational consumer and efficient technologies; however, a 'technological fix' has not proven to comprehensively reduce energy consumption in the Western world. Energy technologies are developed as part of the modern consumer society, without questioning the meanings, knowhow and materialities of the social practices consuming energy. This thesis was developed on the basis of a quest to better understand the energy consumption of housing and how this could be more sustainable. The main question of 'what is comfort' should help to reveal why and how we consume energy in houses, building on an assumption that ideals about home and everyday life would be prominent in explaining the ever rising levels of energy consumption. In this way, the thesis also sought to come closer to comfort as a social and cultural concept. The empirical work is obviously context-dependent, as situated in the suburbs of a Danish city. This points to ideas of cosiness ['hygge'] related to Danish culture, which are also closely related to the seasons and changing weather in Denmark and, more broadly, Scandinavia. The notions of how comfort is related to warmth and light are not specific to Denmark as such; however, these are very prominent in the data as fieldwork was conducted in winter when the weather is most often cold and overcast, and daylight is scarce. In Danish culture, this is often countered by creating cosy indoor environments that include a warm

home and lighting lamps and candles around the house. This was especially mentioned in relation to Christmas, as a time of the year representing considerable cosiness by putting up decorations in the house, extra candles, gathering the extended family and baking cookies. In this way, comfort was a social and cultural concept. This further showed in ideas of how to conduct an appropriate family life that implied avoiding odour in the house, unless it was 'positive' odours such as from baking or cooking, a warm floor for children to play on, a spacious house that accommodated all of the family members' everyday practices, and privacy from noisy neighbours. Such ideas about home, everyday life and comfort are strong indicators of how and why energy is consumed in housing, adding an understanding of comfort that goes beyond technologies and the physical structure of housing. Conventions of comfort can be traced on different levels, when examining Danish housing. On the one hand, such conventions are expressed in the daily life of residents in detached houses, and on the other, conventions are expressed through the building regulations that structure how to build houses. Conventions of comfort have already been scrutinised, as reviewed in the theory section. However, when understanding comfort as part of energy-consuming practices, social conventions are not the only relevant factor. Comfort is also a bodily sensation. These two perspectives are joined when residents perform an array of everyday practices in their home as the papers of this thesis demonstrated.

The notion of comfort implies many expectations to the house-as-home of today and these expectations materialise in the built environment of housing. The papers of this thesis show that comfort entails different sensorial and social aspects and forms part of a variety of daily practices in homes. This also means that comfort can be attained in different ways, which points to a more flexible idea of comfort. As such, there is scope for more research into how such a broad understanding of comfort can be used to design more sustainable homes. The standardised understanding of thermal comfort used in building codes does not encompass ways of sustainable living, and therefore a reframing of (thermal) comfort is needed to build and renovate sustainable houses-as-homes. As Shove has stated, conventions of comfort are changing and evolving in a relationship with the developments of technologies, policies and societies and, as such, there is also scope for developing new meanings of comfort and housing that are more sustainable or better suited to accommodate a sustainable life of the residents. Instead of future vision of a smart utopia, encompassing the smart homes controlled by technologies, comfort could be rethought in sustainable everyday life visions of the future.

6. CONCLUSIONS

Research has previously stated how conventions of comfort are socially constructed and produced in socio-technical systems. This thesis has further contributed by investigating how comfort is perceived and practised in daily life in Danish detached houses, through exploring comfort as both a sensorial and a socio-cultural construct that forms part of everyday practises. In so doing, the thesis contributes an understanding of comfort as jointly bodily and social, i.e. as sensations and social conventions that are intermingled and part of practices at the same time. Furthermore, it is shown how comfort is situated within the everyday life in homes and must be understood in relation to everyday practices of homemaking. Therefore, together, the thesis papers suggest that the 'comfortable home' is a more holistic concept for understanding energy consumption in housing and argues that this perspective is central in terms of envisioning future sustainable homes.

The introduction showed how comfort has, historically and culturally, been seen as encompassing social skills, feelings and physical well-being. However, this broad perspective of comfort has not been prominent in research on residential comfort and energy consumption. Technical energy research focuses on comfort as thermal comfort, and this focus has further been used in many socio-technical studies, as thermal comfort is directly related to the consumption of energy for heating and cooling. This thesis concludes that the concept of comfort entails more than 'thermal', as comfort in homes is concluded to incorporate aspects of warmth and coolness, air, light and material stuff, and that these are strongly interrelated. These aspects were sensed and perceived through everyday practices. The different aspects formed part of the majority of daily practices in homes, either directly as part of elements of meanings, materials and competences, or in the background of the performed practices. Comfort was bodily sensed and socially interpreted at the same time and, in this way, comfort was constituted as sensorial, social and material. Sensing comfort was thus not only related to the sense of thermoception, but also to other human senses such as touch, vision and olfaction. Often more senses were interrelated in the perception of comfort through practices. These sensations, and the interpretations of them, varied according to the practices of which they formed part, which underlined how the perceptions of comfort were related in different ways to the materialities,

knowhow and social meanings of the specific practices and the surroundings of the home. Thereby, sensations of comfort mediated between the material structures of houses and the social meanings of comfort, homeliness and everyday life.

The meanings of comfort and of home were shown to be closely related, which implies that residential comfort should not merely be understood as related to the material structures of the house, but equally to the social aspects of a home. That is, to understand residential energy consumption, we should look to the comfortable home rather than the comfortable house. However, the meanings of comfort and homeliness also differed and these differences provided indications of how different rooms of a house were used, according to practices that were more related to experiencing comfort and those that were more related to experiencing homeliness. These norms of comfort – and homeliness – were materialised in the physical structures of housing, influencing how houses are built and used. Furthermore, the material structures of houses, including energy technologies, influenced how comfort is sensed and perceived in everyday practises and thereby how practices related to comfort were performed. Hence, comfort is both materialised in housing structures and technologies and influenced by social conventions of home and family life; these material and social structures are joined in the social practices related to comfort and form how these are performed.

Comfort is bodily sensed and, in order to understand comfort in social practices, the perspective of senses and the body is therefore crucial. This study showed how senses translate between practice elements of materials and meanings, and are incorporated in the embodied habits and knowhow related to practices of comfort. The sensorial translations of materials in practices are interpreted according to the meanings of comfort in the home, and then again influence how comfort is perceived. This means that there is a mutual relationship between the material and social elements of practices in conceptualising comfort in housing. Comfort is sensed by individuals in the performance of practices and, at the same time, it is perceived and interpreted through the shared understandings of social practices, as these understandings, or meanings, incorporate notions of comfort according to the social and cultural context. At the same time, the material structure encompasses predispositions of how to perform practices related to comfort according to the social conventions materialised in these structures.

Thus, this thesis contributes to the understanding of residential comfort and energy consumption by showing that a broad perspective on comfort, as sensorial, social and material, and situated within the framework of everyday life and the home, is needed to comprehend the energy consumption that is related to comfort and how this is performed. Practices in the comfortable home consume energy to create both a comfortable and a homely environment – making houses into homes in the process – according to individual bodily sensations and social conventions of comfort, home and everyday life that are shared and interpreted.

6.1. PUTTING COMFORT INTO PERSPECTIVE

The thesis investigated how comfort is sensed and perceived through everyday practices in detached housing on the outskirts of a city in Denmark. This context, detached houses connected to district heating in an urban environment of a Scandinavian welfare state and climate, obviously adds to the specificity of the conclusions that can be drawn from this explorative and qualitative ethnographic study. The participants belonged to a broad middle-class group, encompassing both academics, shorter or longer educated participants, as well as some participants with practical training; almost all of the participants were working, with a few receiving pensions. The participants ranged from lower to upper middle-class in socio-economic terms; however, none of the participants were in economic trouble or had difficulties with paying their energy bills, at least to my knowledge. Therefore, this study was focused on Danish middle-class residents who are able to afford to buy a house and pay their energy bills. Another image of comfort might have developed from interviewing residents of other types of housing, such as apartments, social housing or countryside houses, or residents that were poor, receiving public welfare or, conversely, immensely rich. Furthermore, the housing standard in Denmark is quite high, houses are generally well insulated and, therefore, energy poverty has not yet proven to be a large problem. A few of the participants were immigrants who had lived in Denmark for many years and were quite used to, and knowledgeable of, Danish housing in general, as well as their own owner-occupied houses. These participants were not, from my interviews, shown to be performing practices related to comfort in significantly different ways from the other participants, although they were quite aware of the differences between

the Danish climate, houses and norms of comfort, compared to what they came from.

Further studies in line with this thesis could offer a closer exploration of how these differences of how comfort as a cultural and social concept relate to the home, and thus have different meanings according to people's life courses. This might give new perspectives on how meanings of comfort and related practices can change or be sustained when life circumstances change. Another important analytical lens that I did not sufficiently explore – and which has not been extensively explored in the literature on comfort and energy consumption – is the gender perspective in sensing, perceiving and practising comfort in the frame of everyday life and the home. The literature on everyday life and home has, in general, engaged significantly with the question of gender and gender roles, and this perspective can entail bodily, social and cultural differences that might be relevant for the performance of practices related to comfort, and for understanding the comfortable home as an arena for future sustainable everyday life.

Looking at the comfortable home and understanding comfort as bodily sensations and social norms can furthermore generate new understandings of residential energy consumption. The perspective enables an understanding of the meanings of practices that are related to both comfort and homemaking, and how and why these consume energy. This also enables an understanding of how houses are used and made into homes, and how different practices consume energy differently around the home, which can be useful in designing homes that are flexible in regards to energy consumption and suited to underpinning a sustainable everyday life of the residents. Energy policies and building regulations, in Denmark, have succeeded in gaining higher levels of comfort without a rising consumption of energy. However, the overall energy consumption is not decreasing despite energy efficiency gains as, in households, the savings on energy bills are converted into more comfort such as higher indoor temperatures. Within energy policies, there has been a strong focus on increasing the energy efficiency of technologies without compromising on comfort, which has predominantly been engaged with thermal comfort. Such policies, relying on rational users who adjust their energy consumption according to economic gains, also participate in reproducing the social convention of thermal comfort as immensely important to feeling comfortable in a house, including specific standardised comfort temperatures and the evenly dispersed heating provided, for example, by underfloor heating technologies. The broader understanding of comfort introduced by this thesis,

encompassing various interrelated aspects of comfort, as part of several homemaking practices, also introduces alternative perspectives on achieving comfort. If comfort is not equal to thermal comfort and, for example, specific standardised indoor temperatures, other ways of practising the comfortable home that might be less energy intensive are possible. When the comfortable home is created from material, social and sensorial aspects, varied ways of feeling comfortable in a home are present.

The thesis follows in the vein of socio-technical research underlining that technologies and smart visions cannot, in isolation, accommodate the changes that consumption of resources necessitates in facing the current and coming climate changes, which call for societal transitions into new ways of consuming. In this line, also alternative ways of living in dwellings might be needed. The study underlines that comfort and energy consumption are not rational calculations and individual decisions, as it contributes with nuancing the understanding of comfort as jointly sensorial and social, as well as closely related to norms of cosiness and homeliness, encompassed in social practices. This is essential to understand residential energy consumption and an in-depth understanding of this is crucial to point to and envision more sustainable ways of living in housing.

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8. RESEARCH PAPERS

8.1 PAPER I

RETHINKING COMFORT: UNDERSTANDING SENSES AND SOCIAL PRACTICES

Line Valdorff Madsen & Kirsten Gram-Hanssen

Abstract

Thermal comfort is central to energy consumption in housing. Comfort has therefore primarily been scrutinized in relation to indoor temperatures within socio-technical research on residential energy consumption. However, comfort in homes also entails other aspects and this paper investigates four of these; warmth and coolness, air, light and material stuff as well as the relation between them. The paper takes a practice theoretical perspective but argues that the senses have to be better incorporated into this approach to understand comfort. This implies a perspective of how to understand the senses and how these are incorporated in embodied and routinized social practices, as comfort is both bodily sensed and socially interpreted. Furthermore, comfort is related to a range of everyday practices in the home, rather than solely to practices such as heating, and the different aspects of comfort are analysed as interrelated and perceived differently in relation to different practices. The study is based on qualitative interview data from a Danish field study. However the findings on how comfort in houses can be understood have a broader relevance as well. It is argued that this broader perspective on comfort can contribute to widening the debate and policy on residential energy consumption.

Keywords

Comfort, social practices, senses, energy consumption

1. Introduction

A large amount of energy is consumed to heat and cool buildings. It has been estimated that energy consumption in buildings is steadily increasing and constitutes between 20 and 40 per cent of all energy consumed in developed countries. The primary policy approach to deal with this trend has been to increase the energy efficiency of buildings (Pérez-Lombard, Ortiz, and Pout 2008). However, in Denmark, like in many other North European countries, the overall heat consumption in households is rather stable, in spite of a growing low-energy housing stock and energy-efficient refurbishments (Danish Energy Agency, 2016). Socio-technical research has pointed at the growing size of houses and increasing expectations to comfort as possible explanations for why heat consumption has not decreased notably in line with efficiency gains (Jensen and Gram-Hanssen 2008; Gram-Hanssen 2015; Shove 2003; Strengers 2008, 2013). Standards of comfort increase in the built environment, as future expectations to comfort are shaped by contemporary experiences (Chappells and Shove 2005: p. 33). In the attempt to keep certain standards of comfort in energy-efficient buildings, ways of living are often overlooked. Therefore, future comfort and energy consumption need to be examined by debating the meanings of comfort in order to understand and adopt a more flexible and sustainable concept of comfort (Chappells and Shove 2005). Comfort is thus crucial in understanding and dealing with energy consumption in housing, as energy is consumed with a view to creating comfortable indoor environments. Following this, understandings of comfort need to be scrutinised rather than being *"taken for granted and thereby naturalising meanings and expectations of comfort that are ultimately unsustainable"* (Chappells and Shove 2005: p. 33). Recent socio-technical research has worked on understandings of comfort (Shove 2003; Strengers 2008; Gram-Hanssen 2010; Hitchings 2011; Jalas and Rinkinen 2013) and has related these understandings to households' heating practices. This follows the line of practice theoretical approaches, stating that energy is consumed while accomplishing social practices (Shove and Walker 2014). Comfort in this approach has hitherto been investigated primarily as thermal comfort, and not in a broader understanding that includes other aspects of comfort such as softness or fresh air. The strong focus on thermal comfort relates to the fact that energy used in buildings is mainly related to maintaining certain indoor temperatures. This article seeks to explore how including other aspects of comfort can contribute to providing new insights on buildings' energy consumption. This entails a broader focus on how material,

social and sensory aspects together constitute comfort in homes. The sensory part of comfort; how comfort is sensed and perceived, has not been thoroughly scrutinised in the bulk of socio-technical research on comfort and energy consumption in light of social practices. As stated by Wallenborn and Wilhite (2014), to a large extent the body has been absent from theories of practice as well as from energy research. Therefore, this paper scrutinises empirical aspects of sensory understandings of comfort in social practices, entailing a comfort perspective that goes beyond thermal comfort. Using theories of practice as a point of departure, the empirical analysis centres on the human dimension of energy consumption, as called for by Sovacool (2014), seeking to understand people's energy use through the senses and the social and material structures of homes. The purpose is thus to investigate how comfort is perceived in everyday practices and how varied comfort aspects are sensed within the home. In doing this, a second purpose of the paper becomes to develop and discuss ways of including sensorial aspects into theories of practices.

2. Social practices, comfort and the senses

2.1 Practices between the individual and the collective

Within energy consumption research, there has been a growing interest in studying everyday practices and understanding energy consumption through a practice theory approach, which implies an understanding of energy consumption as the outcome of routinized practices (Shove and Walker 2014). The practice theory approach bridges the dualisms between actor and structure, social and material, as practices are regarded as being at the centre of understanding social life: *"The social is a field of embodied, materially interwoven practices centrally organized around shared practical understandings"* (Schatzki 2001, p. 12). Everyday practices are considered to be routinized and embodied, which makes a central statement in understanding everyday life and residential energy consumption. Bodies and practices constitute each other in this embodiment of practices, which characterise how human activity is entwined with the human body (Schatzki 2001). Furthermore, everyday practices are materially mediated and rely on both shared skills and understandings, or know-how, that are also embodied. Thereby 'the skilled body' becomes centre of both mind and activity, and of individual activity and society (Schatzki 2001, p. 12). Practices are both shared

as collective entities, for example practices of heating and airing, and performed individually. Schatzki uses the term 'intelligibility' to describe the individual phenomenon of what makes sense to practitioners in performing practices (Schatzki 2002). This practice as performance is the actual carrying out of a practice, as practices have to be performed in order to be realised, sustained and reproduced (Schatzki 1996; Warde 2005). McMeekin and Southerton note that practices as performances attend to the daily activities on the micro level and how these are produced and reproduced, thereby presenting the individual *"as the intersection of practices"* (McMeekin and Southerton 2012). Reckwitz further states that individuals are carriers of many different practices in routinized ways of understanding, knowing and desiring, both bodily and mentally (Reckwitz 2002). Therefore, social practices are both individually performed and collectively shared.

2.2 Comfort in practices

Several researchers have approached the concept of comfort within the practice theory framework to understand everyday practices related to energy consumption and comfort (Shove 2003; Shove et al. 2008; Strengers 2008; Gram-Hanssen 2010; Hitchings 2011). Shove brought forward the concept of comfort as a socio-technical issue, by scrutinising how conventions of comfort have co-evolved through history in a dialectic relationship between technological development, policy and legislation, marketing and everyday life (Shove 2003). Furthermore, Chappells and Shove (2005) stated that comfort is a negotiable socio-cultural construct as it is both an idea and a material reality. Gram-Hanssen (2010) used practice theory to investigate differences in how comfort is practiced in the same historical and technical setting, with households representing different socio-material configurations of meanings, know-hows and knowledge. Strengers (2008, 2010) studied how demand-management programmes shape and sustain comfort expectations, norms and practices, in relation to cooling. Thermal comfort practices are here understood as *"the activities householders undertake to heat and cool their bodies and homes"* (Strengers 2010, p. 7313). Strengers and Maller (2011) analysed cooling practices to highlight how public policies on hot weather and heat waves conflict with householders' everyday experiences and adaptive strategies for accommodating to heat. Hitchings (2011) investigated office workers' perception of comfort as habitual actions within the specific context of a working environment, understood as a reproduction of social practices and a

taken for granted ambient comfort. Day & Hitchings (2011) wrote about the elderly's practices of keeping warm at home in winter, to focus on how the concern for winter welfare of older people is influenced by specific notions of biological age and thereby bodily changes. The study shows how practices of keeping warm are shaped by ideas about identity and how certain clothes and objects for keeping warm are inscribed with an elderly identity that would rather be avoided by elderly people. The above studies focus on comfort as thermal comfort and state that comfort is a socio-technical issue, being both a social idea (norm or convention) and a material reality. It is also stated that comfort practices can be understood as the activities done to obtain comfort and that these should be seen as habitual actions reproducing certain social practices which can vary with different ideas of identity and social histories. It is not precisely developed how the notion of comfort, as either norms or conventions, as activities, or as materiality and technology, can be conceptualised within theories of practice, and aspects of sensations are not profoundly discussed in relation to theories of practice within this literature. Therefore, there is a question of how comfort can be understood as sensed and perceived within social practices and the surrounding material environment. To scrutinize this, a perspective of the body and senses is needed (Wallenborn and Wilhite 2014).

2.3 The body and the senses

Practices are understood as embodied habits and thus the body is included in theories of practices. However, the perspective of bodily senses has not been thoroughly scrutinised. A sensual and embodied approach in the social sciences rejects a division between body and mind, behaviour and perception, as also developed in phenomenological and practice theoretical work. Several senses are at play in perceiving and practising a comfortable home environment, especially as *"the senses are skills for embodied action"* (Vannini 2011, p. 1269). For example, senses like smell and touch are relevant in a study of comfort as well as the sense of thermoception, which allows us to perceive heat and cold (Vannini 2011). Pink also argues that, although sight has been privileged in the Western discourse, this is not necessarily the case when studying domestic everyday life. Pink shows how metaphors of senses such as touch, smell and sound also represent embodied experiences of home-making practices (Pink 2004). Such practices are seen as embodied actions through which individuals engage with the sensory environments of their home, for example by cleaning,

cooking, playing music, burning oils or candles and choosing the floor type (Pink 2004, p.10). Pink et al. combine practice theory with sensory ethnography rooted in phenomenological anthropology, thereby moderating the analytical priority of practices, though maintaining a focus on practical activity (Pink et al. 2013). This implies a stronger focus on the individual in practices with a focus on the sensory experiences and perceptions of both material surroundings and social phenomena. Pink et al. further state that *"to understand how and why people consume energy in their homes we ask how people live, move and know in these environments"* (Pink et al. 2013, p.25:4). This approach helps to focus on how people feel and perceive material and sensory elements of homes as places, situating perception and practice within the surrounding environment (Pink et al. 2013). Similar to this, the present paper argues that to understand everyday comfort and its relation to energy consumption, comfort should be investigated as a social phenomenon that is bodily sensed on an individual level, interpreted in the everyday life at home, as well as shared as social conventions.

3. Methods and data

The paper is based on a field study using qualitative methods among residents in single-family housing in the suburbs of Aarhus, Denmark. The study consisted of two interview rounds, comprising 17 interviews, during the heating season. The first round included 14 interviews with residents in different households, with either one or both partners, and the second round was a follow up interview, including a photo-elicitation study conducted with three of these participants. The analysis in this paper builds on the interview study as a whole, although it does not include the photos explicitly. The participants were selected from three groups of single-family housing that related to the building age (see table), reflecting changes in the Danish Building Regulations regarding insulation, ventilation and heating systems, for example. All households were connected to district heating, and as such housing with other primary types of heating that may have different heating routines, were left out. This also represents a specific urban context, geographically and socio-economically. Aarhus is the second-largest city in Denmark, representing an urban environment, although the participants live in the outskirts and the suburbs, where there are large areas of detached houses. The participants vary in relation to gender, age and family types (see table); however, they represent a rather homogeneous socio-economic group which could be characterized as

lower to higher middle class. Except for one tenant, they were all house-owners in an urban area with rather high house prices. The aim was not to construct a representative study, but to have a varied group of participants within this specific housing type, in order to give a more varied picture of the everyday practices related to comfort. The participants did talk of differences between themselves and their partner, which might be gendered. However, for the purpose of this paper, the focus was rather to find similarities in patterns of comfort across the data. Furthermore, there were some indications that age changed perceptions of temperature, and that family type played a role in how houses were used and perceived as comfortable, though this is not elaborated on in the present paper. The qualitative study is thus based on one specific, contextualised case and therefore the results cannot be generalised to apply in all other contexts. However, through the analysis incorporating theoretical concepts, the results can point to general findings in understanding comfort as a concept in relation to detached housing.

In-depth interviews were carried out in the dwellings of the participants, and each interview was supplemented by a 'home tour'. These qualitative interviews were used to provide knowledge of the life worlds of the participants and in-depth understanding of their perceptions and activities (McDowell 2010). The interviews had a flexible thematic structure with a semi-structured question guide framing the interview, but which allowed for each interview to follow the concrete interaction of the interview process (Holstein and Gubrium 2010). The interviews centred on the participants' everyday life, with specific interest in how comfort is experienced and related to the home and energy consumption. The questions were concerned with the participants' activities during a normal day, specifically the managing of temperatures and the indoor climate, how they used the house including specific rooms, what comfort meant to them in relation to this, and how and where they felt most comfortable in their home. The interviews engaged more broadly with the participants' everyday practices related to comfort and energy consumption, though for the purpose of this paper, the analysis focused primarily on sensations and perceptions of comfort. The interviews were recorded and transcribed and all participants have been given fictive names to secure anonymity. Further, quotes have been translated from the original language (Danish) to English. The analysis approach was inductive, thus the following section is based on the four sensorial comfort aspects which turned out to be prominent in the empirical data.

Table 1. Participants in field study.

Participants	Ownership	House type by year	Heating technology	Gender	Age	Household type
Helene	Rented housing	1969-1979	Radiators, underfloor heating, wood stove, heat pumps	Female	40s	Couple, no children at home
Birte & Peter	Owner-occupied	1969-1979	Radiators, underfloor heating	Female & male	60s	Couple, no children at home
Maria	Owner-occupied	1969-1979	Radiators, underfloor heating, wood stoves	Female	50s	Couple, 2 children at home
Sarah	Owner-occupied	1969-1979	Radiators, underfloor heating, wood stove	Female	40s	Couple, 2 children at home
Marianne	Owner-occupied	1997-2001	Underfloor heating	Female	60s	Widow, no children at home
Claus	Owner-occupied	1997-2001	Underfloor heating	Male	40s	Couple, 2 children at home
Pernille	Owner-occupied	1997-2001	Underfloor heating, wood stove	Female	30s	Couple, no children yet
Camilla & Behram	Owner-occupied	1997-2001	Underfloor heating	Female & male	30s & 40s	Couple, 1 child at home
Birgitte	Owner-occupied	1997-2001	Underfloor heating	Female	50s	Couple, 1 child at home
Linda	Owner-occupied	1997-2001	Underfloor heating	Female	40s	Couple, 3 children at home
Jacob	Owner-occupied	2012-2013	Underfloor heating	Male	40s	Couple, 4 children at home
Kasper	Owner-occupied	2012-2013	Underfloor heating	Male	30s	Couple, 2 children at home

Tilde	Owner-occupied	2012-2013	Underfloor heating	Female	30s	Couple, 2 children at home
Karen & Erik	Owner-occupied	2012-2013	Underfloor heating	Female & male	60s	Couple, no children at home

4. Four aspects of comfort in social practices

4.1 Sensing warmth and coolness

As described above, scholars have studied warmth and coolness in social practices related to thermal comfort, often focusing on practices such as heating, or other activities related to heating (or cooling) bodies and homes. The present interview study points to warmth and coolness as a thermal aspect in many domestic practices rather than it being related solely to heating, for example. Warmth, or an adequate temperature in the house, was perceived as central to feeling comfortable in the home, and often warmth was connected to cosy domesticity:

"You're cosy, sitting together, relaxing after the rigours of the day or week (…) it's a comfortable temperature around 22 degrees, where you're not cold, it's also often we bring in the duvet and sit in the sofa, just to have it as part of the cosiness, you could say" (Kasper, 30s).

Kasper explained how he feels comfortable in his home, which relates to having a cosy time with the family, relaxing and sensing an adequate temperature in the house. The family brought in a duvet for extra warmth and cosiness on the couch, even though they lived in a low-energy house, with a high level of insulation and they were content with the temperature in general. Kasper explained that his wife would often bring the duvet when they watched television on the couch in the evenings, and that he would bring it in on weekend mornings, together with his two young children. This was not because they felt cold, but because the duvet was perceived as an element of cosy domesticity. The bodily sensation of a comfortable temperature, together with the soft and warm duvet, is therefore part of feeling cosy and relaxed when watching television and caring for the family. Relaxing was a practice that was often related to the comfort aspect of warmth. For example, it was essential to another participant, Claus, that the temperature in his house was always

adequately warm, so that he did not have to put on a sweater or blanket when relaxing on the couch:

"It's not hard to cut back on it, but it's more of a comfort factor, it's nice to be in a home with an okay temperature, it's annoying if you are sitting in the living room and then you have to put on a blanket or fetch the duvet or something, it's just nice that you can sit in whatever clothes you feel like" (Claus, 40s).

Claus did not like to bring in the duvet as he related it to being too cold in the house, which to him did not equate to relaxing at home. This material aspect of duvets and blankets also relates to issues of clothing. Claus said that he did not like to put on a warm sweater or socks to keep warm at home; *"then your nose still freezes"* as he said. As such, practices of relaxing, heating and dressing are all influenced by the perceived comfortable temperatures and sensation of warmth, as well as an understanding of how this associates with being at home and with the family. There are, however, different bodily sensations of what a comfortable temperature is, and different perceptions of how this is best achieved within the material structure of the home. In the interviews, comfort was often explained as a bodily feeling of warmth, especially in terms of heated floors, reflecting heating practices and technologies:

"(…) underfloor heating, I would say it's lovely, it's wonderful to walk around on the warm floor, but the radiators, you can turn them up and then the heat comes in a short while, and in the same way you can turn them down, and it'll be registered quickly, that's what I had to get used to" (Marianne, 60s).

Marianne likes the underfloor heating in her house, because she can feel the warmth underneath her feet. This is central to her wellbeing, but at the same time she finds it hard to control the heating. She has had to change and accommodate her heating routines since moving from a 1970s house to a house from 2001. As such, comfort is both about the bodily feeling of warmth and about the usability of the heating technologies in relation to everyday life; the sense of comfort is related to competences of controlling the heating according to an idea of a comfortable temperature, which can change with practices and seasons.

A difference between warmth and coolness as comfort aspects between the different rooms of a house, and the related practices was also apparent. The interviews reflected a cool bedroom as comfortable, in opposition to the warmth of the living room: *"There are different needs, for example in our*

bedroom we seldom turn on the heating, because we cannot sleep if we feel (…) that the air is dry" (Maria, 50s). Some of the participants said that, when going to sleep, they felt comfortable with their bedroom at a much lower temperature than in the rest of the house; this was related to the specific practice of sleeping as opposed to practices situated in the living room, as well as the material setting of the bed and duvets providing warmth. Some aired the room and some held a lower temperature in the room: *"(…) in the bedroom we close the door, we like it to be ice-cold in there" (Linda, 40s)*. Kasper had some trouble with keeping a lower temperature in the bedroom of their low-energy house, which he and his wife felt was most comfortable, and therefore they aired the room before going to bed: *"We always open the window in the bedroom in the evening to cool it down, so that we have a more comfortable temperature when we go to sleep in there" (Kasper, 30s)*. Hence, the participants perceived a cool room as comfortable for sleeping, but a warm room as comfortable for relaxing, and this again reflected their practices of heating and airing. Also, the spectrum between warm and cold was apparent in relation to the bathroom. In Denmark, many older detached houses only have underfloor heating in the bathroom, while newer detached houses often have underfloor heating in the entire house. Jacob explained how this changed the sensation of warmth and comfort in his newly built low-energy house:

" (…) the old house, what was really pleasant there, it was to come out into the bathroom where the floor was heated, it really gave this feeling of comfort (…) what we actually felt was comfort and well-being and nice in a bathroom, it's not there when you create this homogenous temperature all over, and then a floor can actually easily feel a bit cold, even though the heat is coming through there (…) now we wear slippers all around all the time, and actually they provide the comfort" (Jacob, 40s).

The feeling of bare feet on a warm floor was an essential aspect of the family's perception of comfort in the old house, while they have now 'lost' this comfort aspect. However, in general, Jacob was very content with the heating and temperature in his family's low-energy house, although the new heating system had changed their dressing practice to wear slippers. Another important aspect of comfort related to the bathroom was the warm shower, which underlines the bodily sensation of comfort in practices related to this room. Kasper mentioned the shower as a place in the house, where he felt comfortable and relaxed: *"(…) our shower, it's a place where you feel comfortable (…) you just relax and feel good in the warm shower" (Kasper, 30s)*. As such, the bathroom is a place that is

related to comfort and warmth in more ways and related to practices of heating, showering and relaxing.

Comfort as warmth and coolness is sensed through the body in several practices such as heating, relaxing, watching television, sleeping and showering. Basically, this comfort aspect is the background to most practices in the home, however some practices are related specifically to sensations of warm and cold, such as heating and airing. Warmth is related to relaxation and cosiness, either being alone or with the family, and coolness is related to sleeping. In this way, sensations of warmth and coolness influence how practices are performed. Further, there are different perceptions of warm and cold according to different practices and the specific rooms.

4.2 Sensing air

Indoor air can be related to many practices in the home, as this is part of creating a comfortable and homely atmosphere forming the background of many everyday practices. Therefore, comfortable temperatures, as described above, are not only about warmth, but can also be related to cool rooms and to airing, and thereby aspects of smell and fresh air. The practice of airing, in this aspect, can be about cooling a room, eliminating odours or simply sensing the fresh air and a connection to the outdoors. Helene focused on fresh air, more than warmth, when explaining how she felt comfortable in her home:

"Then you just put on another sweater and slippers. We're probably the types that would rather have fresh air and then put on another sweater, because it should not be smelling of the wood-stove and rather not of smoke (…) I'd rather go and get another sweater than not open the door" (Helene, 40s).

Helene explained how it is important to air the house, as fresh air is an essential comfort aspect. This comfort aspect influences her practices of heating and airing, together with many other everyday practices, for instance working from home, having guests and taking care of pets. Helene and her husband rented an older detached house from the 1970s, where usually only the kitchen and the bathroom were heated during the day and the living room in the evenings. The couple had grown-up children and ran a company from home, therefore many employees passed through the house during the day, and there was a lot of smoke from cigarettes. The family also had a dog that went in and out through

the terrace door. As such, airing was an essential practice related to their everyday comfort, while also influencing their dressing and heating practices, as only a smaller part of the house, where they spent most of their time, was heated.

Airing is further related to temperatures as it is often about cooling down the house. There were different strategies for defining when a house needs to be aired. For example Camilla, who was pregnant at the time of the interview, said: *"I probably air for a longer time than you [partner] (…) I do it until I don't sweat anymore, I just do [laughs]"*. This reflects a sensory know-how of airing as well as a bodily sensation of being cooled. On the other hand, Camilla's partner used rational knowledge of how to air; he had read that the best way to air a home is three times ten minutes each day, and he followed that 'rule' as he found it the best way of providing a good indoor climate for the family. These are different forms of competences in the practice of airing, informed by either a sensation of comfort or knowledge (common rules) about avoiding health issues such as asthma. Therefore, airing, like heating, is a practice related to comfort, that is bodily sensed and important in taking care of a family. Maria also had a sensory perception of when the house needed to be aired:

"Sometimes I feel, for example if I've forgotten to air down in the basement, then it's like the climate or the air is cramped, it's like it radiates from the furniture and clothes, from all the stuff that's in there" (Maria, 50s).

This sensation was part of her idea of a comfortable house, as Maria explained that it was important to her comfort at home that the house was filled with fresh air. Hence, fresh air in the house is a comfort aspect connected airing practices in the way that airing the house is performed to get rid of 'bad' air (e.g. smell and damp) and to let fresh air in, to feel comfortable. However, aspects of comfort were related to air in different ways. Some aspects, such as temperature and smell, relate to the practices of having guests or caring for a family:

"(…) it's a luxury to be in a house that has the right temperature, you can feel it immediately when you enter someone's house (…) smell and temperature and indoor climate (…) it also has something to do with getting sick, I really think we have a good example, we think that we have a good indoor climate here, and we haven't been sick, any of us, since we moved in" (Tilde, 30s).

Tilde is a mother of two young children, and this quote shows how the comfortable indoor climate and temperature is part of caring for her family, in providing a safe and healthy home. This practice of caring for a family by providing a decent home is related to all of the comfort aspects, however it is specifically apparent in relation to air and issues of illness, as air can be perceived as carrying 'bad stuff'. Furthermore, smell and indoor air were also related to inviting guests into a home: *"It means a lot to us (…) that the air is good and we feel like inviting guests" (Tilde, 30s)*. Fresh air and the lack of negatively related (unwanted) smells are comfort aspects that relate to inviting guests and the issue of smells is further related to the idea of a decent home and a feeling of homeliness. In this way, smells could also have positive connotations related to cosiness and homeliness:

"(…) if it smells new, if it still reeks of plastic paint, or the sense of wood, there could be many, that could have a positive effect in some way…well, it can't always be smelling of freshly baked buns everywhere, which is some kind of sales parameter, but, there's always something that says; this is a nice place to be" (Jacob, 40s).

Jacob explained how sensory perception of the smell of home can vary; essentially all homes have their own smell and this is a central part in feeling comfortable as well as maintaining a home. The practices that are carried out in the home affect smell in positive or negative ways and thereby the issue of indoor air is related to many everyday practices, besides from airing, such as decorating and baking. Furthermore, air that is comfortable and homely can be seen as an outcome of different practices, as smell identifies practices that either have or have not been carried out (e.g. airing, cleaning, cooking). Claus explains how smells are related to a homely feeling and to cooking and baking, for example when returning home from work and someone is preparing food in the kitchen:

"What I think is nice is when you come home from work, if you're not supposed to cook yourself, it is to smell that there's something, when you enter the door (…) it's also something to do with cosiness, also if you come home some day and someone has been so nice as to bake a cake, it's just nice to come home to" (Claus, 40s).

This quote shows how practices of cooking and baking are sensed through smells and thereby supply perceptions of a comfortable home which underline both bodily and social meanings of comfort. To sum up, comfort in relation to

air is connected to avoiding bad smells, but also to enjoying the fresh air from outside and to producing positive smells through other everyday practices such as cooking. Therefore, the practice of airing can both be about getting rid of something 'bad', whether it is smell or damp, and producing something 'good', like fresh air. This was related to feeling at home, and maintaining a home that is both adequate for having a family and for inviting guests. Specifically, the issue of providing a healthy environment at home is closely connected to a perception of fresh air in the house. Therefore, the comfort of fresh air and smell are part of practices that aim at creating a pleasant home and avoiding health risks.

4.3 Sensing light: daylight, lamps and candles

Lighting, like heating and airing, can be seen both as a comfort aspect in many practices in the home and as a practice in itself. Different aspects of light were mentioned as relating to comfort; daylight coming in through the windows, electric lights and candles. As with warmth and fresh air, lighting was often mentioned when discussing a comfortable home, for example in relation to providing a cosy home for guests: *"(...) when we have guests we have more lights on, and then candles" (Camilla, 30s)*. Camilla explained that they light more electric lamps and more candles when having guests, which underlines how lighting is part of creating a comfortable and cosy environment. In this way, as with temperature and especially fresh air, light is part of the practice of having guests, which is also related to maintaining a decent home. Candles in particular are related to creating a cosy environment; however, they are also related to the practice of heating, as candles also produce warmth. This was most evident in low-energy houses, as participants living in such highly insulated houses explained that lit candles, together with guests, would affect the temperature in their house:

"(...) the temperature rises when you have guests because then candles are lit (...) it doesn't take much to make it warmer, then you quickly reach 24 degrees (...) there's not much heat that goes out...so it does get warmer when there's guests" (Erik, 60s)

Therefore, the building technologies of low-energy houses provide a connection between light and warmth. As with the preceding themes, light can be seen as an essential aspect in most daily practices at home. However, light was also

specifically explained as an aspect providing comfort. Linda explained how feeling comfortable in her home is related to light, either daylight coming in through the windows or lighting candles as part of creating homely comfort: *"(...) now it's bright and the sun is shining, but I think it's just as cosy when it gets dark and we light candles in the autumn and winter" (Linda, 40s)*. This quote underlines how light is both central to wellbeing and to creating a cosy and homely atmosphere, which is also performed according to the changing seasons, as different kinds of light can be appreciated at different times of the year. Daylight was also in itself an aspect that was related to comfort, however this cannot actually be practiced, but is facilitated through a material element, the windows of a house. The perceptions of both light and warmth are related closely to the changing seasons of the Scandinavian climate, just as the notion of cosiness is related to the climate and seasons.

Claus explained how it was important to him and his wife to choose the right kind of electric lighting, that would not just light up the room, but also create a cosy and intimate atmosphere around the dining table in the kitchen-dining area: *"What was very important to us was to have good lighting here, cosy lighting (...) it should be cosy to be here, it should be pleasant, it shouldn't just be neon tubes" (Claus, 40s)*. As such, light as a material element forms the background of performing the practice of dining in a comfortable and homely way. To Claus and his wife, this should support the evening meal as being a meeting point for the family to talk about daily life, and thereby light is also part of caring for the family, like fresh air and warmth. Light is also part of a decorating practice, with the aim of creating a cosy and comfortable atmosphere in the home. In this way, both light and warmth are used to create cosiness in the home. However, light is related more closely to the materials of and within a home, such as windows and furniture. Windows are associated with comfort by letting daylight and sun into the house and by facilitating a view out of the house, into the garden or the neighbourhood: *"It was this panoramic view that I fell for, it was nice that you could stand there and have so much light in, after all, light does make you happier" (Behram)*. Behram's partner is more ambivalent about the windows. She is very content to have the light coming in, and to have the view out into the street, but she does not like the feeling that other people passing by can look in, as it compromises her privacy:

"One thing that I feel ambivalent about is our window section in the kitchen, on one side I think it's great to have so much light coming in, that it faces the way it does, because I can keep an eye on [her son] when he's out, but on the other hand it's very annoying that everyone can look in" (Camilla, 30s).

In this way, the window as a material structure facilitates the comfort aspects of light coming in and a view out. To Camilla, this is specifically connected to a practice of caring, or parenting; however it also disturbs her idea of privacy at home. As with the other comfort aspects, light can be seen as an essential aspect of being at home and carrying out all kinds of everyday practices. Light, either natural or electric, is an essential element in most everyday practices that would be difficult to perform in darkness. This comfort aspect is sensed both through the vision and through the body, as rooms are both illuminated, but can also be warmed by light coming from natural sunlight or lighting practices and technologies. Light as a comfort aspect is connected to the seasons, as more daylight comes in through the windows, and for a longer time, in the summer season than in winter, where electrical light is needed most of the time. In other ways, candles are used to create a cosy atmosphere for families and guests, especially in autumn and winter. This additionally affects the warmth in a home. As such, light is more explicitly materialised in material structures of a home, such as lamps and the windows that facilitate light coming in; but also in walls, ceilings and furniture, as presented below.

4.4 Sensing softness and spaciousness: material stuff

Everyday practices related to residential comfort are situated in the material and social structure of a home. This section focuses on how the materiality of a home is perceived in relation to comfort, both socially and bodily, and how it differs in different social practices. For example, Marianne explained how the colour and brightness of the furnishing, floors and ceilings, are important to her feeling of comfort:

"(…) the dark floor and the dark furniture (…) I couldn't stand it, it had to go, it had to be bright (…) I bought these two carpets (…) So it brightened a bit, and then I had all the ceilings painted white, they were whitewashed before, but they had started to get yellowish (…) I felt (…) when I came home; it's so dark, even though I turned on the lights and so on, but now, it's like it's had a boost".

Marianne brightened the indoor environment by buying white carpets and having the ceilings painted white. She refurbished the material environment of her home to have a brighter atmosphere, underlining how light in material structures can also contribute to the feeling of comfort. In this way, light is materialised in the material structures and furniture and part of decorating

practices to create comfort. Comfort was also related to the function and usability of material stuff, like a specific appliance or technology. Participants mentioned how things that did not work or were not 'user friendly' conflicted with their perception of comfort, for example in relation to heating systems, as Marianne explained above with her difficulties in adjusting the underfloor heating. Further, material comfort was perceived as a combination of usability in daily life and, for example, the sensation of soft furniture:

"This couch, you sit comfortably in it, it feels nice, comfort would not be that it looked nice (...) the important thing is that I feel good in it and that it's practicable in daily life, especially with these small children" (Tilde, 30s).

A comfortable couch is sensed through the body, for instance the feeling of softness and good support for the back. In this way, the couch as a material object is integrated into various practices related to comfort such as relaxing, watching television, reading or caring for children. Soft furniture was often mentioned as part of feeling comfortable at home: *"(...) to sit in soft furniture, or to lie in a soft bed, then you feel comfortable...or to sit in a good office chair" (Kasper, 30s)*. The bodily sensation of softness is part of practices related to comfort, such as relaxation, alone or together with the family and for some participants it was also related to a good home working environment. Another comfort aspect closely related to the material structure is the layout and design of a house, especially spaciousness. Comfort in terms of the layout was connected to having adequate space for practising everyday life: *"Now that there's only three of us living here, I think it's the appropriate size" (Birgitte, 50s)*. Mostly, space was seen as an essential aspect of a comfortable home and thus as a comfort aspect in itself. Living in a house that felt too crowded, or in an apartment with neighbours too close, conflicted with the participants' perceptions of comfort, as it was important to have enough space for a family, for instance having a separate room for each family member. For these participants, all living in detached houses, an essential comfort aspect was the space and privacy of the house. The appropriateness of the size and space of a house was also linked to ideas about family life:

"It would give many problems if we had to move to a smaller apartment, the space here is enough for [his son] to walk and run and we can go outside (...) also there's no one upstairs, no one downstairs, there's no noise and everything, to me that's also some form of comfort" (Behram, 40s)

To Behram, the aspect of spaciousness is the possibility for his son to play around the house, to have a garden and thereby a private outdoor area and also the privacy of the detached house, as there are no neighbours upstairs or downstairs making noise or demanding consideration. Kasper explained that what was really important to his comfort in his newly built house, together with the other comfort aspects examined here, was that they had enough space for practising their everyday life and raising a family. It was important to have an adequate bedroom, a home office and for the children to have each their own room:

"(…) we lived in a small terraced house (…) a good deal smaller than this, I think we had 93 m², my wife and I, we had a room, a bedroom, where (…) the bed was from wall to wall…that's how small it was (…) and then the children, they shared a room. So it sure meant a lot to move here (…) the children had more space, well, we all had more space, but the children got a room each, and we got a proper bedroom, a decent office" (Kasper, 30s).

As such, the layout and the qualities of the house, specifically the floor area and how this is distributed into rooms, contribute to Kasper's notion of comfort, as the floor area had to accommodate the everyday practices of Kasper's family life. Basically, this is related to taking care of a family by accommodating it properly, which means being able to perform daily practices appropriately and comfortably, e.g. sleeping, playing, dining and working from home. This comfort aspect is specifically related to a practice of decorating, as people shape, create and use the material structures according to their ideas of comfort, but it is also incorporated in the structures of the house and its technologies that cannot necessarily be changed by the inhabitants. The aspect of material stuff incorporates the other comfort aspects in different ways, like heating through the floor, airing through the window or lighting with a lamp. The material structures are both background for, and part of, practices related to comfort, and furthermore they incorporate specific comfort aspects perceived through the senses. However, this comfort aspect also forms the background for all home-making practices, as these are situated within the material structures of a house, including furniture.

5. Comfort aspects as sensed and perceived in practices

Senses are not very explicitly dealt with in the research on comfort and energy inspired from theories of practice, however they are central to understanding comfort in housing, as this analysis shows. Comfort is about an overall bodily involvement with the surrounding environment, as it is sensed through the different senses such as vision, touch, and olfaction, for instance by way of feeling soft furniture, a warm indoor environment or breathing in fresh air. Royston (2014) has similarly showed how a variety of sensory perceptions (thermoception, touch, vision) of temperature are used in heat management in homes, arguing that know-how is both embodied and conscious as well as related to life-courses, material arrangements and social conventions. The different sensations are often interrelated in the practices related to comfort. The sensation of cool and warm is specifically related to the sense of thermoception, however warmth and coolness are not sensed separately, but often together with touch, by sitting in furniture, visibility, by experiencing light and material arrangements, olfaction, by the smell of fresh or cramped air or sound, by hearing noise or silence, for example. Therefore, more senses are at play at the same time when perceiving comfort; as also argued by Pink (2009), senses should be studied as in a close interrelationship with no one dominating over others.

The analysis shows how comfort is sensed differently according to the different comfort aspects and the related everyday practices. For example, for the comfort aspect of warmth and coolness, there is a clear distinction between when a warm room is felt as comfortable and when a cool room is comfortable, which is related to specific rooms of the house as well as the practices performed in them. Therefore, comfort is part of practices in different ways. The aspects of comfort that are dealt with in this paper can be seen as both material elements in practices, such as warmth, fresh air and light, and as signifying specific practices, such as heating, airing and lighting. Warmth, air and light form the background as 'invisible' materials to an array of practices, as it is difficult to imagine everyday practices that would be comfortable, at least in a Scandinavian climate, without the house being heated and light turned on or coming in through the windows. This is clearly connected to the seasons in Scandinavia, as both heating and lighting are less needed in summer, depending on the material structure of the house. However, heating and lighting, as well as airing, are also practices in themselves aiming to create a comfortable indoor environment. Wilhite et al. (1996) also showed how warmth is closely connected to creating cosy domesticity in Norwegian homes.

Comfort aspects are relevant both in the background of many different practices and in understanding how specific practices are performed by individual carriers of practices. Airing is a designated practice in relation to fresh air and the indoor climate and, as with warmth and light, at the same time forms the background of other practices carried out in the home. Specifically, airing is clearly affected by other everyday practices, as different practices in the home (e.g. cooking) produce smell that can either be wanted or unwanted. These practices again affect our sense of comfort and the practice of airing, for example in airing the house to get rid of a bad smell, or beforehand to make sure there is a fresh smell if someone visits. Therefore, the comfort of fresh air is part of being a host and caring for family, with the normative aim of providing a healthy, welcoming and cosy atmosphere in the home. In the same way as the other aspects, the comfort aspect of material stuff forms either a background for practices, or is included directly in them. However, this is quite different, as the material stuff cannot constitute a practice on its own, but rather the material can figure as part of an array of practices in different ways. All practices in the home are related to the material structures of that home, either by being situated within (or outside) the house, or by including specific objects as part of performing practices. However, the material stuff of a home is also interpreted through practices related to comfort and can provide comfort by way of being soft or warm, for example.

The analysis also shows that the comfort aspects of warmth and cold, air, light and material stuff interrelate in different ways, according to the practices they are part of. Warmth is related to the softness of the material of furniture such as the bed, the couch, arm chairs or office chairs, and to other material such as clothes, duvets and blankets as well as to the materiality of building components such as the floor. When relaxing, watching television or working from home, both warmth and softness are essential aspects of feeling comfortable. However, when it comes to warmth and cold, there is a difference in how the materials form part of practices. In the living room, the duvet is brought in to an already warm room, while the bedroom is preferred to be cool and the duvet and the bed provide the warmth. Warmth and indoor air are closely related in a sensorial way, as airing is sometimes performed when it feels too warm inside the house or specifically to cool down a room. Warmth is also connected to the issue of light, and thereby to all other comfort aspects, however this is most evident in low-energy houses, where lighting candles affects the indoor temperature. Light is further related to fresh air, as these aspects share the same technology; windows. Besides windows, light can be materialised in other material too, most obviously in lamps (bulbs) but also

other furniture as well as walls and ceilings that reflect the light and can have lighter or darker colours that affect the atmosphere and sense of light in a room.

The perceptions of these comfort aspects are shared between individuals by social norms, for instance how to care for a family or maintain a decent home for guests, as well as materialised in the material structures constituted by the house and its technologies. How comfort is perceived in practices is influenced by the social relations within and surrounding the families and their homes. Health and care for the family is an important issue in the perception of comfort and the related practices, which has also been described by Hauge (2013) in relation to fresh air. This is connected to being a good parent and having a good time with the family, while notions of privacy, for example, also characterise some practices. Participants mentioned the kitchen-dining area as a place where they felt comfortable because of social gatherings with their family, and the bathroom as comfortable because of the privacy. As such, the comfort of reading on the couch, working in silence in the home office, or being alone in the bathroom for a while, are connected to feeling comfortable at home too. The participants reflected on comfort in many ways and in relation to different dwellings and situations during their life course. In the Danish context, single-family housing often reflects a specific part of life, such as becoming a family with children and two incomes, as well as moving 'upwards' in accommodation standard and comfort level. Hence, the perceptions of comfort are also related to ideas about what an ideal home should provide. Practices are partly constituted by meanings or teleoaffective structures that outline normative ideas of practices; for example what a comfortable temperature is, how an ideal home should be designed and used and how to best take care of a family or have guests visiting. Teleoaffective structures describe normative aims in practices, and these social meanings are connected to, and materialised in, the physical structures of a house, the things and technologies within it, and the know-how of using them. The sensations of hot and cold, air, light, spaciousness and softness in a home are related to these notions of comfort, home and family as well as the know-how of embodied habits in creating a comfortable environment.

6. Conclusions

The analysis showed how comfort can be understood as sensed and perceived in practices. Comfort aspects were sensed and interpreted in relation to social meanings, materialities and embodied know-how related to warmth and coolness, air, light and material stuff, and these comfort aspects were interrelated in different ways according to the everyday practices performed. In relation to comfort, the senses of touch and thermoception were particularly prominent, but also vision, sound and olfaction are used when perceiving comfort. The embodied know-how of everyday activities related to comfort is inherently sensorial, as both the body and mind are involved in performing practices. These sensations can be said to mediate between material structures and notions of comfort for the participants, influencing how they would perform different practices. In other practices, comfort aspects are rather in the background, as an overall comfortable and homely ambience for performing everyday practices. Therefore, the sensorial translate between materials and meanings in practices. The relation between bodily know-how, social norms and material objects is translated and interpreted through the senses and thereby influence perceptions of comfort. Comfort is sensed and perceived individually as part of performing social practices that are collectively shared and related to notions of comfort in different ways.. Thus, comfort is sensed through practices and perceived in relation to social conventions and material structures.

All of the comfort aspects are related to practices that are situated in a context of social relations; the everyday practices are carried out alone or together with the family, and this also characterizes the practices and how comfort is understood in relation to them. This shows a social and cultural characterisation of comfort and the related practices, in which a central element is the family relations and social relations to others outside of the family, as well as privacy. The detached house has a strong connotation of both privacy and the ideal home of family life. Therefore, the perceptions of comfort in the interview study are also expressions of specific cultural perspectives of comfort related to the Danish norms of family life, cosiness and homeliness, as well as the Scandinavian climate that forms specific preconditions for feeling comfortable and creating a comfortable indoor environment. Understandings of practices related to comfort, as analysed here, are thus situated in a specific context of time and space, however, the discussion on how to interpret notions and practices of comfort is also valid outside this context. Thus, the conclusions derived from this study may not be generalized, but can still be applicable in

other contexts to understand aspects of comfort in relation to detached houses. Social and cultural perspectives influence how comfort is practiced, and the perceptions of what comfort is, are intimately linked to the way we sense different aspects of comfort. Therefore, comfort can be understood as sensed and translated in practices crossing diverse aspects of domesticity and the everyday. In this way comfort guides how we perform such practices in the home while we are at the same time sensing our environment.

Large amounts of energy are consumed to accommodate comfortable indoor temperatures in homes, and many policy efforts focus on how to provide this comfort more energy efficiently. Socio-technical research has established that comfort norms of indoor temperatures are co-constructed with building technologies, and this begs for debate on conventions of comfort and lifestyle. This analysis showed that comfort could be understood in relation to a variety of everyday practices, and the article suggests broadening the discussion of comfort to include other aspects than the uniform (high) indoor temperature which is strived for in many new buildings. The article also calls for an understanding of comfortable temperatures as sensed in relation with other aspects of comfort such as air, light and material stuff, all of which must be understood in a social and cultural context. Understanding more about how comfort is sensed and perceived says something about what is important to residents in their living environments, and this analysis can point to alternative ways of achieving comfort in housing in a broader understanding of comfort. If comfort is not solely about standard temperatures and indoor climate, comfortable homes can also be supplied by, for instance, providing opportunities to manually air the house, flexibility in heating rooms and in decorating and creating homely environments within the material structure of the house, and houses can be designed to accommodate everyday life activities of the residents. The article has shown how many aspects are at play in creating comfortable homes, which also leaves room for homes to be comfortable in other ways than complying with still higher indoor temperatures. This could point to less energy-intensive ways of thinking about comfort, as comfort can be achieved in different ways through everyday practices, pointing to a greater flexibility and less standardised housing.

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8.2 PAPER II

THE COMFORTABLE HOME AND ENERGY CONSUMPTION

Line Valdorff Madsen

Abstract

Notions of comfort and homeliness are closely related in everyday life regarding housing. In this paper, the relationship between these concepts is investigated, aiming at a better understanding of residential comfort and the related energy consumption. Comfort is considered as bodily sensations and social meanings in homemaking practices and as something that appears in between the social and material structures of a home. The paper examines how conceptions of comfort and homeliness interrelate through homemaking practices and thereby redefine comfort within a framework of the home and social practices. This implies a focus on what a comfortable home is; the comfortable home is not measureable but made up of homemaking practices including materials, knowhow, sensations, emotions and social norms. The empirical basis comprises interviews and visual data from a field study on detached housing on the outskirts of a Danish city. The paper concludes that the notion of home is central in understanding comfort and energy consumption in dwellings, as conceptions of comfort and home are intertwined, but also carry different meanings. The different rooms of a house relate differently to the notions of home and comfort, which has implications for how energy is consumed within the home.

Keywords

1. Introduction

It has been established that changes in energy and heat consumption, for example in houses, can be due to changes in the way we perceive comfort, in other words standards of comfort and comfort norms (Strengers 2008; 2011; Shove 2003; Chappells & Shove 2005; Shove et al. 2008). In Denmark, the energy used for residential heating has not lowered significantly in spite of a growing low-energy housing stock and energy-efficient refurbishments (Danish Energy Authorities, 2016; Gram-Hanssen 2013). This can be ascribed to an increased heated area due to larger houses and a rise in single-person households, as well as conventions relating to comfort, housing and living standards and a resource-intensive everyday life in the Western world (Jensen and Gram-Hanssen 2008; Maller, Horne, and Dalton 2012; Hagbert 2016).

Comfort is central to how dwellings are used, everyday life practiced and, consequently, how energy is consumed at home. To feel comfortable in a home is essential to the idea of a house. Hence, to approach changes in residential energy consumption, it is necessary to understand what a comfortable home means and what implications this may have for daily energy consumption; this includes looking at houses as homes. Much of the research on energy-efficient housing in building science is concerned with the physical structure of the house such as, for example, the efficiency of the technologies that sustain energy and other functions, without much regard to the social practices that turn a house into a home (Ellsworth-Krebs et al., 2015). While considering a 'comfortable house' means looking at materials and technologies, considering a 'comfortable home' takes into account practices of homemaking and the lived everyday life. Recent studies in relation to residential energy consumption and sustainable housing have placed focus on the social and sensory aspects of comfort, knowhow, homeliness and resource use, broadening the ways of understanding energy use in the home (e.g. Pink 2004; Royston 2014; Wallenborn & Wilhite 2014; Hauge 2013; Gabriel & Watson 2013; Goodchild et al. 2014). Further Vannini and Taggart (2013) have studied domestic comfort in off-grid homes while taking into account the everyday life and specific socio-spatial context of this type of home. They note that: *"(...) notions of comfort shape how we value our dwellings and relate to them"* (Vannini & Taggart 2013: 1078). Hence, when scrutinising domestic comfort, it is essential to understand the relation to the home. Feeling comfortable in a house is dependent on many aspects of the house-as-home, including temperature and indoor climate, daylight and fresh air, design and layout, furniture that is soft or hard, being surrounded by 'stuff' that is familiar and meaningful, the social relations of a

family or others living together or apart, as well as identity, control and privacy. Therefore, in this paper, I investigate how comfort and homeliness relate to each other, and thereby how homeliness can contribute to qualify the understanding of comfort in relation to dwellings. This is central to understanding how dwellings are made into comfortable homes, and how energy is consumed through homemaking practices such as doing laundry, baking, relaxing, showering, and caring for family members. As such, the aim is to qualify comfort as social meanings and bodily sensations in energy-consuming homemaking practices and to examine the implications for residential energy consumption.

I will firstly introduce practice theoretical perspectives related to comfort and energy consumption followed by an introduction to the concept of home. Hereafter, I present the qualitative methodology of the study and the data used. The empirical analysis engages with meanings of comfort and home in homemaking practices, and with how different rooms of a home relate to these meanings. The discussion reflects on these issues and the 'comfortable home' as well as the relation between homemaking practices, uses of the home and the implications for consumption of energy.

2. Social practices of comfort and homemaking

2.1 Sensations, knowhow and the body in social practices

Theories of social practice have attracted great interest in the socio-technical research field of energy consumption, as an approach that engages with the habitual and mundane practices of the everyday, while energy consumption is seen as an outcome of these practices (Shove & Walker 2014). Practices are regarded as central to understanding the social world; hence emphasis is on practice entities such as cooking, cleaning and watching television that are shared across space and time, but performed differently by individuals. Scholars within practice theory and energy consumption studies have established that everyday practices of residents in housing to a high degree determine the energy consumption of a house, or household, as the majority of daily residential routines consume energy (Wilhite et al. 1996; Gronow & Warde 2001; Gram-Hanssen 2010; Strengers 2011; Butler et al. 2014). Practice theoretical scholars have further researched thermal comfort related to heating and cooling, as these are highly energy-consuming practices related to

residential comfort (Strengers 2008; 2011; Shove 2003; Gram-Hanssen 2010, 2011; Hitchings 2011; Jalas and Rinkinen 2013). Day and Hitchings have studied comfort within the domestic setting of homes for the elderly and their practices of keeping warm in winter, that is practices that are related to the body and the home (Day & Hitchings 2011: 887). These practices are viewed as embodied, thermal sensory experiences, and as cultural phenomena relating to social activities, privacy and identity. The practices of keeping warm included warm clothing, and items such as blankets and hot water bottles. The practices were discussed as reflecting style and self-presentation, the spatial order of the homespace, public-private domains as well as ventilating the home even in cold winters to receive fresh air to keep mentally alert and avoid odours (Day & Hitchings 2011). Also in the domestic setting, Vannini and Taggart characterise comfort to be *"a quality attributed to sensations, emotions, and objects"* (Vannini and Taggart 2011: 1079) and following Bissel, they define comfort to be an affective complex of bodily capacities and feelings. This bodily capacity is combined with socio-cultural notions of comfort. When studying practices related to comfort, the body plays a significant role, as knowhow related to, for example, heating practices, such as using a thermostat and determining hot and cold, is incorporated in the body as embodied habits, while practices are described as routinized and embodied (e.g. Reckwitz 2002; Gram-Hanssen 2010, 2011). Wallenborn and Wilhite (2014) further establish the importance of the body in energy consumption and practice theory by criticising the focus on rational and individual behaviour in energy consumption literature. They instead state that the escalating energy consumption can be interpreted as a 'transformation of bodies', through practices, in other words, changes in what we perceive as comfort and how we practice our daily lives are inherently bodily (Wallenborn & Wilhite 2014). Simonsen further states that everyday practices are intrinsically corporeal (Simonsen 2007: 171). Thereby bodies are shaped by practices just as bodies perform and sustain practices. Consequently, comfort is sensed and perceived both bodily and mentally and can be understood as embodied knowhow, bodily sensations and social meanings, for example of home.

2.2 Practicing home as a place

Schatzki considers practices as situated in space and place through his concept of the 'site ontology', a broad framework where practices and material as well as immaterial entities relate to each other in arrangements or orders. These

orders comprise immaterial and material aspects of the social and are interwoven with practices. They are not stable but unfold according to sites in time and space (Schatzki 2002, Everts et al., 2011). This applies a dynamic conception of space and place, where places can only exist through practices arranging the surrounding entities, as well as practices occurring within these arrangements. In line with this, Doreen Massey's conception of place as a social production forms the grounds of understanding home as a place in this paper; that is, the meaning of place is to be found in social relations that constitute 'sense of place' and place is seen as a process constructed through relations between human beings and the physical environment enacted across space and time (Massey, 1995). As such, the boundaries of place are not fixed, but changing and permeable; this also applies to the concept of home (Massey 1995; Mallett 2004; Easthope 2004) Easthope states that *"home is, first and foremost, a special kind of place"* (Easthope 2004: 135) and further that a home is situated in space and time and inscribed with meanings.

An understanding of comfort as an element in homemaking practices requires an understanding of the home as both material structure and social construct, as social practices are situated in material structures and comprise social meanings. Following Blunt and Dowling (2006), home is essentially a spatial conception, that is, home is a site and a physical structure where we live, but just as much an idea imbued with feelings (e.g. of belonging, alienation). These ideas are spatial and contextual, imbued with cultural, social and historical meanings and thereby construct and connect places of home. Often, conceptions of home have favoured the physical structure of the house, and 'house' and 'home' have been conflated, resulting in a one-dimensional representation of the home (Mallet 2004). However, a home does not simply exist but is rather formed by homemaking practices; processes of both materiel and imaginative elements that turn a house into a home (Blunt and Dowling 2006). This also means that home cannot be equated with the physical house or the socio-economic household, as these concepts do not capture the socio-spatial relations constituting home. Rather, home is a socio-spatial system and a multi-dimensional concept; an entity constructed through homemaking processes relating the social and the physical (Mallet 2004; Blunt and Dowling 2006). People create a home through material processes of constructing and building, they form structures and use, place and replace objects. At the same time, people create a home through social and emotional relations (Blunt & Dowling 2006; Mallet 2004). Home is a site of social practices and the material culture of home is not only understood as the physical structure of a house with

its technologies, but all the 'stuff' outside and inside of the house that plays a part in giving meaning to the house as a home (Miller 2001).

Research on social practices, comfort and energy consumption has contributed with highly relevant knowledge on how social and material structures are entwined in daily energy consumption in households, and in criticising the mere focus on technologies and individual behaviour change. In the research on residential comfort and energy consumption, however, the notion of home has not been predominant. Therefore, to contribute to this bulk of research, the paper engages with sensorial and social aspects of practices related to comfort and the home, which might concern practices such as heating but also an array of other energy-consuming homemaking practices. As described by Pink and Mackley (2014), energy in dwellings can be seen as consumed; "*as part of the process of the ongoingness of the everyday constitution and perception of home as sensory environment*" (Pink and Mackley, 2014: 2). Pink has conceptualised the 'sensory home' as a way of understanding domestic contexts as intersections of materials and humans, together with discourses of moralities, identities and the sensory, social and material production of a home, through residential everyday activities (Pink 2012: 52). Along this line, comfort and homeliness is here understood as being part of homemaking practices; energy consuming daily activities of constituting everyday life and a home. This implies looking at homemaking and the everyday as relations between social life and material entities, in other words everyday practices as situated in a homely space with a specific set of material possibilities and boundaries. Thereby the house-as-home is seen as a space where homemaking practices are situated and performed and comfort is sensed and perceived.

3. Methods and data

The study has used qualitative methods as part of an interpretative research methodology, focusing on the life worlds of the research participants (Kvale 1996; McDowell 2010). A field study was carried out using qualitative interviews and photo-elicitation to supply an in-depth understanding of perceptions and practices of the residents, as well as the relationship between the residents and their surroundings; the specific setting of their home (McDowell 2010). The empirical study, as a whole, included visiting the participants in their homes carrying out in-depth interviews, home tours, taking photographs and a photo-elicitation study. It was carried out during

February-April 2014 and December-January 2014-15 in detached housing on the outskirts of the Danish city of Aarhus. The study comprised participants in three groups of detached housing, relating to the building year of the house. The first round of the study included fourteen interviews featuring home tours, and the second round was a photo-elicitation study (inspired by Blinn & Harrist, in Rose 2007), comprising three participants, which is used in this paper. The photo-elicitation encompassed participants taking photographs, followed by interviews discussing the printed photos. This process helped the participants in reflecting on aspects of their everyday life that they did not usually give a great deal of thought; however, this reflection already began with the interviews in the first round, in which these participants had already participated. At the same time, the photos document the material structure or 'feel' of the dwelling places (Rose 2007). The three participants were asked to photograph what they experienced as, and related to, respectively feeling comfortable [*tilpas*] and at home [*hjemme*] in their dwellings (things, people, situations etc.) as well as where in the dwelling they felt respectively most comfortable and most at home, over three different days. Two of the participants decided they would not include their families in the photographs for reasons of privacy and in order to avoid exposing their children in public. The analysis uses photos and quotes from the photo-elicitation. The interviews were transcribed and, for the use of this paper, interview quotes have been translated from the original Danish to English.

The three men, who consented and completed the photo task, all had a higher education, jobs in the private sector and were living with their families in newer detached houses. This can say something about who agrees to a study like this, involving some technical skills and portraying the private domain of the home. Moreover, it might give a gender-specific version of the meanings of comfort and homeliness in the analysis, as women, for example, might have other favourite spots in the house or other reasons for photographing the kitchen, living room etc. Thereby the analysis presents examples of how a middle-class Danish male perceives and expresses a version of homely comfort. For the purpose of this paper, the three cases photo-elicitation serve as exemplifying cases of how comfort and homeliness can be perceived and related. These examples represent a 'thick' in-depth description consisting of narratives that approach the complexity of social phenomena (Flyvbjerg 2006), such as comfort and homeliness, in the specific context of the middle class and Danish detached houses. As such, the three accounts presented cannot necessarily be generalised, although when relating these to the study as a

whole, they do represent a broader qualitative account of how comfort and homeliness are experienced.

The three informants are: Claus, who is in his 40s and lives with his wife and two nearly grown-up children in a house from 1997. Kasper, who is in his 30s and lives with his wife and two young children in a low-energy house, built in 2012. Jacob, who is in his 40s and lives with his wife and four children (aged four to ten) in a low-energy house, built in 2013. Jacob and his wife were specifically interested in the low energy standards and the house is built to a higher low-energy standard than what has usually been applied in these years. All three participants had the house built for them and were, more or less, involved in the design process together with the architects. This is not uncommon with newly built houses in Denmark; however, the three participants can be regarded as a special case, as they were all involved in making decisions on the layout, energy technologies and more, which is not common for the majority of Danes living in older houses. Therefore, the participants had also already had some reflections on the issues of comfort and creating a home.

4. Homemaking practices and perceptions of comfort and homeliness

"I think in itself it is a comfort to have a house to come home to" (Camilla, 30s).

This quote from the field study shows how perceptions of comfort and the home are closely entwined. The analysis engages with these meanings of home and comfort according to the participants and, subsequently, follows a route of the different rooms of the houses as presented in their photographs. The analysis therefore further engages with uses of the home and how different rooms carry different meanings in relation to comfort and homeliness.

4.1 Meanings of comfort and home

This first section deals with ideas, perceptions and sensations of home and comfort as represented in photos and discussions with the three participants.

The photos above (Fig. 1) show where Kasper felt most comfortable and most at home, in the living room and the kitchen-dining area. The feelings of comfort and home are entwined; when and where he feels most *at home* is also when and where he feels most *comfortable*. In one photo, he was alone reading in the armchair in the living room, the other three show situations with his family[1]. Discussing the pictures, he explained that it is both about the spot in the house, the room, about the furniture that is soft and comfortable, the coffee, Christmas cookies and candles, and about the practices such as reading by himself or relaxing in the company of his family. As such, his feelings of comfort and homeliness are both attached to the material structure of the room and furniture, the bodily sensations, and to the practices such as relaxing or doing social things like watching a film with his wife, watching TV on a weekend morning with his children tucked under the duvet or having the extended family over for a Christmas gathering. To Kasper, feeling comfortable and at home is very much

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[1] The family is not present in the photographs; however, they were present when Kasper photographed the rooms. He decided that he did not want to have his family present in the pictures.

about relaxation, cosiness and being with the family. Describing one of the pictures from the living room, he explained:

"It's the couch, obviously, where you sit comfortably and soft, relaxing, being entertained, we have candles on the table, and coffee in the coffee pot and cookies (…) we like, especially on the weekends, to sit and watch a movie or something (…) I sit together with my wife and watch a bit of television after the children are in bed."

The photos and the quote together show homemaking practices that contribute to Kasper's feelings and understanding of comfort and homeliness as being closely related; relaxing, reading, watching television, drinking coffee, eating cookies, having a Christmas gathering, in all these practices Kasper feels equally comfortable and at home in the dwelling. On experiences of feeling comfortable and feeling at home, Kasper further explained, referring to the photo in Fig. 2:

Fig. 2
Kasper
Utility room

"I thought it was very difficult to see the difference between feeling comfortable and feeling at home, to be honest, because it is somewhat the same thing, so I thought about what is really the difference between feeling comfortable and feeling at home (…) this, a picture of all the clothes scattered about [in the utility room], the clean clothes that should be folded, that is where you feel at home, but not necessarily comfortable (…) it is not so much fun standing and folding clothes, but you are very much at home, when you do it."

Kasper is talking about doing laundry as part of the homemaking practices, and he explains that, while he does not necessarily enjoy such domestic duties and perceive them as comfortable, they do underline the meaning of home to him. When discussing the two concepts, Kasper explains that comfort is more related to relaxation and leisure time, whereas homeliness can be both about relaxing and doing things with the family, but also about daily chores, and therefore more about the constitution of the family and their home. Claus agrees that it is difficult to separate feelings of comfort and homeliness. He oversees:

"I feel, to feel at home you also have to feel comfortable (...) I'm happy to come home, it's a place, well, it can be cosy, but it's also a place where you feel safe, there are no unpleasant surprises or anything, you know what you come home to, and, it's also something to do with habits."

To Claus, a home is where you feel comfortable, which underlines how notions of comfort and of home are entwined. The quote is also about what these notions mean in terms of a space, physically and socially; it is where you feel safe, it is somewhat your own domain in the sense that you control what happens. Such ideas have also been central to theorising upon the concept of home, underlining the home as a 'haven' and a sharp distinction between private and public spheres (e.g. Blunt & Dowling, 2006). In our discussion of the photographs, Claus did however, when asked, distinguish between where and when he feels most comfortable and where and when he feels most at home, as illustrated in the pictures below (fig.3):

Fig. 3 Claus
Kitchen-dining
area and living

Claus explained that he feels most at home when having dinner in the evening with his family in their kitchen-dining area. This is the social gathering place of the family; he explained that it is the one time during the day when they all sit down together and take their time to dine and talk. The other picture is what Claus explained as the most comfortable; it is also socialising with the family but, at the same time, it has much to do with relaxing and sitting comfortably on the couch, he told me. Like Kasper, Claus also explained that , to him, feeling very comfortable is to be relaxing in the living room, without any everyday chores to do, just enjoying the company of the family, reading a book or using the IPad.

This shows a clear distinction between two main rooms in a modern Danish detached house; the living room and the kitchen-dining area, the furniture in these rooms, and the practices acted out there. To Claus, the practice of dining with the family is part of a daily routine that makes him feel much at home. The way the room is furnished makes it less comfortable to Claus, compared with the living room furnished with a large couch. Even though dining is one of his favourite activities of the day, essentially representing homeliness, it also has to do with the daily chores of cooking, doing the dishes and so on that, to Claus, are not necessarily related to comfort. Therefore, the dinner in the kitchen-dining room represents homeliness, whereas relaxing on the couch represents comfort. Jacob looks at comfort and homeliness as somewhat separate ideas:

"To be at home and the thing about comfort, it is not necessarily super-connected… I would say, comfort, I think of as being climate stuff, temperature related stuff, and it does not have to be because it is regulated, all the technology behind it, it can just as well be in a thoroughly thought out house, in relation to the sun, light and wind, so to speak, even of much older date."

Fig. 4 Jacob Overhang and thermostat

Jacob photographed what, to him, symbolises and demonstrates important aspects of indoor comfort: A thermostat showing the temperature in the house, the air duct of the ventilation system, a skylight, and the balcony with an overhang that ensures a good balance between sunlight and shadow in the house (examples in Fig. 4). These photos represent a perception of comfort tied to the material structures and the technologies of a house, maintaining a comfortable indoor climate and temperature according to Jacob and his family and, as such, relates well to a more technical understanding of comfort. At stake here though, are also various sensory, bodily, perceptions of an adequate indoor climate and the importance of this to feeling at home.

In this section, perspectives on comfort and homeliness dealt with the material and social aspects of homemaking practices. Perceptions of homeliness tended to involve more of a social and symbolic aspect, but also the daily routines that occur and sustain the everyday life of a family practices of dining and doing the laundry. These practices underline the social meaning of home. Perceptions of

comfort tend to be more related to materiality, but also entail the social aspect of homemaking in being together with the family, such as watching television, reading and relaxing. Feeling comfortable is more related to leisure time for the three men, whereas feeling at home has much to do with sustaining the daily family life. To expand these notions of what comfort and homeliness mean, in the next section I look into each of the photographed rooms and examine how these carry meanings of comfort and homeliness in different ways.

4.2 Places to feel comfortable and places to feel at home

The first section of the analysis indicated differences between the rooms of a house in how they relate to the various perceptions of comfort and homeliness, as well as the daily use. All of the informants photographed their living room, the kitchen-dining area and their home office. However, in addition, there were photos of the bedroom, the bathroom, the kitchen and a workshop. Thus, most rooms of a standard Danish detached house are represented, excluding the children's rooms. However, there were different emphasises on the rooms and differing reasons for photographing them.

Fig. 5 Jacob
Living room

The living room: Relaxing alone and with family

One of the first choices to photograph for the participants was the living room, that relates to both comfort and homeliness. For Kasper, it is where he equally feels both comfortable and most at home, relaxing by sitting in an armchair reading, in the evening on the couch with his wife watching a movie when the children are tucked in, or on an early weekend morning watching TV with the children (Fig.1). He claimed that the central aspect of this room is that it is for relaxation, on your own or with the family, sitting comfortably and softly, maybe with a duvet for even more cosiness. Similarly, Claus said that he feels most comfortable in the living room sitting on the couch (Fig. 3), because this room is purely for relaxation when at home; to him it is not related to daily

chores, but just for being together with the family or reading a book. He explained that this is very much the core of being at home as well, because you only do this in your home. Jacob also explained his picture of the couch (Fig. 5) to be where he feels equally comfortable and at home. The picture reflects relaxing practices such as watching television with his wife in the evening, when the children are in bed, providing a calm place and time in the house. Moreover, he explained that the picture also shows a bookcase that he produced himself from the floorboards of their former house, and therefore symbolises nostalgia related to that house. Furthermore, he stated that books are important to him in a home, because they tell something about him, just as books in other homes tell something about the people he visits. This reflection ties homemaking closely to identity perspectives.

Fig. 6 Jacob, Kasper &
Claus
Home office

The office and the workshop: A private domain

All three informants photographed their office (Fig. 6). Kasper noted:

"I think it's really pleasant to sit in the office, to have that room and environment to work in, you sit comfortably in our office chair and at the table, and there's complete silence from all surroundings, compared to when you're in the workplace... so it's just nice to be able to sit at home and work, you're more relaxed when you work from home, and actually also produce more because it's quiet".

Fig. 7a Jacob Workshop

Kasper relates the room of the office to feeling comfortable, as it is a quiet working space with comfortable furniture. Claus said that the office is where he feels much at home, because he sees it as his 'cave'; it is his domain, where he likes to sit, both when he works from home and in his spare time, for instance,

Fig. 7b Jacob Workshop

working with photographs. Jacob similarly explained that

the office is one of the places in the house where he feels most at home, because it is a space in which he is surrounded by all the things he needs and where he is in charge, and also for all the clutter in there, which does not bother him, because it is his own. At the same time it is a space where he feels very comfortable working from home, because it is quiet. Jacob expressed the same feeling of homeliness, of belonging, about the workshop (Figs. 7a and 7b), which is separate from the house, but still, to Jacob, an important part of it: *"(...) it's not really home if you don't have a place for this [repairing etc.]"*. He explained that this room is also about 'ordered clutter', as the room might appear cluttered to outsiders, but to him there is perfect order, because he knows where everything is. The two rooms are his domains and therefore he feels at home there. At the same time, the workshop is where he produces and repairs objects (e.g. the bookcase, bicycles and children's toys) that are significant in terms of making the house homely. Further, Jacob also photographed, among other objects, pegs hanging in the house that he produced in the workshop and thus, to him, make the house homely.

The bathroom: Privacy and warmth

Two participants photographed their bathroom (Fig. 8) which is associated with feeling comfortable, but not necessarily at home. Kasper said:

"(…) our shower, it's a place where you feel comfortable, but maybe not necessarily so much at home, it might as well be any other place, where you stand under the shower head and get thoroughly warm… so, I do also feel at home, but it's more about, you just relax there and feel good in the warm shower."

Fig. 8 Jacob & Kasper Bathroom

Kasper further explained that the bathroom is also where he can have a modicum of privacy and calmness for a short while, being the father of two young children. Jacob emphasised the same aspect about privacy in the bathroom. Further he explained that here you could feel that you 'loose' some comfort in a low-energy house, compared with an older 1960s house. The new house is thoroughly insulated, which, he said, provides a high degree of comfort in the house in general, and therefore you cannot have a heated floor in the bathroom as it would be overheated. The heated floor was what he associated with comfort in the old house, where only the bathroom had floor heating, and even though the whole house has floor heating now, the floor feels cold because it is equally heated, he explained. Therefore, they now wear slippers around the house for comfort.

The bedroom: Homely and comfortable

The bedroom is both associated with feeling comfortable and feeling at home. As an example, Jacob said that when you are sick, the only place you want to be is in your own bed, and therefore to him the bed and the bedroom is one of the

Fig. 9 Jacob Bedroom

most homely spots in the house (Fig. 9). He further explained that it is not just about the bed, the familiar sounds and smells of the home also make it a homely place; if you moved that same bed to another place, for instance a hotel room, he felt you would not feel the same tranquillity of being at home. This has much to do with the security of a familiar space and knowing that this is your place to stay. Kasper told me that his picture from the bedroom represented a place where he feels comfortable, lying in the bed under the duvet, relaxing, for example by reading before going to sleep. Consequently, Kasper primarily related the bed and the bedroom to comfort, feeling warm and relaxed in a soft spot, whereas Jacob found that the bed is really an image of the most homely place he can think of.

The kitchen-dining area and the kitchen: Homely smells and daily routine

The participants associated the kitchen-dining area with both comfort and homeliness. Jacob photographed the kitchen-dining area to show the inflow of

Fig. 10 Jacob Kitchen-dining area

light (Fig. 10), as well as the view from the windows, which was important to his feeling of comfort. Claus and Kasper rather related the kitchen-dining area to homeliness, as a place where family life was acted out. Kasper said that the kitchen-dining area was one of the most homely rooms in the house (Fig. 1), because this is one of the places where the family gather and do things together, such as drawing, playing board games or making Christmas decorations. Kasper did not photograph the kitchen, but he said it also relates to the feeling of homeliness, either by way of the daily practices of cooking, which he does not find enjoyable as such, or by infrequent baking, for example Christmas cookies with the children, which he finds very homely.

Claus explained how he had realised that the central spine in the house was the kitchen-dining area and the living room; this is where he (and his wife) spends most of their time. He was the only participant who photographed the kitchen (Fig. 11), which shows his son baking Christmas cookies:

Fig. 11 Claus Kitchen

"C: (…) the kitchen it's also a great part of it (…) I like to cook, and actually we all do…so therefore we also spend some amount of time in the kitchen, and it's both something we do together and one person cooking for the rest of the family, and it can both be the evening meal and it can be breakfast and it can be someone baking something, or other things (…) I: So it's a kind of meeting place? C: it's a meeting place, yes."

To him, the kitchen is a meeting place, and a space in the house where he said that, in some ways, you spend much time there, cooking meals, cooking tea or just picking up something, but on the other hand, it is not where he spends a longer amount of time. Even when cooking, he said, he spends half an hour there and then travels back and forth many times. The family eat in the adjacent kitchen-dining area, where they spend a longer duration dining and talking, he explained. Nonetheless, the kitchen is a room where he feels comfortable, especially because he likes to cook and to come home from work and smell that someone is cooking dinner.

Claus' and Jacob's photographs were taken around Christmas time, which showed in the situations they particularly related to homeliness, such as Christmas gatherings with the extended family and baking cookies. Christmas cookies were also part of everyday practices such as watching television, and Claus photographed a decoration with Christmas elves that he thought represented homeliness at this time of year. As such, Christmas time added some meaning to the idea of homeliness in this study as the winter season might have increased the focus on warmth and light for all of the participants.

5. Discussion

The perceptions of comfort and homeliness were expressed as bodily sensations and social meanings such as hot and cold, well-being and ideas of cosiness. Comfort was experienced as warmth, soft furniture, relaxation, privacy and also social relations to family. This reflects energy consuming homemaking practices such as heating, watching television, drinking tea or coffee, showering, and also working from home. The rooms related to this feeling of comfort are the living room, the bedroom, the home office and the bathroom. Homeliness is primarily experienced as the social life of the family, including daily chores of sustaining home and family life as well as things that symbolise this (paintings, books etc.), but also to privacy, safety, control and relaxation. This reflects energy consumption in homemaking practices such as cooking, doing laundry, decorating and spending time with the family such as talking, dining and playing. The rooms associated with homeliness are the kitchen-dining area, the living room, the bedroom and the office. This shows that the rooms of a house carry different meanings in terms of comfort and homeliness, which reflect the practices acted out in the rooms, and further how energy is consumed differently within these rooms according to the practices. The rooms that are mostly related to comfort, are the rooms where the residents relax, together or separately, where there is soft furniture, warmth and serenity. Rooms that are related to homeliness also signify warmth, cosiness and family time; however, some rooms are more functional, where daily chores are carried out. These rooms might have lower requirements in, for example, heating, because they are used for activities rather than relaxing. The kitchen is heated differently, for instance by cooking, and the utility room is not a room where longer time periods are spent, but one for doing the laundry or other practical activities. Energy can be consumed more or less directly in a home, while practices such as talking and playing do not necessarily consume electricity directly, but are nevertheless acted out in a home that is heated sufficiently to feel comfortable and with adequate lightning. On the other hand, practices such as cooking, doing laundry and watching television consume varied forms of energy in a more direct way, while at the same time being acted out in a comfortably heated home. This means, for example, that the comfortable home is not necessarily one that is heated equally with the same temperature in all rooms, but rather one that accommodates different homemaking practices in different rooms of a home.

Through this study, perceptions of comfort and homeliness were expressed in relation to the structures of a Danish detached house; the use and meanings of

different rooms and the daily life lived there. The versions of comfort in these homemaking practices highlight how energy is consumed in the home, which should be taken more into account in designing and retrofitting houses-as-homes. The common building and retrofitting of houses is primarily concerned with widely standardised versions of comfort related to the indoor climate. However, this study shows that the comfortable home is just as much influenced by ideas of homeliness and the social relations of families. Homemaking practices reflect this everyday creation and sustaining of the home and family life. Some of these homemaking practices are less energy-consuming but just as important for feeling comfortable as practices such as heating. Understanding how we make ourselves comfortable and create a homely ambience can also point to reasons why residential energy consumption is ever rising. Homemaking practices in Danish detached houses include heating the home to be comfortably warm, preferably without feeling draughts or cold floors, especially when relaxing, reading, watching television and so on. The heated home is the frame of daily family life, but warmth is more important when relaxing than when actively doing everyday chores, for example. Homemaking practices related to comfort also comprise lighting with lamps that create cosy indoor atmospheres, as also showed by Bille (2015). Accordingly, warmth and light are central aspects in this Danish version of the comfortable home in winter time. Further homemaking practices consist of decorating with objects that have a homely feel because they are familiar or related to the identity of the residents, such as books and homemade items, as well as decorating with furniture that is comfortable and suitable to the way daily life is performed in the home. Such practices consume energy while they are entangled in bodily sensations and social expectations for the comfortable home. In relation to this Vlasova and Gram-Hanssen (2014) have also pointed to the importance of energy retrofittings to accommodate sustainable everyday practices for the inhabitants to be successful in reducing energy consumption. These reflections are similar to the findings of Maller et al. (2012) when scrutinising green renovations in Australian homes: that green renovations were ineffective in reducing households' energy consumption, precisely because these intersected with everyday practices and notions of the ideal home. This resulted in, for example, increased floor space, kitchen extensions and added bathrooms. Vannini and Taggart further note that: *"(...) mainstream ideas of domestic comfort are so deeply imbricated with consumer ideologies"* (Vannini & Taggart 2013: 1078). Therefore, the notion of domestic comfort in Western homes is also closely combined with intensive resource use and, as has been noted by, among others, Shove (2010) and Strengers (2013), the strong focus on individual behaviour change within energy research and campaigns do

not sufficiently address such shared, highly energy-consuming, homemaking practices.

6. Conclusions

The aim of this paper has been to stress the importance of home and homeliness in terms of understanding residential comfort and the related energy consumption. Research on comfort and energy regarding the house as a physical structure, often addresses people as either passive or active users of buildings and technologies, while this study regarded people as everyday practitioners performing homemaking practices that involve materials, social meanings, knowhow and bodily sensations. The study showed how the notion of home was important in perceptions of comfort, recognising that this entails social meanings as well as material structures. Feeling comfortable in a house was intimately related to feeling at home. The perceptions of comfort and homeliness were both entwined in the participants' homemaking practices, but at the same time, there were distinctions between the two. Comfort was related more to materiality and experiences of bodily sensations as well as to relaxation and leisure time, whereas homeliness was related more to both social aspects of family life and the daily chores that sustain domestic life. At the same time, the homemaking practices were just as much about sustaining daily family life as creating comfort in the home. The relation, and at the same time distinction, between the two concepts showed that both notions of comfort and notions of home have implications for residential energy consumption.

Comfort and homeliness were interrelated in homemaking practices. Therefore, comfort is both social meanings and bodily knowhow and influenced by social and material aspects, in terms of acting out daily chores and mastering energy technologies. This way of looking at comfort and homeliness contributes to a reframing of the concept of comfort for the built environment, in terms of connecting the knowhow, social meanings and material surroundings that constitute a home through homemaking practices. In this way, comfort and homeliness are closely related in the everyday life and space of the home, and furthermore, the concepts of home and homeliness have an important role to play when dealing with residential comfort. The interrelation of comfort and homeliness implicates different uses of the rooms of a house, including the consumption of energy. Therefore, the concept of comfort can be researched as

part of homemaking practices, depending on both embodied habits, social relations and bodily sensations, rather than solely on how residents as energy 'users' perceive and operate for example temperatures and indoor climate. Living in a house is not solely a question of being a user of a material structure including technologies, but rather a matter of creating and sustaining a home. An important issue is that rooms of a house are connected to different everyday practices requiring different energy uses, for example different levels of heating. However, building regulations assume houses to be heated evenly and newer technologies often also push for this development; for example newer houses in Denmark are often heated by underfloor heating that cannot easily be regulated to different temperatures in different rooms. When designing houses, this flexibility of use could be reflected in a varied way of using energy such as heating and electricity, which could more closely follow the practices of the inhabitants. This could be an example of an alternative approach to reducing residential energy consumption.

Energy is consumed in houses to create comfortable homes for the everyday life of the residents. Accordingly, residential comfort and energy consumption must be understood in terms of the house-as-home. This perspective implies a shift in focus from 'comfortable houses' to 'comfortable homes', while, as shown here, considering the comfortable home takes into account daily homemaking practices including embodied habits and social meanings of comfort. This is relevant in terms of understanding the relation between comfort and residential energy consumption, because it looks into what people do and why, as well as recognising the social aspect of daily life at home. This entails recognising that houses do not exist only as material structures but, at the same time, are homely or unhomely homes, in which the comfort of the residents might depend on physical, material, mental and social aspects connected to the idea of home. As such, comfort, in light of homemaking practices, is a concept that cannot solely be defined in terms of technologies sustaining houses with, for instance, heating. To understand residential comfort and obtain housing for sustainable living, with reduced energy consumption, it is necessary to look at the comfortable home, as this approach deals with the social practices that consume energy in dwellings.

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8.3 PAPER III

MATERIALITIES SHAPE PRACTICES AND IDEAS OF COMFORT IN EVERYDAY LIFE

Line Valdorff Madsen

Abstract

Standards of comfort in the built environment aim at ensuring thermal comfort, together with a growing focus on energy efficiency in buildings. The development in material structures and technologies in housing aimed at ensuring thermal comfort influences how practices and perceptions related to this are performed in everyday life. In order to investigate this relation, the paper analyses empirical examples from interviews with residents in three groups of Danish detached houses, with a focus on differences in heating systems and practices between them. This housing type makes up 44 per cent of the housing stock in Denmark, which makes it the most widespread type of housing. On the background of a qualitative field study, the analysis shows how changes in technologies and material structures shape practices of heating and airing which relate to perceptions and ideas of comfort. In relation to heating practices and the meanings of comfort, a shift in heating technology from radiators to underfloor heating was found to make a clear difference in how houses are heated and comfort perceived. It is concluded that changes in material structures of houses consequently change residents' perceptions of comfort and the related everyday practices.

Keywords

1. Introduction

Building regulations continuously prompt changes in the physical structure of housing and the energy technologies that sustain dwellings with for example heat, together with technological development and norms of comfort. With a growing focus on energy efficiency and sustainable buildings, specific quantifications of comfort are regulated in terms of how to achieve comfort with the lowest energy consumption. This is reflected by a strong focus on energy-efficient technologies that presuppose a rational behaviour by residents. In Denmark, and most other EU countries, this approach has succeeded in lowering the heat consumption per square meter in newly built housing; however the overall consumption of heat in Danish housing has not decreased significantly.

Socio-technical research has established that the energy consumption of dwellings varies in relation to differences in household behaviour, which shows that houses do not operate in a vacuum, but are highly influenced by, and influences, the residents living there and the everyday life carried out in the house (Gram-Hanssen, 2010; Gram-Hanssen & Hansen, 2016). Shove (2003) has established that the concept of comfort is a socio-technical issue in showing how conventions of comfort are shaped by standards of building technologies together with, among other things, policy and everyday life. These perspectives suggest that matters of comfort and energy consumption are not solely related to questions of economy and technologies, as notions of comfort change with material and social structures as well as everyday routines of for example heating (Strengers 2011, 2013).

Therefore this paper examines empirically how notions of comfort are manifested and normalised between building schemes and everyday life and what this means for energy-efficient housing. The notions of comfort in detached houses are scrutinised in a nexus of materialities, routinized activities, bodily senses and social norms. The paper aims at a deeper understanding of how the material structures of housing and everyday practices related to comfort relate to each other, by scrutinising residents' practices and perceptions of comfort in three types of detached housing. The three housing types denote three time periods of building regulations in

Denmark. The paper starts with a short introduction to theories of social practices and the literature on comfort and energy consumption within this framework. The background and methods section briefly introduce the Danish Building Regulations and Danish detached housing as well as presenting the methods used and the empirical data comprising interviews and photos.

2. Comfort and everyday practices

The paper takes its point of departure in everyday life and how technologies and materials are integrated in this, as practices of heating and ideas of comfort are carried out in the daily life in homes. The everyday life can be described as the cohabitation of objects, people, feelings and activities in the setting of the home (Löfgren 2014), which fits well with the approach of social practice theory. For the purpose of this paper, scrutinising the relation between the social everyday life and the technical and material structures of home heating, a practice theory framework is useful because it interrelates the social and the material in analysing social practices as central to understanding social phenomena, such as comfort (Reckwitz 2002; Shove et al. 2012; Warde 2014). Practice theory addresses relations between humans and objects in everyday life; or between elements constituting practices such as materials, competences and meanings, as named by Shove and colleagues (2012). Social practices can be seen as coordinating entities, as for example the practices of heating and cooling, that are shared across space and time through common understandings (Schatzki 1996). Schatzki distinguishes between this practice entity and the performance of practices, which is the way individuals carry out specific practices, implying that there can be individual differences in how shared social practices are performed, according to material surroundings and practical understandings. Practice entities are realised and sustained by this performance of practices (Warde 2005; Schatzki 1996).

The practice theory approach has gained influence within socio-technical research on energy consumption and comfort, understanding energy consumption broadly as the outcome of routinised practices (Shove and Walker 2014). Within this approach, comfort practices have been related to thermal comfort including practices of heating and cooling (Gram-Hanssen 2010; Hitchings 2011; Jalas and Rinkinen 2013; Judson and Maller 2014; Rinkinen and Jalas 2016; Shove et al. 2008; Strengers 2008, 2011, 2013; Strengers and Maller 2011; Wilhite et al. 1996). This body of research has established that

residential comfort and energy consumption are greatly influenced by the everyday practices of residents in housing. For example, Gram-Hanssen (2010) showed differences in how comfort is practised within similar material settings of housing, with households that represent varied social configurations of meanings and know-how. Hitchings (2011) showed how office workers' practices related to thermal comfort should be understood in an interaction between elements such as embodied sensibilities (clothing), habitual modes of thought (social contexts) and physical infrastructure (ambient environments). Strengers and Maller (2011) showed, among other things, how residents' adaptive strategies of cooling practices in hot weather were enabled or restrained by the material design of the house. Further there is a growing focus on the relations between practices consuming energy, comfort and the house-as-home (Aune 2007; Ellsworth-Krebs et al. 2015; Rinkinen and Jalas 2016). This paper investigates practices that relate to residential comfort in a Scandinavian climate, notably heating and airing, as part of a complex web of everyday home-making practices entailing both the materials and technologies of houses, embodied know-how or competences and meanings of comfort, home and family life.

3. Background and empirical data

In the years 1960-1980, around 450.000 detached houses were built in Denmark, which nearly doubled the housing stock. In this period, the housing sector also became strongly industrialised and many standard houses were built from standard designs and prefabricated elements. The construction of new detached houses decreased in the 1980s and into the 1990s. The standard detached houses built during this period does not differ much from earlier houses in their general design, reflecting quite strong conventions of aesthetics and building techniques (Lind & Møller 1996). Most detached houses, 40 per cent, are heated by district heating which has been the dominating energy supply for heating since the 1980s (Statistics Denmark 2016). The Danish Building Regulations outlines the legal requirements governing all types of buildings in Denmark. It contains requirements on topics such as layout, services, indoor climate and energy consumption. The objective of the subject of indoor climate is that buildings should be built so that when using the building for the prescribed purpose, there will be a sustained and satisfactory healthy and safe climate including comfort (The Danish Transport and Construction Agency 2015). This comprises thermal indoor climate, air quality,

acoustic indoor climate and lighting conditions. Since 1979, the Danish Building Regulations include provisions on how to improve the energy efficiency of the built environment and reduce the energy consumption. Over the years, the energy requirements have changed from regulating the performance of building elements to regulating energy performance of the total building, including energy production (Gram-Hanssen 2014).

The empirical data comprised interviews including home tours and photos from a field study on the outskirts of Aarhus, Denmark's second largest city. The study included two rounds of interviews in the participants' homes during the heating season comprising 17 interviews. The first round included 14 interviews in different households, either with one or both partners of the household (see table). The second round was a photo-elicitation study including a follow-up interview conducted with three of the participants. Interviews were transcribed and analysis software was used to support the empirical analysis. Quotes have been translated from the original Danish into English by the author. The analysis in this paper builds on all interview material and includes photos by the author. The three groups of housing were subdivided by building age (see table). This subdivision reflects changes in the Danish Building Regulations, for example regarding heating systems and insulation. All households in the study were connected to district heating; thereby households with other primary types of heating were left out. Further all houses, except one, were owner-occupied, as are most detached houses in Denmark (Lind & Møller 1996). This reflects specific heating practices and a specific urban housing context, both socio-economic and geographic. The participants varied in relation to gender, age and family types (see table). However, they represent a rather homogeneous socio-economic group, characterised as being from lower to upper middle class. The study did not aim to resemble a representative study; however, a group varying in relation to gender, age and family structure reflect a more varied picture of heating practices within this specific type of housing.

Table 1. Participants in field study.

Participants	Ownership	House type by year	Heating technology	Gender	Age	Household type
Helene	Rented housing	1969-1979	Radiators, underfloor	Female	40s	Couple, no

			heating, wood stove, heat pumps			children at home
Birte & Peter	Owner-occupied	1969-1979	Radiators, underfloor heating	Female & male	60s	Couple, no children at home
Maria	Owner-occupied	1969-1979	Radiators, underfloor heating, wood stoves	Female	50s	Couple, 2 children at home
Sarah	Owner-occupied	1969-1979	Radiators, underfloor heating, wood stove	Female	40s	Couple, 2 children at home
Marianne	Owner-occupied	1997-2001	Underfloor heating	Female	60s	Widow, no children at home
Claus	Owner-occupied	1997-2001	Underfloor heating	Male	40s	Couple, 2 children at home
Pernille	Owner-occupied	1997-2001	Underfloor heating, wood stove	Female	30s	Couple, no children yet
Camilla & Behram	Owner-occupied	1997-2001	Underfloor heating	Female & male	30s & 40s	Couple, 1 child at home
Birgitte	Owner-occupied	1997-2001	Underfloor heating	Female	50s	Couple, 1 child at home
Linda	Owner-occupied	1997-2001	Underfloor heating	Female	40s	Couple, 3 children at home
Jacob	Owner-occupied	2012-2013	Underfloor heating	Male	40s	Couple, 4 children at home
Kasper	Owner-occupied	2012-2013	Underfloor heating	Male	30s	Couple, 2 children at home
Tilde	Owner-occupied	2012-2013	Underfloor heating	Female	30s	Couple, 2 children at home

Karen & Erik	Owner-occupied	2012-2013	Underfloor heating	Female & male	60s	Couple, no children at home

3. Perceptions and materialisations of comfort in detached houses

3.1 Detached houses from 1969-79

The houses built from the late 1960s to the late 1970s are typically heated mainly by radiators with a thermostat and often with underfloor heating in the bathroom. These heating technologies can also be supplemented by other heating devices.

Heating and airing: a variety of technologies and practices

In the older houses, there were multiple technologies involved in heating, as Helene explained:

"Actually we only have that radiator turned on [in the kitchen] and then there's one in the bathroom, it's on two and I also think the underfloor heating is on there, that's all we have turned on, because we have a wood stove and then we have that heat pump in there [the living room] (…) that one [radiator in the kitchen] is only turned on if we're out here, otherwise there's obviously no need and then we turn it off when we fire up the wood stove (…) [the heat pump] we actually only turn on when we don't use the wood stove, otherwise it's not turned on and there's no heat anywhere else" (Helene, 40s).

This heating practice is quite complex involving radiators, underfloor heating, a wood stove and a heat pump. Helene and her husband rented a big house and a large part of it was not heated at all. They mainly heated rooms when they used them, mostly the kitchen and the living room, and then the bathroom was kept warm with both a radiator and underfloor heating. They owned a company and worked from home, which involved their employees walking in and out of the house. They had 'inherited' the heating installations and technologies that came with the house, when they moved in recently. Their heating practice involved turning on and off the different devices as they moved around the house during the day. Most of the participants living in older houses owned and used a wood stove. Sarah explained that they used a wood stove in winter, because otherwise the house could not be heated sufficiently:

"In the winter months we use it from October to March (…) now the weather is good but otherwise we use it every day in the winter (…) when it's on the radiator turns itself off, it's not like we turn it off, it regulates itself (…) even though the radiator is turned on, if the wood stove is not fired up then it gets very cold" (Sarah 40s).

Sarah and her husband lived with their teenage daughters in a house which was not well insulated. She found it was difficult to heat the house when it was cold outside, especially the hallway felt ice cold and therefore they had placed a carpet. In winter, they used the wood stove as a supplement to the district heating and radiators when they arrived home from work. Moreover, they had underfloor heating in the two bathrooms, which Sarah enjoyed. Thereby several heating technologies, and a carpet, were used to keep the house warm. Another participant, Maria had immigrated to Denmark together with her husband and lived in a large house with two levels together with two of their three grown-up children. She explained that they hardly ever used their wood stoves, because they felt that the house was well insulated and easily heated to satisfy their needs:

"We have two wood stoves, here in the living room and then one in the basement. But the one in the basement we've used only maybe two times, in all fourteen years, because it gets very warm, and the basement is very well insulated, the children don't use any heating downstairs (…) the heating pipes, they're in their rooms, so you know, when the heating is transported, it gives a lot" (Maria, 50s).

Maria explained that when the heating was turned on it ran through pipes in the basement and heated the downstairs rooms. They did not need the wood

stove in their heating practice; however once in a while they did use the one in the living room.

The heating technologies of these older houses were closely related to practices of airing, as the radiators and the wood stoves were involved in different ways in how houses were aired. This connection, between technologies and heating and airing the home, was partly because airing was used to regulate the heat in the house, although this was more pronounced for participants in newer houses, but also because airing affects the function of heating technologies like radiators. This was most pronounced with the participants in these older houses, where the knowledge and routine of turning off the radiators when airing the house, in order not to waste energy and control the temperature was apparent: *"when I air I turn off the radiators and then when I close I turn them on" (Maria, 50s)*. Airing was often performed daily, for example in the mornings, and all of the participants living in this housing type spoke of the importance of turning off radiators when the windows were open and turning on the radiators when they were closed again. Practices of heating were also related to practices of airing in the issue of smells; for example how the heating technology of a wood stove affects the indoor climate in a house. Helene explained that she airs the house a lot, especially the living room and the kitchen through the terrace door: *"(…) it's the first thing I open (…) when I get up, but that's because I don't like that smell from the wood stove" (Helene, 40s)*. In general, Helene was concerned about the smell in the house and about letting in fresh air, because there were many people and a lot of smoking during the day, which is why she would rather put on another sweater if she felt cold, than not opening the door.

Heating and airing: sensing warmth and cold

The relation between heating and airing is also a relation between warmth and cold, as airing affects the temperature in the house and can be used to adjust this. Warm and cool were further sensed and perceived through the material structures of the house, as explained in different ways by the participants. Maria felt the house was well insulated and easy to heat because of the walls: *"When we have turned down the heating in here, you cannot feel that the walls are cold, it's well insulated" (Maria, 50s)*. Feeling that the walls were not cold, she also felt that the house was not too cold. She further found the basement well insulated, because on the one hand is was easily heated through the

uninsulated pipes, but on the other hand it also kept out the heat in summer, and she explained that as a consequence they sometimes slept in the basement, when it was too hot upstairs.

Erik and Karen, a couple in their sixties, explained how their old house differed much from the newly built low-energy house in which they had been living for a year, especially when it came to draught and thermal bridges, which is a common problem in the Danish standard houses of the 1960s and 1970s (Lind & Møller 1996). In their old house they could feel the warmth and cold of the seasons changing, as Karen said: *" (…) in the winter, we could feel right away when it was really cold and we could feel in the summer when it was warm (…) And this, we don't feel that change so strongly, because it's well insulated" (Karen, 60s)*. And Erik explained how the cold could be felt in the materials of the house: *"The floors in a house like the one we lived in before, they're cold, because there was a crawl space underneath (…) and when you sat reading underneath the windows, you'd be cold, because the cold gets in through those double-glazed windows from the 60s and the 70s and these windows insulate 3-4 times more" (Erik, 60s)*. Karen further explained how this affected their sensation of the floor and their practice of decorating: *"In the winter in the bedroom, we didn't have a rug in there, we had a nice floor (…) it was icy cold when you got up…and in the living rooms we kept the carpets for a long time after it had become fashionable to take them off" (Karen, 60s)*. In this way, Karen and Erik described how their perception of heating in their old house was materialised in the walls, windows and floors of the house, which they felt especially in cold winters and how a carpet could be an element in creating comfort.

3.2 Detached houses from 1997-2001

The houses from the late 1990s and the early 2000s typically have underfloor heating with thermostats placed throughout the house.

Underfloor heating: sensing and practicing

Camilla and Behram, who lived with their young boy and were expecting a baby, were very fond of the underfloor heating in the house, as Behram noted: "*Especially when having a little one crawling, then it's nice" (Behram, 40s)*. In this way, the material structure of the home and the heating technology of underfloor heating was connected to family life and creating the most comfortable surroundings for a child. Further, Behram also enjoyed the even heating and comfortable temperature of the house, throughout rooms and seasons, which was why he would be wearing a t-shirt all year round. Many of the participants said they enjoyed the heated floors: *"it's lovely, it's wonderful to walk on the warm floors" (Marianne, 60s)*. Marianne explained that she could feel the warmth through her socks, also in the spare bathroom where the heat was turned down a bit, and in this way she estimated that the room would be heated enough for guests. She added that her feet would always be freezing cold when visiting friends living in older houses from the 1970s, though she had herself lived in such a house before. The participants agreed that the underfloor heating supplied a comfortable and even heating, as it also ensured 'warm feet'. When Birgitte, who lived with her husband and one of two grown-up children, compared the underfloor heating in their house with the heating of older houses by radiators and wood stoves, she also focused on warm and cold feet:

"I like better being at our place, because we have the heat from below, that you're warm around the feet (...) at my mother-in-law's who live in an old house, she has a wood stove and radiators, and it's bloody cold in there, even though it's warm, then it's warm up here and cold down at the feet" (Birgitte, 50s).

Underfloor heating was perceived as a comfortable way of heating the home, and the participants living in these houses rarely talked of being too cold in the house, compared with the participants in the older houses above. Heating is practised in more identical ways by the participants living with underfloor heating, as there are in some ways less scope for regulation with this technology and because it is most often the only heating technology in the house. Several of the participants seldom regulated the heating, either because they did not find it necessary or because it was too complicated:

"(…) we don't turn the underfloor heating up or turn it down (…) it just runs (…) every room has its own thermostat, so you can regulate, but I'm not really sure about, and I know you should be careful, because if it gets cooled down then it costs more to warm it up" (Behram, 40s).

Behram and other of the participants were not sure how to operate the heating system in their house, which was why they simply did not regulate much. Birgitte further explained: *"it's so inconvenient to regulate, simply because it's in the back of the cupboard and you need to go in with a tool and screw, so we don't, then of course we open doors and windows" (Birgitte, 50s)*. Because it was too complicated and inconvenient, Birgitte stated that if they felt warm in the house, they would rather air than turn down the heating. However, she also felt that it was easier to control the temperature in this house, than in a house with radiators, especially in relation to airing because radiators would start overheating if they were not turned off. Underfloor heating was in some ways seen as a complicated technology that it was difficult to regulate daily, but in other ways it was also experienced as simple:

"We don't really regulate that much, we just leave it, we regulate the rooms where we don't spend so much time, we turn it down, also in the bedroom (…) we don't really touch it much, so I think it's easy [laughs]" (Pernille, 30s).

Pernille found this heating technology simple because she did not feel the need to regulate much, and still she could keep lower temperatures in specific rooms. As such, they did not regulate the heating frequently, as they had done with radiators in an earlier home. One inconvenience that more of the participants talked about was the delayed reaction of the system when regulating the heat up or down, which meant that the change would be felt around 24 hours later. Therefore the participants would often not regulate the heating when they felt too cold or to warm, or when using rooms that were not used on a daily basis. Claus explained:

" (…) we don't do night-time drop on the heating, and neither do we lower the temperature 1 or 2 degrees when travelling, we leave it, and then it's comfortable to say; well, then you maybe save 100-200 DKK and then you need to heat it up when you return, and then what was the setting (…) we keep the status quo (…) it's easy and convenient and that's also comfort" (Claus, 40s).

Claus found the long reaction time of the heating system very inconvenient and therefore he did not bother to regulate the heating frequently or when the

family went away. He lived with his wife and two teenage children and explained that he cared more about comfort than saving a little money.

Underfloor heating: practices between seasons and rooms

Claus further explained how it could be difficult to regulate the heating when the weather changed:

"(...) it's concrete floor all over and that means that when you turn the heating up, then it needs to warm up all of that concrete before you get the heat (...) you also have a problem, when you have spring/autumn, then if you have a warm summer day it gets really warm, because it also takes 24 hours to cool it down again" (Claus, 40s).

In this way the technology and the materiality of the floor together created an inconvenience in Claus' heating practice and difficulties of adjusting the heating when seasons were changing. Though most of the participants did not regulate the heating daily, there was often some regulation around the summer season. This regulation often included a gendered division of tasks, like for example in Camilla and Behram's case:

"Camilla: No, I never regulate the heating, its Behram's responsibility, when I start chattering teeth and freeze and say; now you need to turn on the bloody heating again, then you do it. R: Yes, but I usually only do it for three months during summer (...) the house is so warm because it's almost sunny for 24 hours" (Camilla, 30s & Behram, 40s).

Behram would turn off the heating during summer and it was also his task to turn it on again when summer was over. This household division of tasks related to heating was also reflected in several other interviews, while some participants said that this division had been opposite, when they lived in a house with radiators. In summer, the sun would often help to heat the house, as Pernille explained: *"(...) here [kitchen-dining area] and in the living room (...) as soon as the sun shines it gets pretty warm, and then I think it turns off when it gets passed a specific temperature" (Pernille, 30s)*. At the moment, Pernille and her husband they did not use all of the rooms in their house; however, they were expecting a baby and anticipated to use all rooms in the future. They primarily heated the open-space kitchen and the living room where the sun

also had an impact, while they seldom regulated the thermostats, but mostly kept the same temperature setting. The bedroom they preferred to be cool. Several participants aimed at having different temperatures in different rooms of the house, according to their use. For example in Marianne's case:

"(…) it's on 23 degrees in here [living room] (…)that's in winter, in summer I turn it down to zero (…) then I have 15 degrees in the bedroom, and in the same way 23 in the bathroom, in there [spare room] I have 20 degrees, because I'm never in there (…) and then the office in there, it's also 21 (…) if it's cold I'd rather close the door in there, and then out where you came in [hallway] it's also 21, and the guest bathroom out there, it's also 20-21" (Marianne, 60s).

Marianne was very aware of the temperature settings in the house and tried to adjust the heating to her needs, living alone in a house where she did not use all of the rooms. She was interested in trying to save money on heating, which is why she wanted to keep the temperature low in the rooms she did not use, and had started to put on a sweater in winter instead of turning the heating up if she felt cold.

3.3 Low-energy houses from 2012-13

The new low-energy houses typically have underfloor heating, and in this way share the same heating technology as the houses above. However, these houses have a tighter building envelope often combined with mechanical ventilation with heat recovery.

Heating practices: between warmth and cold

The participants living in low-energy houses were quite content with their heating system, although they sometimes had troubles regulating and adjusting it. The houses were perceived as satisfactorily warm in general, although even if the house was suitably warm, the floors would sometimes feel cold, as Jacob explained:

"(…) in a more leaky house (…) then you go out into the bathroom and the floor is heated (…) when you come into a new well insulated house here, then the floor is not warmed in the bathrooms (…) the heat cannot leak out and that's exactly what it would do in a more leaky house, so it was like the reverse, you didn't have that nice bare feet on the bathroom floor" (Jacob, 40s).

Jacob lived with his wife and four children in a large two-storey house, which they had designed themselves. He described how moving into the newly built house had changed his perception of comfort in the bathroom, so that he now wore slippers. For the bathrooms, a part of the comfort feeling was connected with warm floors, which are not possible to have in the tight houses. Another participant, Kasper, also found it difficult to adjust the temperature, as he would like the floors in the house to feel warm and not cold as they did sometimes, because the heating control turned off when the house was heated sufficiently. This reflects another bodily perception of warm and cold compared with the older houses with underfloor heating. The participants appreciated the tight houses though, as there was no draught. Jacob said that they could use more of the space in the house, because it was possible to sit close to the tight windows as opposed to their old house. Erik also explained this difference:

"Before we sat in front of a window and felt the cold, and we could feel the cold in the floor too (…) We can't here, it's pleasant when it's cold outside; now we're going home to our comfortably warm house" (Erik, 60s).

Karen, his wife, further said that before she appreciated that they could easily turn up the heating with the radiator, but on the other hand the heating would easily slip out of the house. Therefore she felt more comfortable in this new tight house with even heating. In general, the participants were happy with the heating of the houses, and did not talk much about problems of overheating. However some of the participants did say that the sun had a big effect on

heating the house. Jacob noted that he appreciated feeling the sun warming the house, especially in the spring: *"It's 25 degrees in here now, and I could open a window, but I haven't done that yet, but maybe it's because it's so early in the spring that you're just delighted in the warmth" (Jacob, 40s)*. This demonstrates another perspective on how the seasons are felt in different houses. This house had an overhang, which protected most of the house from overheating in the summer. However, the temperature could sometimes rise quite a lot in these houses, when the sun was out or when having guests and candles were lit, as Tilde explained:

"(...) if we have many guests then it can get warm, because the house is so tight, of course it also has an effect, now I lit candles today, because it was so dark this morning, it heats a lot in a house like this" (Tilde, 30s).

This explained how materials and practices that were not directly linked to the heating practice affect the heating of the house. Tilde lived with her husband and two young children in a newly built house, which they had designed themselves and she found the house very comfortable. She commented also that they had decided their house should face north in order to avoid overheating, and she added that some neighbours had the curtains drawn all the time because the house would get too warm. Erik explained how they had to take care on sunny days:

"In the summer, we have to be very careful that we have pulled the curtains a bit, at the large windows in the kitchen-dining area and the living room, because otherwise it gets too warm in those rooms (...)it can also be necessary to do some extra airing in the morning" (Erik, 60s).

In this way, the close relation between heating and airing was also connected with the changing of seasons. Erik's wife, Karen, further explained that airing was easier in this house, because you could air without regard to the heat controls, as this heating system would not start accelerating because of cold air. Airing and ventilation systems were important for these participants, as the tight house, which provided a comfortably warm indoor temperature most of the year, also meant that the houses needed to be aired. Kasper said that they would open the window in the bedroom in the evening to cool it down before going to bed, as it was difficult to keep the temperature low, which they preferred. Accordingly, practices of airing and heating were again interconnected. In general a mechanical ventilation system was needed as explained by Jacob:

"(…) there's mechanical ventilation with heat recovery… we knew for sure that we wanted that, both because we would not be good enough at airing (…) a tight house, it's simply the recommendation to have that (…) but also there's no doubt that it's an amenity…and at the same time it's nice that when it's warm outside to be free to open windows and doors and get the fresh direct air inside (…) another contact with the garden" (Jacob, 40s).

This explained well how the low-energy houses of the interviewed participants provided a comfortable indoor climate most of the time, with technologies in practices of heating and airing, but at the same time it showed how the manual possibilities were important to the everyday home-making of the participants, for instance by sensing the outdoors.

Heating practices: between senses and technologies

In general, the participants would have their temperature settings at around 20-22 degrees, which they felt was comfortable and normal: *"It's probably not something I think much about, I think it's pretty standard that you have around 21 degrees in a house" (Kasper, 30s)*. In the newer houses, the participants were more aware of temperatures and in the low-energy houses the heating technologies had an explicit role in the daily heating practice, because digital thermostats were visible in each room. The participants focused a lot on the temperatures shown on their thermostats placed around the house. Jacob said they had thermostats in all rooms of the house and this was an important factor in controlling the heating. He explained that they could follow how warm it was in the house, so even though they would have the same temperature setting on the thermostats most of the time, they served as a check to see if the house was warmer or colder than the desired 20 degrees:

"We often look at it, because (…) you can say; oh, it's a little cold in here, then we go and have a look and read off the temperature digitally, it's 21.5 degrees, you trust the number it says and adapt to it – how do I feel in relation to that number (…) I wonder how much difference it would actually be if you had the same control, just without the display" (Jacob, 40s).

Jacob explained how the thermostat technology provided the possibility of comparing bodily sensations with technological facts in the practices of heating and airing; for example if it got too warm in the summer and they needed to

open some windows. Or during a cold spell in winter when the house was somewhat colder than usual; then they could put on a sweater, when feeling cold before leaving the house in the morning reassured that it would be sufficiently warm later on, as Jacob said. Erik also watched the thermostats and was content with the heating system, as the temperature did not differ much from the setting:

"When you get up on a cold winter morning, even though it's minus 20 outside then you have the temperature you need in here…of course, sometimes if it's really cold outside you can see that maybe the temperature is 0.4 degrees lower in the kitchen-dining area than it should be (…) but we don't feel it much" (Erik, 60s).

Erik observed the small variation in indoor temperature, which he said they did not sense too much. In this way, the thermostats played an active role in the thermal comfort of the residents in low-energy houses as they compared their bodily sensations of warmth and cold with the temperature on the thermostats and adjusted their heating practice accordingly.

4. Concluding discussion

The analysis showed how the different materialities and technologies in the three different groups of houses shaped the heating practices of the residents in different ways through their everyday life and how comfort was embedded in these material structures. A clear difference was found between the oldest detached houses, heated mainly by radiators, and the newer houses with underfloor heating throughout the house. This shift in heating technology changed the residents' heating practices and meanings of comfort; how warmth and cold were experienced as comfortable. For residents living in older houses, the daily heating routine was more varied and complex involving different heating technologies and turning on and off the devices according to their daily practices; especially in winter different heating technologies were used to create a comfortably warm indoor temperature. It has similarly been noted by Jalas and Rinkinen (2013) how wood heating is an everyday practice of comfort that reflect daily and annual cycles, such as seasons. Further, Pink and colleagues (Pink et al. 2013) showed how sensory perceptions of cold and warm shifts the everyday practices of family life around the home, according to seasons, as some rooms might be either too cold or too hot. Heating was also closely related to the insulation of the houses; some participants felt their

houses are well insulated and easy to heat with radiators and some participants felt colder and draught in winter, which is why they use both carpets and wood stoves to obtain a comfortable temperature. The heating practices were characterised by an embodied know-how of regulating the heating between cold and warmth as well as fresh air. Cold and warm were sensed with the body and in the material structures of the house such as the walls and the floor that are elements in an on-going evaluation of the indoor temperature. Such sensory knowhow in heat management was also studied by Royston (2014) demonstrating how several of the human senses were used to define a comfortable temperature in a house. The underfloor heating, both in the bathroom of the older houses and throughout the floors of newer houses characterised a bodily sensation of warm feet, which was a strong comfort idea induced by heating technology. This comfort aspect lacked in the new houses, where the material structure would not allow for a floor heated to a level, where the warmth can be felt in the floor material. However, the even heating of this technology was still perceived as the most comfortable. In some cases, the heating technology did not need much regulation, which is why it might be perceived as a simple technology, but the knowledge of regulating the underfloor heating was also perceived as more complex, as some participants found it difficult to adjust it to their needs continuously, while these needs changes with daily activities and seasons.

The bodily know-how of regulating the heating technology was less apparent in the newer houses, where the technology was seen as complicated and in some ways took over the heat regulation, and definition of comfortable temperatures, from the participants. The materials of the house, and the layout, were also issues with this heating technology, as some materials are more difficult to regulate and the rooms of a house are used for different activities at different times and do not necessarily need the same temperature. Therefore some participants found the radiator to be a more simple heating technology, which prompted a more frequent regulation of the heating. In the older houses, the participants differentiated between temperatures in different rooms, depending on what the rooms are used for and how often they are used. The idea of a cold bedroom to sleep in is apparent with many participants across older and newer houses; however, it is more difficult to keep a cold bedroom in the low-energy houses, where the heating is even. In the standard estimations of comfort in housing, it is expected that all rooms in a house are heated in the same way, which also assumes that residents will have the same thermal comfort needs in all rooms, notwithstanding the different everyday activities that are carried out in the rooms. This analysis of everyday practices related to

comfort showed that residents like to differentiate the temperatures in the different rooms throughout the house, although they also appreciate the even heating of the underfloor heating technology. The even heating and lack of draught in these new houses created new possibilities for using the house, as the participants did not feel cold when sitting close to windows and walls. Differences in insulation and ventilation systems of the houses also influenced the heating and comfort perceptions, especially as the sensation of warmth and cold were intimately connected, which also related heating practices with airing practices. Airing was used to cool down the house or to rid it of bad smells and sometimes the heating technologies like wood stoves were the reason for airing, because airing affects the function of the heating technologies, such as radiators starting to overheat. The participants in low-energy houses felt that the technology of mechanical ventilation with heat recovery creates a comfortable and fresh indoor climate. Further, practices of airing were also connected to comfort in creating a relation between the indoors and the outdoors, by letting in fresh air. The seasons and the weather were felt differently in the different housing types; in the older houses outdoor cold temperatures and wind was felt strongly, whereas in the newer tight houses the heat from the sun was felt more.

In conclusion, the analysis demonstrated how comfort was sensed and perceived by residents in different types of detached housing in relation to the material structures of the houses. It showed how materialities and technologies figured in practices of heating together with the competences or know-how of how to operate the technologies or manual ways of attaining a comfortable indoor temperature. This was further linked with the meanings, or ideas, of a comfortable temperature in the home as related to different everyday practices. Furthermore, ideas of a comfortable home, related to temperature as well as fresh air, size and layout of the house, were found to be connected to these material structures of the housing types. Accordingly, the analysis showed how notions of comfort are materialised in dwellings and thereby how changes in building standards influence residents' perceptions and practices of comfort. As such, the differences in material structures of housing and technical installations, reflected in changing building regulations, formed the heating and airing practices of the residents. These changes in practices revolved around perceptions of comfort that did not necessarily match an efficient energy consumption of the house types, and that were furthermore enmeshed with other practices related to comfort as well as other energy-consuming everyday practices. Heating practices change with the development in material structures and technologies, but also with the competences to operate the

house and meanings of a comfortable home, which develops in relation to other societal changes in for example family forms, welfare and prosperity. Accordingly, the development between the three housing types as reflected in the Danish Building Regulations also reflects developments in expectations to standards of houses. This analysis demonstrated how practices related to comfort are formed by developments in materials and technologies, as notions of comfort are embedded in these. This understanding of the relation between social and material structures in perceptions of comfort contribute to ways of understanding the scope of changes in material structures of housing and how these can undermine or support the energy efficiency of dwelling. This insight indicates that there is scope for building standards and policy to influence energy-consuming practices related to comfort by incorporating a more holistic understanding of the comfortable home.

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APPENDICES

Appendix A.

Appendix B.

Appendix C.

Appendix D.

APPENDIX A

Interviewguide

Baggrundsinfo

- Hvem bor der, hvad laver de, alder, husets størrelse, lejer/ejer
- Hvornår flyttede du/I hertil? Hvorfor? (hvor boede du/I før)
    - Hvordan oplevede du/I indflytningen? (skiftet, forventninger)
    - Hvor længe regner du med at bo her? (tidshorisont)
- Hvilke varmekilder er der i huset?

Hverdagslivet – rutinerne – interaktion med teknologier

Vil du vise mig rundt i huset?
- Kan du beskrive forløbet på en almindelig hverdag for dig? (Fx i går)
  Hvilke daglige aktiviteter foregår i boligen? (alene/sammen)
    - Morgen (fx regulering af temperatur, udluftning, aktivitet, påklædning, mad & drikke, bad)
    - Dag (fx regulering af temperatur, udluftning, aktivitet, påklædning, mad & drikke, bad)
    - Aften (fx regulering af temperatur, udluftning, aktivitet, påklædning, mad & drikke, bad)
    - Nat (fx regulering af temperatur, udluftning, aktivitet, påklædning, mad & drikke, bad)

- Regulerer du temperaturen og/eller indeklima i jeres bolig? Har du nogle daglige rutiner?
    - Hvordan regulerer du på varmen i boligen? – hvad med ventilation, udluftning, døre, vinduer?
    - Er der forskelle på, hvad du gør, og hvad de andre beboere gør?
    - Gør du noget anderledes, hvis der kommer gæster?
- Hvad synes du, om temperaturen i din/jeres bolig? Hvad synes du om indeklimaet?
    - Hvad betyder temperaturen/indeklimaet i boligen for dig?
    - Har du boet andre steder, hvor du oplevede temperatur/indeklima anderledes?
    - Kender du nogen, som har et anderledes indeklima/temperatur? (for varmt/koldt, indelukket etc.)
- Hvilke muligheder og begrænsninger, synes du, din bolig giver dig i hverdagen?
- Hvornår og hvordan bruger du de forskellige rum i boligen?
    - Bruger du boligen anderledes om sommeren end om vinteren?
- Føler du dig tilpas i boligen?

- o Hvornår og hvor føler du dig mest tilpas i din bolig?
- Hvad betyder komfort for dig? Hvordan føles komfort?
    - o Hvad er komfort i boligen/hverdagen?
    - o Har du oplevet, din komfort følelse har været anderledes andre steder, du har boet?

Hjemfølelse – hjemliggørelse – renovering

- Hvad synes du om din bolig?
    - o Passer den til din/jeres hverdag/liv?
    - o Lever den op til dine forventninger til en bolig?
- Hvem har indrettet boligen?
    - o Har du/I ændret noget ved boligen?
    - o Har du/I planer om at ændre noget (renovere, bygge om, ommøblering etc.)?
- Hvilket sted i din bolig kan du bedst lide? Hvorfor ?
- Hvad forstår du ved et hjem? Hvad er et hjem for dig?
    - o Hvordan vil du beskrive dit hjem?
- Føler du dig hjemme her? (Hvordan/hvorfor ?)
    - o Har du boet andre steder, hvor du har følt dig mere/mindre hjemme?
    - o Er der andre steder du føler dig hjemme?
- Hvordan hygger du dig? Hvad er hjemlig hygge?
- Hvad betyder dit hus for dig?
- Har du nogen ønsker til et hjem, som du ikke får opfyldt her?
- Hvor længe forestiller du dig at bo her?
    - o Hvor tror du, du bor om 10-20-30 år?
- Hvad er det ideelle hjem for dig?

Energiforbrug – feedback – viden

- Hvordan forstår du dit hus' energitilstand? (god/dårlig – bedre/dårligere ifht. tidligere boliger)
- Tænker du over dit/jeres energi (varme)forbrug?
    - o Hvad er din oplevelse af jeres varme/energiforbrug (samlet, generelt)?
    - o Hvad betyder energiforbrug for dig?
- Følger du dit/jeres forbrug? (hvorfor/hvorfor ikke?)
    - o Kunne du finde på at følge det?
- Er der noget ved dit forbrug, du gerne vil ændre på?
- Hvilke faktorer påvirker dit forbrug?
    - o hvad skulle der til for at ændre noget?

APPENDIX B

Interview guide (translated to English)

Background information

- Who lives there, what do they do, the size of the house, tenant/owner
- When did you move to the house? Why? (where did you live before)
    - How did you experience the move?
    - For how long do you expect to live here?
- What type of heating technologies does the house have?

Everyday life – routines – interactions with technologies

Can you show me around the house?

Can you describe a normal weekday for you? (e.g. yesterday)

- What daily activities are there in the house?
    - Morning (e.g. regulate temperature, airing, activities, clothing, food and drinks, showering)
    - Day (e.g. regulate temperature, airing, activities, clothing, food and drinks, showering)
    - Evening (e.g. regulate temperature, airing, activities, clothing, food and drinks, showering)
    - Night (e.g. regulate temperature, airing, activities, clothing, food and drinks, showering)

- Do you regulate the temperature/indoor climate in you house? Do you have daily routines?
    - How do you regulate the heating in your house? (what about ventilation, airing, doors/windows)
    - Are there differences between what you and other members of the household do?
    - Do you do anything different when you have guests?
- What do you think about the temperature in your house? What do you think about the indoor climate?
    - What does the temperature/indoor climate mean to you?

- o Have you lived in other dwellings, where you experienced the temperature/indoor climate differently?
  - o Do you know someone who has a different temperature/indoor climate? (e.g. too hot/cold)
- What possibilities or limitations does your dwelling give you in daily life?
- When and how do you use the different rooms of your house?
  - o Do you use the dwellings differently in summer and winter?
- Do you feel comfortable in your dwelling?
  - o How and when do you feel most comfortable?
- What does comfort mean to you? How does comfort feel?
  - o What is comfort in your everyday life?
  - o Did you experience your comfort feeling differently in other dwellings?

Feeling and making home (refurbishments)

- What do you think about your dwelling?
  - o Does it fit your everyday/life? Does it meet your expectations?
  - o Who decorated the house?
  - o Did you change anything about the house? Do you have plans to change anything (refurbish, rebuild)
- What spot in your house do you like the best? (why)
- How do you understand a home? What is a home to you?
  - o How would you describe you home?
- Do you feel at home in your house? (how/why)
  - o Have you lived in other dwellings that felt more/less homely to you?
  - o Are there other places where you feel at home?
- How do you feel cosy? What is homely cosiness to you?
- What does your house mean to you?
- Do you have any expectations to a house, which are not met here?
- For how long do you expect to live here?
  - o where do you think you live in 10-20-30 years?
- What is the ideal home to you?

Energiforbrug – feedback – viden

- How do you understand the energy conditions of your house? (good/poor, better worse than other dwellings)
- Do you think about your energy (heat) consumption?
  - o What is your experience of your energy consumption? (overall/in general)
  - o What does energy consumption mean to you?
- Do you follow you consumption? (why/why not)

- o Would you like to follow it if possible?
- Is there anything about your consumption you would like to change?
- What factors influence your energy consumption?
  - o What would it take to change something?

APPENDIX C

Opgave til informanter

Tag 3-5 billeder med et kamera i din bolig over 3 forskellige dage (dvs. 3-5 billeder pr. dag). Billederne skal omhandle følgende:

1) Komfort. Jeg er interesseret i at vide noget om, hvor, hvornår og hvorfor, du føler dig bedst tilpas i din bolig:

  a) Fotografer situationer, steder eller ting, som du forbinder med at føle dig godt tilpas i din bolig i din hverdag.
  b) Fotografer det sted/de steder, hvor du føler dig mest tilpas i din bolig.

2) Hjemlighed. Jeg er interesseret i at vide noget om, hvad der får dig til at føle dig hjemme i din bolig:

  a) Fotografer situationer, steder eller ting, som gør, at du føler dig hjemme i din bolig.
  b) Fotografer det sted/de steder, hvor du føler dig mest hjemme i din bolig.

Det gør ikke noget, at billederne overlapper hinanden, eller at du fotograferer det samme under de forskellige opgaver. Billederne kan både være med eller uden personer.

APPENDIX D

Instructions for participants (translated to English)

Take 3-5 photographs with a camera in your house during 3 different days (3-5 photos each day).

The photos should be about the following:

1) Comfort. I am interested in knowing about where, when and why, you feel most comfortable in your house:
    a. Photograph situations, spots or things, which you relate to feeling comfortable in your house in your everyday life.
    b. Photograph the spot(s) where you feel most comfortable in your house.
2) Homeliness. I am interested in knowing about what makes you feel at home in your house:
    a. Photograph situations, spots or things that make you feel at home in your house.
    b. Photograph the spot(s) where you feel most at home in your house

It does not matter whether the photos overlap or that you photograph the same things/spots during the different tasks. The photos can be with or without persons.