HOME-ING IN ON DOMESTIC ENERGY RESEARCH: HOME COMFORT AND ENERGY DEMAND

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Abstract

Climate change has become a major concern for research and policy in recent decades, and housing has been an important area to tackle as globally this sector accounts for roughly a quarter of energy demand, and its resulting carbon emissions (Staffell *et al.*, 2015). Behaviour change campaigns constitute a significant strand within government responses to reduce carbon emissions. However, on the grounds that environmental impact has little to do with individual's intentions, there is growing interest in the ordinary, rather than the extraordinary (e.g. pro-environmental values), and the socio-material transformation of collective conventions (Shove, 2010). Research emerging from this 'practice turn' is often underpinned by evidence of changing expectations of comfort that undermine improvements in energy efficiency (Hitchings and Lee, 2008; Walker *et al.,* 2016). Notably, research indicates that it is increasingly common for indoor environments to be maintained within a narrow range of temperatures through mechanical heating and cooling, which has significant implications for energy (Shove, 2003).

While these practice-informed studies have successfully offered new avenues for intervention in sustainable consumption, home comfort has been rather narrowly investigated and has often been equated with thermal comfort. Yet expectations of home comfort and household management decisions are much more complex and multifaceted than the desire to be sufficiently warm or cool. A focus on thermal comfort has arguably trivialised other meanings of home comfort that might also be significant to understanding patterns of domestic energy demand. The aim of this thesis therefore was to develop a concept of home comfort to inform understandings, debates and policy related to domestic energy demand, and this thesis presents data from whole-household interviews, house tours, ideal drawings and home energy adviser interviews to address this aim.

A key finding of this thesis was that home comfort is a sense of relaxation and wellbeing, which results from companionship and having some sense of control in the home. Broadening out understandings of occupant satisfaction to account for some of this complexity draws attention to householder's perception of the space per person 'needed' to facilitate comfortably sharing the home with others. Engaging with the trend towards increasing space per person is important because it has the potential to reduce energy demand for space heating without falling back into emphasising technical intervention or questioning the standardisation of thermal comfort. Furthermore, householder's actions to reduce domestic energy demand were found to be tightly, if implicitly, linked to expectations of home comfort and processes of homemaking. It is important to remember that changes to the home are not simply the result of financial rationalisation or attempts to improve thermal comfort. There is certainly scope for the concept of home comfort to inform understanding of domestic energy demand and to highlight alternative strategies to 'steer' towards more sustainable forms of everyday life.

List of Acronyms

ABC Theory = Stern's (2000) Attitude-Behaviour-Context theory

AHP = air-source heat pump

BB = biomass boiler

GHP = ground-source heat pump

ImmerSun = addition to PV installation that diverts surplus electricity to heating hot water

PV = photovoltaic panels

ST = solar thermal

TPB = Theory of Planned Behaviour

WBS = wood-burning stove

WT = wind turbine

Publications, Conference Papers/Presentations, and blogs written during the PhD

JOURNAL ARTICLES

Ellsworth-Krebs, K. and Reid, L. (2016) "Conceptualising energy prosumption: exploring energy production, consumption and microgeneration in Scotland", *Environment and Planning A,* online release.

Ellsworth-Krebs, K., Reid, L., and Hunter, CJ. (2015) "Home-ing in on Domestic Energy Research: 'house,' 'home,' and the importance of ontology", *Energy Research and Social Science*, 6: 100-108.

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CONFERENCE PAPERS/PRESENTATION

Ellsworth-Krebs, K. (2016) "The history of homemaking and expectations of 'normal' home life today" *DEMAND Centre Conference,* Lancaster, 12th-14th April.

Ellsworth-Krebs, K. (2015) "Home-ing in on Domestic Energy Research: the difference between house and home" *Housing Studies Association, annual conference,* York, 8th- 10th April.

Ellsworth-Krebs, K. (2014) "Developing a new conceptual understanding of low energy living" *BEHAVE, biennial conference*, Oxford, 3rd- 4th September.

Ellsworth-Krebs, K. Reid, L., McCauley, D. (2014) "Conceptualising Prosumption: exploring household energy production and consumption in Scotland" *European Network for Housing Researchers, annual conference*, Edinburgh, 1st - 4th July.

Ellsworth-Krebs, K. (2013) "Homes don't use energy people do" *Royal Geographical Society with the Institute of British Geographers, annual conference,* London, 27th - 30th August.

BLOGS

Ellsworth-Krebs, K. (2015) "Our obsession with comfort is the carbon conundrum everyone ignores" on *The Conversation*

Ellsworth-Krebs, K. (2015) "Home-ing in on domestic energy research: moving away from technological house improvements to consider the dynamics of home life" on *Critical Urbanist*

Ellsworth-Krebs, K. (2015) "Why you should start an academic writing group" on *Patter*

1: Introduction: Sustainability and domestic energy demand

The richest 10 per cent of the global population produce nearly half of the carbon emissions, while the poorest half contribute only 10 per cent (Chancel and Piketty, 2015; OXFAM, 2015). Not only is this evidence of gross economic inequality, it is indicative of vastly different experiences of 'normal' lifestyles and of what is essential for a basic quality of life. This thesis is focused on understanding these expectations of 'normal' home life in Scotland, UK. As it is now widely agreed that many familiar ways of life and patterns of consumption associated with them, particularly for the world's richest citizens, are fundamentally unsustainable (Shove and Walker, 2014; Walker *et al.,* 2016), if there is to be any effective response then some transformation or change to new forms of living and working will have to occur.

Domestic energy demand has come to the forefront in climate change debates given that homes account for just under a quarter of energy consumption globally (Staffell *et al.*, 2015). In the UK, 27 per cent of carbon emissions come from the housing sector (DECC, 2015) and given that the UK has legally committed to reduce its carbon emissions by 80 per cent of 1990 levels by 2050 (Climate Change Act 2008) housing is an important sector to tackle. Domestic energy demand is also a topical policy issue in terms of fuel poverty and energy security, which are entangled in climate change discourses. Behaviour change strategies, which encourage citizens to assume greater personal responsibility for their lifestyles and their 'choices' in the marketplace, have dominated responses to climate change (Shove, 2010). However, on the grounds that environmental impact has little to do with individual's intentions there has been a turn in sustainable consumption scholarship in the last decade (Hargreaves *et al.,* 2010; Hitchings *et al.,* 2015a; Ho, 2015; Shove, 2010). This is because individuals that consider themselves to be pro-environmental often still have a higher environmental impact because they are usually from higher socio-economic groups and therefore can, and do, consume more (Gibson *et al*., 2011a).

Instead this thesis contributes to the 'practice turn' in sustainable consumption scholarship, acknowledging that individual activities are inseparable from broader social processes. The focus then is on the construction and transformation of collective conventions (Hards, 2011; Ho, 2015; Moloney and Strengers, 2014; Shove, 2010). In particular, this thesis explored the meanings of home comfort. This focus is informed by the 'practice turn' because this line of enquiry moves away from speaking about 'barriers' and 'drivers' of behaviour (e.g. what discourages or enables householders to invest in energy efficiency retrofitting) (Shove, 2010). Rather investigation considered how collective norms in the home have evolved and the implications these changing expectations of home comfort may have for reducing domestic energy demand. The 'practice turn' is in many ways underpinned by Elizabeth Shove's (2003) seminal book on *Comfort, cleanliness and convenience*, which highlighted that as the materiality of homes evolve (e.g. central heating, air-conditioning) social norms and expectations of indoor environments change as well (e.g.

narrow definition of comfort zone being 18°C to 21°C). Such scholarship challenged the focus on individuals and intentionality in strategies to address climate change, and has sparked a considerable body of writing on comfort by social scientists particularly in consumption, energy and sustainability research.

Whilst comfort has been a rallying concept for social scientists critiquing mainstream techno-centric solutions to reduce energy demand, comfort has arguably also been narrowly defined. Certainly there is more to the home and comfort than being sufficiently warm and a focus on thermal comfort trivialises other meanings of home comfort that might also be significant in understanding patterns of domestic energy demand. Therefore, the aim of this thesis was to develop a concept of home comfort to inform understandings, debates and policy related to domestic energy demand. In order to address this thesis' aim, a series of research objectives (ROs) and research questions (RQs) were developed (Figure 1.1).

Figure 1.1 Thesis Research Objectives and Questions
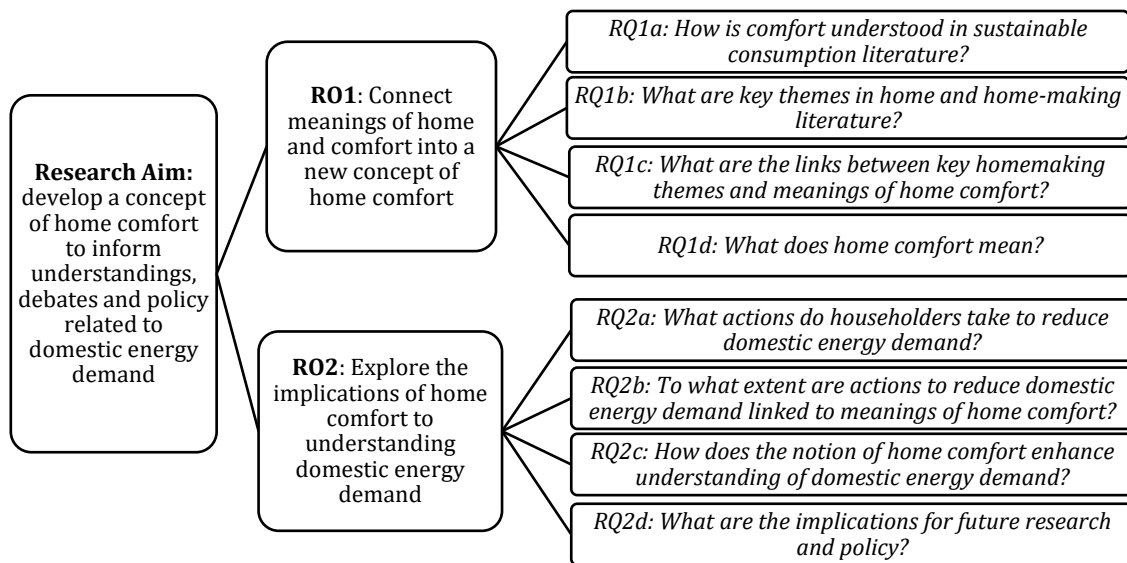
Exploring the meanings of home comfort is an important contribution to domestic energy research. Energy efficiency improvements and everyday activities are not simply driven by the pursuit of thermal comfort or environmental concern, but by more fundamental expectations of what a home is for. Even though the subject of home constitutes a considerable body of interdisciplinary academic work, domestic energy researchers have yet to draw extensively on this scholarship (Aune, 2007; Ellsworth-Krebs *et al.,* 2015; Gram-Hanssen and Darby, 2016). This thesis therefore makes a novel contribution to knowledge by uniting domestic energy research with themes and debates in housing and home scholarship thereby enhancing understanding of everyday considerations that shape domestic energy demand.

The thesis begins with a review of the literature surrounding theories of change for sustainability, providing a context to the development of the ROs, RQs, and methodological approach (Chapter 2). Examining scholarship on sustainable consumption, section 2.2 explores how change is conceptualised and where this thesis is situated in relation to the 'behaviour' and 'practice' debate. Following this, section 2.3 considers how the debates about 'steering' or directing change manifest in domestic energy research and policy. Part of this 'practice turn' has been a growing body of literature on comfort and energy which has challenged current expectations and standards of comfort for being increasingly energy demanding. Furthermore, comfort is a particularly interesting topic in relation to home scholarship considering that the two are often inextricably linked. Section 2.4 thus reviews literature on comfort, finding that the majority of this scholarship narrowly assumes that comfort is only thermal. Subsequently, section 2.5 explores the much more extensive literature on the home and homemaking in order to support the development of the concept of home comfort, and to identify potential links to domestic energy scholarship.

Chapter 3 sets out the methodological approach. Section 3.2 explains the criteria used to choose a qualitative methodology. Section 3.3 outlines the justification for the development of whole-household interviews, house tours, using drawings for data collection, and expert interviews. Informed by this review of methodological literature, section 3.4 provides details of the research instrument design, analysis and ethics procedure and offers some critical reflection on the methodological approach of this thesis. Section 3.5 outlines the sampling strategy and characteristics of the sample, reflecting on the generalisability and biases of this thesis.

Chapter 4 presents the results, exploring how householder's expectations of home comfort and their understanding of energy saving. Sections 4.2 and 4.3 present evidence on the meanings of comfort and home, respectively (contributing to RO1). In so doing, a new framework to understand occupant satisfaction or home comfort is developed. Section 4.4 explores the findings in relation to what householders did to save energy, specifically how energy retrofitting related to moments in homemaking (contributing to RO2). Section 4.5 discusses the extent to which comfort is considered by Scottish home energy advisers in order to gauge the novelty of a broader framing of home comfort in a practical and policy energy context (contributing to RO2). Section 4.6, the conclusion, brings together common themes within each of the sections.

Chapter 5 discusses the results in the context of wider literature. To address the overall aim and explore this thesis' contribution to knowledge, the chapter is centred on linking meanings of home and comfort to domestic energy demand. This chapter weaves together energy and housing scholarship, drawing heavily on literature about the home which has received limited attention in

the energy demand discourse. Section 5.2 explores householder's understanding of the meanings of home comfort and links this to existing scholarship (in response to RO1). Section 5.3 begins to connect expectations of home comfort with understanding domestic energy demand by connecting the home themes with meanings of comfort (RO1). Section 5.4 presents a new framework of home comfort and the implications of understanding home comfort to domestic energy demand (contributing to RO2). Section 5.5, offers some critical reflection on the methodological approach. The final part of the chapter, section 5.6, summarises the findings of this thesis.

Chapter 6 examines to what extent this thesis met its aim, ROs, and RQs and offers some suggestions for future research.

2: Literature Review: Setting the scene for studying home comfort

2.1 Introduction

This chapter begins by situating the aim of developing a concept of home comfort in the context of wider debates on theories of change in sustainable consumption scholarship. This shift to an explicit interest in the ordinary (e.g. social, material, practice elements of everyday practices), rather than the extraordinary (e.g. pro-environmental values), will therefore be discussed in section 2.2, providing a context as to why 'home-ing' in on domestic energy research would be desirable (section 2.3). Following on from this, section 2.4 presents a review of key literature on comfort, a topic that has received increasing attention in energy scholarship, addressing RQ1a. Then to advance understandings of home comfort, section 2.5 discusses key themes in the making and meanings of home, contributing to RQ1b. This chapter thus sets out a justification and foundation to develop the concept of home comfort (RO1) and explore its implications for domestic energy research (RO2).

2.2 Sustainable Consumption and Theories of Change

Behaviour change strategies have dominated responses to climate change (Lutzenhiser and Shove, 1999; Schweber and Leiringer, 2012; Shove, 2010; Shove and Walker, 2014; Sovacool, 2014; Stern, 1992). Under this behavioural approach, reducing environmental impact is achieved through educating and incentivising individual's behaviour (Moloney and Strengers, 2014). Thus, behaviour change campaigns encourage citizens to assume greater personal responsibility for their lifestyles and their 'choices' in the marketplace. Yet the dominance of behaviour change has been critiqued in sustainable consumption scholarship as it arguably restricts the scope of how to live sustainably, how to direct such behaviour, and who should make this change (Moloney and Strengers, 2014; Shove, 2010). Consequently, a 'practice turn' is widely documented in sustainable consumption scholarship, which proposes that individual activities are inseparable from broader social processes and draws attention to more mundane aspects of everyday life that shape consumption (Hards, 2011; Ho, 2015; Moloney and Strengers, 2014; Shove, 2010; Shove and Walker, 2014; Hitchings *et al.,* 2015a).

This section of the chapter is therefore structured around this key debate in sustainable consumption scholarship: whether to assume behaviour or practice is the basic unit of analysis. Explaining the decision to adopt a practice-informed approach is important because this affects the theoretical and methodological approach of this thesis. Stern's (2000) Attitude-Behaviour-Context (ABC) theory and Shove and colleagues' (2012) practice theory are considered because they are representative of, and often-cited in, their respective research areas. In this section, the

theoretical and methodological underpinnings of each theory are explored in order to explain the importance of adopting a behaviour or practice approach to understanding and developing strategies to reduce domestic energy demand.

2.2.1 The ABC theory

Stern's (2000) ABC theory combines a few of the best-know approaches from psychology that are used to explain human behaviour, the most prominent of these being Ajzen's (1991) Theory of Planned Behaviour (TPB). Methodologically, the TPB generally uses surveys with questions (e.g. on attitude toward a behaviour, subjective norms and perceived behaviour control) aimed at providing numerical values to put into an equation for behavioural intention (Ajzen, 1988). The questionnaire approach is valuable because it is cost-effective, has high external validity and is useful in studying the relationships between variables (Steg *et al.*, 2012). The TPB model has been widely applied and validated by numerous empirical studies, with reports of an ability to predict relationships between variables and in situations it was not designed for (Armitage and Conner, 2001; Jackson, 2005). The TPB has been applied particularly in psychology, environmental-psychology and health-related studies, but has been widely critiqued as belonging to the family of rational choice models and for ignoring that people frequently behave in automatic or habitual ways (Stern, 1992). The TPB has also been critiqued for assuming that the best way to predict behaviour is to ask individuals if they intend to behave in a certain way, which cannot take into account what individuals know about their (in)ability to undertake an action (Jackson, 2005). Nonetheless, the TPB is often the foundation for many more complex behaviour models used today (Jackson, 2005). These criticisms are important considering that even though Stern's (2000) ABC theory aims to address some of these concerns by adding contextual factors and habits into the framework, the ABC theory reproduces the core assumptions of the TPB.

Stern's (2000) approach understands behaviour (B) as a function of the actor (A) and context (C) (Figure 2.1).

Figure 2.1 Elements of behaviour in Stern's (2000) ABC theory (Zepeda and Deal (2009: 703)

19
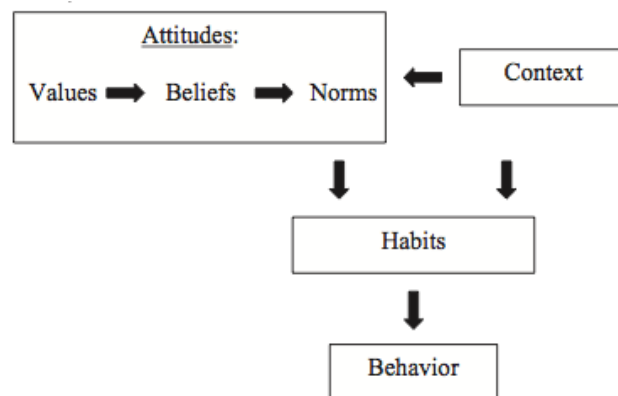
Stern (2000) grouped causal variables into four major types (Figure 2.1): *attitudinal factors* (including norms, beliefs, values, and perceived control), *contextual factors* (including government regulations, monetary incentives, constraints from technology or the built environment, and the broader economic/social/political context), *personal capabilities* (including knowledge and skills required for a particular action, time, general capabilities and resources) and *habit*. While the ABC theory adds the influence of structure by including 'contextual factors' a leaning toward agency of the individual is still evident as Stern explicitly stated that "understanding [behaviours] requires an actor-oriented approach" (2000: 422).

Empirical research informed by the ABC theory is predominantly applied to understanding and evaluating individual's values in relation to engaging in pro-environmental behaviours (Gatersleben *et al.*, 2002; Hares *et al.,* 2010; Lorenzoni *et al.*, 2007; Zepeda and Deal, 2009). Research in this area initially tended to employ large scale quantitative survey methods, however more mixed methods and qualitative approaches (e.g. qualitative questions in surveys, interviews, focus groups) have appeared in recent research (Lorenzoni et al., 2007). Nonetheless, common measures of pro-environmental behaviour are based on responses to how often respondents perform certain behaviours (e.g. from a list usually developed by the researcher), which may be problematic for several reasons (Gatersleben *et al.*, 2002). For instance, respondents may not give accurate accounts of their behaviour due to response bias (e.g. conscious or unconscious perception of cultural norms)(Ibid, 2002).

Furthermore, the identification of certain activities as 'pro-environmental' is problematic. Considering that a large proportion of the world's non-privileged population engages in activities such as cycling, growing their own food, and abstaining from flying, the categorisation critically overlooks how socio-economic conditions allow certain activities to be identified as pro-environmental, and not others. Begging the question of whether a particular activity is environmental because of the intention or the impact (e.g. is not flying because you cannot afford to still a pro-environmental behaviour?). Indeed, individuals frequently involved in activities that may be deemed comparatively low impact or pro-environmental (e.g. layering clothing instead of turning up the thermostat) have been found to be indifferent to characterising these actions in these terms (Hitchings *et al.,* 2015a). This is the basis for one of the main critiques of pro-environmental behaviour research because individuals who identify themselves as engaging in pro-environmental behaviours often have higher environmental impacts because they are generally from higher socio-economic groups and therefore consume more (Gibson *et al.*, 2011a). Furthermore, lower impact choices are not always, or often, self-evident (e.g. is it better to use plastic supermarket bags as bin liners or buy reusable bags and dedicated bin liners)(Gibson *et al*., 2011b). Doing the 'right' thing is further complicated because the impact of certain behaviours can vary widely. Even for one electronic appliance, a study compared different brands in the same

price bracket and found that energy consumption can vary 400 per cent (Gibson *et al.*, 2011a). Consequently, there is little evidence that an individual's environmental impact is linked to that individual's concern or intentions to reduce their footprint (Gatersleben *et al.*, 2002; Gibson *et al.*, 2011a; Paling and Winter, 2011).

Evidence of this approach, and its dominance, is apparent from a review of carbon reduction initiatives (Shove, 2010) with the majority of interventions being focused on behaviour change and the individual (Southerton *et al.*, 2011). The ABC theory, derived from psychological and economistic ways of understanding human action, results in understanding behaviour as the outcome of mental processes (e.g. attitude, intent, values)(Hitchings *et al.*, 2015a; Shove, 2010). Framed in this way, government's task is to encourage citizens to adopt pro-environmental behaviours (e.g. by removing barriers such as poor mass transit infrastructure and funding awareness raising campaigns). This subsequently places the burden to bring about change onto individuals rather than the government. Explanations of energy demand reflect and reproduce contrasting theories of society and social change (Shove and Walker, 2014) and the 'practice turn' represents a growing group of researchers less inclined to prioritise mental processes (e.g. sociologists, geographers, historians). The next section thus turns to explaining the alternative framing of change offered by social practice theorists.

2.2.2 Social Practice Theory

Practice theories constitute a broad theoretical approach. In this field, practices are generally understood as "historically and geographically recurring localized occurrences" (Nicolini, 2012: 10). Practice approaches became increasingly influential starting in the 1970s and have been applied to analyse a broad range of phenomena (e.g. science, policy making, culture, and consumption)(Ibid, 2012). Bourdieu (1984) and Giddens (1984) are generally seen as the founders of the approach as they proposed that practices should be the basic units of study for social science. There are many practice theories, but research in the sustainability arena is clearly dominated by Shove and colleagues' social practice theory and hereafter it is the focus as it is most relevant to the research aims of this thesis (hereafter references to 'practice theory', 'practice theorists' and 'practice-informed' research generally refer to social practice theory).

The development of social practice theory is based on an eclectic range of topics (e.g. the history of showering in the UK (Hand *et al.*, 2005), Nordic walking in Finland (Shove and Pantzar, 2005), and cars in the US (Shove *et al.*, 2012)) in an attempt to illuminate the elements that make up practices and how practices form, stabilize, evolve and disappear. According to Shove *et al.'s* (2012) framework, practices are made up of three elements: *materials* (including things, technology, and the physical stuff that makes up objects), *competences* (skill, know-how, and technique), and *meanings* (symbolic meanings, ideas and aspirations) (Shove *et al.*, 2012: 14)

(Figure 2.2). Moreover, practices are generally conceptualised as bundles of practices to account for the complexity and interconnected nature of everyday life. For example, driving is influenced by working and shopping practices, but also by other forms of transport such as being able to cycle or take public transportation.

Figure 2.2 A practice as a constellation of groupings of elements, interconnected through a multitude of links (Kuijer, 2014: 52)

competencies

meanings   materials
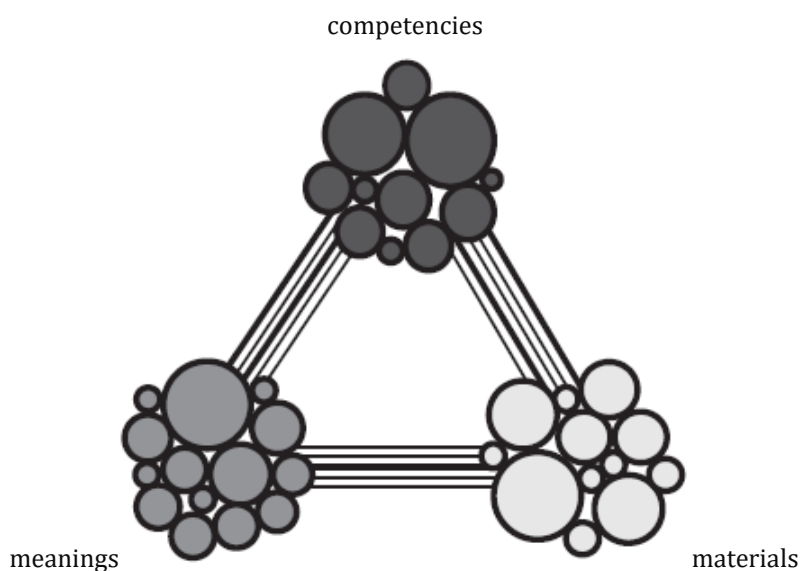
While these elements may be similar to the causal variables identified in Stern's (2000) ABC theory (i.e. attitudinal factors and meaning, contextual factors and materials, personal capabilities and competencies), explaining an individual's action is *not* the intent. Shove (2010, 2012; Shove and Walker, 2014) has been consistently critical of research that uses the term practice to simply mean 'what individual's do' because this equates practice largely with behaviour. This is because practice theorists argue that tacit knowledge and embodied experiences, which are not always dependent on conscious reflection, affect individual's performances of practices and understandings of situations (Hui and Schafer, 2016).

Yet several concerns have arisen as a result of the lack of agency awarded to individuals (Watson, 2012). For instance, that social practice theory is better at accounting for stability than understanding change (e.g. if actor(s) not identified for initiating change)(Watson, 2012). One of the main criticisms then, partly following on from the topic of agency, is that it is difficult to translate findings into practical or policy recommendations. Indeed, Cool Biz is the most often cited example in practice studies of an effective government scheme to reduce energy demand but it was still designed and understood as an exercise in raising environmental awareness (Shove, 2016). Cool Biz was introduced by the Japanese government in 2005 as part of a wider effort to reduce carbon emissions and was designed to persuade organisations to use less air conditioning.

From the example set in government offices, many companies followed suit by letting indoor temperatures rise to 28°C and refashioning business attire so that it was no longer normal to wear a jacket and tie during the summer. Nonetheless, Shove (2016) suggested that Cool Biz was accidentally effective; the mechanisms of change were misunderstood. In other words, Cool Biz reduced energy demand but not because of increasing environmental awareness (Ibid, 2016). Rather it represented an intervention in the social process of keeping cool, redefining normality and codes of office life (Ibid, 2016). Shove (2016) argued that Cool Biz could have gone further. For example by re-writing building codes to reflect the assumption that there would be no heating or cooling between 20°C and 28°C. Yet this potential was not considered because of the 'imagined role of policy' being to persuade individuals of the benefits of a low impact lifestyle.

Shove and Walker (2014) have identified three key propositions which the 'practice turn' signals. Firstly, it is assumed that energy is not used for its own sake but as part of accomplishing social practices (Ibid, 2014). This is in contrast to analysis which considers the production and consumption of energy as a generic resource (e.g. interest in reducing electricity demand without considering the different activities electricity enables and how intervening in these may therefore vary).

Secondly, practice theorists acknowledge that energy demand is shaped by material arrangements (Ibid, 2014). Rather than focusing on actors, their intentions or sense of control (i.e. ABC theory or research informed by psychology or economics), it is recognised that actions are materially scripted and technologies matter (e.g. power stations, the grid, plumbing, building regulations are co-constructed with social norms and conventions). Often practice theorists reference the importance of this idea by stressing that their own understanding and analysis is 'socio-technical' or 'socio-material'. To study the socio-materiality of everyday practices or describe, explain and interpret social life for sustainable consumption research practice theorists draw upon a broad range of sources: including but not limited to technical literature, historical accounts, consumer reports, advertisements, interviews, visual analysis, and diaries (Shove, 2003; Shove *et al.,* 2007; Shove *et al.,* 2012; Hui and Schafer, 2016).

Finally, is the assertion that policy impacts energy demand by modifying and transforming material arrangements, practices and social orders, not by simply changing pro-environmental values or awareness (Shove and Walker, 2014). It is important to recognise that policies that are designed to deliver similar services, but with less energy, are not neutral. Rather these sorts of policies play an important part in *reproducing* the status quo and in legitimising current material arrangements and practices. Taking practice as the basic unit of analysis is thus positioned as reflecting a social theoretical account of energy, society and social change that is distinct from that which underpins behaviour or ABC-informed approaches. Subsequently, the aim is to understand

how taken-for-granted 'normal' ways of living evolve and then influence this process so that more sustainable practices are adopted in the future without the individuals necessarily needing to consider what they 'ought' to do (Hitchings *et al.,* 2015a). In other words, the task is to 'steer' cultural change so that societies eventually are living in ways that require less energy.

Kuijer (2014) provides an example of 'steering' practices. The material features of our homes script available practices and Kuijer (2014) redesigns the components of the bathroom to facilitate an alternative form of bathing by researching individual's preferences and 'needs' for bathing and developing a way that these can be met in a new way, which she calls 'splashing' (Figure 2.3). Participants were asked to imagine 'splashing' was their normal way of bathing and requires a new vocabulary of skills, meanings and materials (e.g. pouring, scoops, seats and basins), and may be better explained by Kuijer's (2014) visual impressions (Figure 2.3).

Figure 2.3 Visual impression of 'splash' prototype (Kuijer, 2014: 132-3)
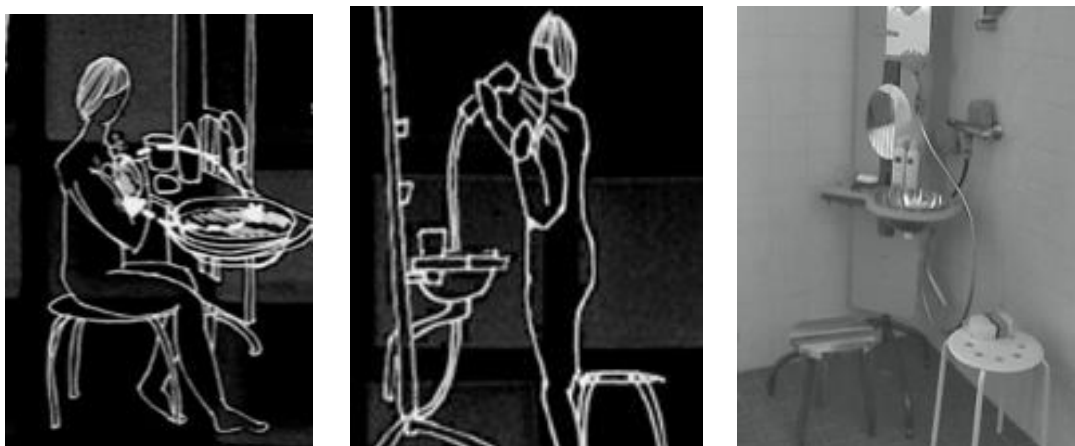
"Washing from a bucket might not seem acceptable at first, but it was developed into a proto-practice that is acceptable for at least a number of people and shows potential to become so for more" (Kuijer, 2014: 170). While the expansion of 'splashing' would still rely on consumers investing in a new bathroom design, reduction in energy demand (i.e. for hot water production) is not dependent on an improvement in efficiency or marketing on environmental or financial grounds. Instead this is an example of transforming the materials, meanings and competencies of 'normal' bathing practices, which is generally less energy intensive than the current configuration (e.g. 'splashing' resulted in substantially less water use compared to having a shower because there is less need to keep the water running).

Ultimately, social practice theorists move away from focusing on the consumer or end user as the (only) target of intervention (e.g. encouraging pro-environmental values, information provision, financial incentives). Rather there is considerable interest by practice theorists in investigating

'steering' by framing policy making as a practice or exploring how non-energy policy initiatives filter through different institutions (Shove and Walker, 2014). By asking different questions, new solutions and strategies for deliberate intervention arise. One example is to think about the patterns of synchronisation that result in peak loads and the potential for reducing peaks, such as reducing energy intensity of the peak commute by working with employers to relax strict 9am to 5pm working hours (Walker, 2014). The result being that the peak is more spread out and therefore puts less stress on the energy system. Recognising that non-energy policies have implications for energy policies and recommending that businesses offer more flexible working hours can make 'normal' commuting practices less energy-intensive but does not rely on persuading individuals of what they 'ought' to do.

For practice theorists the concept of steering has to be broader and their conceptualisation of demand means that what is seen by policy makers as 'energy policy' only covers a small area of intervention that relates to the evolution of energy demand (Reardon *et al.,* 2016). This understanding of steering fits with the interest in complex systems and considering the growing evidence that environmental impact has little to do with individual's intentions (Hargreaves *et al.*, 2010; Hitchings *et al.,* 2015a). Therefore, this thesis acknowledges that individual activities are inseparable from broader social processes and takes an interest in the construction and transformation of collective conventions (Hards, 2013; Ho, 2015; Moloney and Strengers, 2014; Shove, 2010).

2.2.3 Comparing ABC Theory and Social Practice Theory

Both ABC theory and social practice theory have been applauded for their ability to negotiate the actor-structure debate (Jackson, 2005; Nicolini, 2012 respectively). This is likely because they combine elements that give weight to the influence of both the individual and structure (e.g. both consider how the individual has an influence in terms of personal capabilities/competences as well as the influence of structure with the inclusion of contextual factors/materials). A closer inspection of what makes up the elements of each theory also suggests that Stern (2000) and Shove *et al.* (2012) address the actor-structure debate in different ways and diverge on whether individuals or social structures have greater agency. Table 2.1 puts the elements of ABC theory (Figure 2.1) and social practice theory (Figure 2.2) side-by-side and this highlights the obvious similarities between attitudinal factors and meaning, contextual factors and materials, and personal capabilities and competences. However, a brief exploration into how Stern (2000) and Shove *et al.* (2012) discuss these elements further emphasises the difference in their intended use.

Table 2.1 Elements of ABC Theory and Social Practice Theory

Stern's ABC Theory	Shove *et al.*'s Social Practice Theory
attitudinal factors- norms, values, perceived control	**meanings**- symbolic meanings, aspirations, states of emotion
contextual factors- government regulations, constraints from technology or the built environment, and the broader economic/social/political context	**materials**- things, technology, objects, infrastructures, tools, hardware, the body itself, the psychical stuff that makes up objects
personal capabilities- knowledge/skills required for a particular action, time, general capabilities/resources	**competences**- skill, know-how and technique
habit	

Attitudinal factors and meanings. In the ABC theory, attitudinal factors are dependent and determined by the individual and their perception of both others' opinion of a behaviour (subjective norm) and their own ability to do that behaviour (perceived control) (Ajzen, 1991; Stern, 2000). Shove *et al.* (2012) discuss the relationship between the meaning of practices and the status of individuals; by enacting some practices and not others, practitioners locate themselves within society and simultaneously reproduce specific structures of order and meaning. However, social practice theorists do not focus on understanding what taking part in a practice says about an individual. By contrast Shove *et al.* (2012) look to determine how meanings, such as being cool or healthy, get connected to practices and how practices determine other practices. Thus, both theories recognise the importance of cultural traditions and norms that influence meanings and attitudes towards certain behaviours and practices. However, ABC theory and social practice theory are interested in the impact this has on the individual and practice, respectively.

Contextual factors and materials. Stern's (2000) description of contextual factors is arguably much broader than the idea of materials because it includes community expectations, interpersonal persuasion, social/economic/political context such as the price of oil or sensitivity of government to interest group pressure. Whereas, social practice theory attends much more to the agency of stuff, accepting that objects also act on individuals. For example, how an objects' design and what it is made of impacts on how an individual may choose to use it (Shove *et al.*, 2012). Both theories aim to account for the impact of the built environment, infrastructure and technology in influencing behaviours and practices. ABC theory deals much more with the *social* context, accepting a view that individuals and groups of individuals make up social structures that may constrain behaviour.

Personal capabilities and competences. Stern (2000) found that an individual's attitudes have little explanatory power in some cases. Thus, the inclusion of personal capabilities (specific know-how and general resources/capabilities) in the ABC theory is to account for socio-economic variables because age, education, income and race are seen as indicators of these personal capabilities (Stern, 2000). The importance of competence in social practice theory is to capture how practitioners reproduce and replicate practices through individual enactments that are dependent on tacit know-how, skills and technique of the individual (Shove *et al.*, 2012). From Stern's (2000) explanation for the inclusion of personal capabilities, the interest is seen to be not in know-how *per se* but what these capabilities tell us about an individuals' socio-economic status. Shove *et al.,* (2012), instead, are interested in how know-how and techniques move and transform between practitioners and thus transform practices.

Habit. There is not much said about habit or routine by Stern, it is included because of the recognition that "behaviour change often requires breaking old habits and becomes established by creating new ones" (2000: 417). However, this inclusion of habit was a point of contention raised by Shove (2010), who argued that including habit as a causal factor of behaviour is confusing because it follows that habit is not itself behaviour. In social practice theory, habits are recognised as practices that are "recurrently and relatively consistently reproduced" (Shove, 2012: 101).

This more in-depth comparison of the elements that make up ABC theory and social practice theory reinforces that the former attends more to the agency of individuals and the latter more to structure. Stern (2000) attends much more to the actor than to structure, emphasising attitudes and values in predicting behaviour. Shove *et al.* (2012) acknowledge the agency of individuals as they undertake a practice and may alter it; yet much more attention is given to forces outside an individual's control. How each theory defines the basic unit of study further highlights this distinction. The term behaviour is used loosely by Stern (2000) to mean an individual's action, activity or what people do (similar to usage by many other writers in psychology and sustainability (Coleman, 2011) and by sociologists as well (Gove, 1995)). By comparison, Shove (2012) is very clear that even though others (Crosbie and Guy, 2008; Gram-Hanssen, 2010; Hargreaves, 2011) have used practice equally loosely to mean 'what people do' this is not the intended usage in social practice theory. Practices have an identity that exists historically and geographically, while the elements and character of a practice may differ across time and space, a practice is not simply made up of one individual's action at one point in time (Shove, 2012). Thus, ABC theory is more actor-centred and social practice theory is more structure and context focused. This distinction influences the methods, findings and recommendations of each theory,

and how this informs and inspires the theoretical and methodological approach of this thesis is important as reflected on in the summary below.

2.2.4 Summary

To summarise, adopting 'behaviour' or 'practice' as the basic unit of analysis influences the methods, findings and policy recommendations of the research. ABC theory and social practice theory do different things: their conceptualisations of change emerge from different perspectives, they ask different questions, and this leads to the use of different methods. In turn, the methods and what is seen as appropriate evidence impacts on the output and recommendations that emerge from research. Social practice theorists contend that ABC theory is too linear and simplistic to capture the complexity of social change (Shove, 2010). Proposed as a weakness, it is also suggested to be part of why the ABC is the dominant paradigm in contemporary environmental policy because it generated results which policy-makers can handle (Shove, 2010).

The implications of using these theories to understand and predict how to bring about change in the context of domestic energy demand thus leads onto different recommendations for deliberate intervention to reduce demand. Recommendations from ABC-informed research likely lead to more actor-focused forms of intervention, such as encouraging uptake of efficient appliances or tips on how to reduce energy consumption at home. Recommendations from social practice theory research are different in nature. For example, understanding 'normal' expectations of home or challenging the bundles of practices connected to changing expectations of indoor temperatures (Shove, 2003, 2016).

This thesis is inspired by certain arguments associated with social practice, especially the necessity of attending to the evolution of cultural conventions. Furthermore, this thesis turns away from the language of behaviour change that places the burden of moving towards less resource intense lifestyles onto citizens and their 'choices' in the marketplace. Being informed by social practice theory means that this thesis asks different questions from the majority of domestic energy research which is informed by techno-economic thinking (which will be demonstrated and elaborated on in the next section). In particular, this thesis explores how householders think about 'home comfort' and what they want from their homes. This focus on meanings of home comfort shifts discussion from speaking about 'barriers' and 'drivers' of behaviour. The intention then is not to contribute to the development of social practice theory *per se* but to the recent expansion of sustainable consumption research that offers new perspectives on explaining and intervening in energy demand (also explained further in the next section). With a practice-informed approach identified for this thesis, the next section turns to reviewing domestic energy research and the implications of adopting a practice approach in this context.

2.3 Home-ing in on domestic energy research

Domestic energy demand has long been an object of research for economists, engineers, and building scientists, and in the past quarter of a century there has been a growth in contributions from social scientists, including psychologists, sociologists, geographers and historians (Schweber and Leiringer, 2012; Sovacool, 2014). In part informed by the 'practice turn' in sustainable consumption research, social scientists writing on domestic energy and home heating have increasingly challenged the dominance of the mainstream techno-economic approach which favours improving design, technologies, or other physical aspects of domestic buildings. Domestic energy demand is widely recognized to vary considerably by country, climate, building type, and even when these factors are the same, occupancy patterns and inhabitant's lifestyles create a significant variation (Gill *et al.*, 2010; Stevenson and Leaman, 2010). Thus, energy demand is not solely dependent on the design and physical features of a building, social expectations and norms shape everyday routines which have energy implications (Shove, 2003).

This section explores the theoretical and methodological assumptions underpinning these diverse contributions, arguing that there is a lack of critical engagement with *what* is being investigated in domestic energy research, specifically the basic unit of analysis. Terms such as 'housing', 'household', 'home', 'house', 'domestic' and 'dwelling' appear to be used interchangeably. Whilst the meanings of, and distinction between these terms has received attention elsewhere, they have not been fully explored within the context of domestic energy scholarship. Addressing this, Ellsworth-Krebs *et al.* (2015) argued that notions of home are instinctively linked to more than the house, and such understandings may be useful to challenge the dominance of the mainstream techno-economic approach which focuses on improving design, technologies, or other physical aspects of domestic buildings. Accordingly, this section brings insights from home scholarship: the widely agreed difference between house and home and significant social aspects of home (e.g. comfort, identity, security, privacy) to help progress domestic energy research. Energy demand is not solely dependent on the design and physical features of a building; social expectations and norms also shape everyday routines which has energy implications (Shove, 2003). Energy research would therefore benefit from adopting the home (and all the baggage the term comes with) as the focus for investigation, highlighting an appreciation for the socio-material nature of domestic energy demand. The current techno-economic approach narrows strategies for intervention, whereas consideration of demand as the result of a socio-material system presents a broader range of strategies (e.g. targeting social conventions, meanings of comfort, fashion and clothing) (Shove, 2003; 2010).

This section begins by exploring the dominant approach to domestic energy research, that which prioritises the 'house' revealing its theoretical and methodological assumptions (section 2.3.1).

Section 2.3.2 moves on to explore the literatures related to the 'home' and connecting key themes back to domestic energy research.

2.3.1 Scholarship on the 'house' and energy

In this section the term 'house' is used to signify a particular, dominant, way of approaching the topic of energy demand and suggest that this reflects certain assumptions. These assumptions have implications for the methodological approaches, how householders are perceived, how 'success' is measured, and intervention strategies in domestic energy research.

A house is the physical building where people live (including flats/apartments in this sense), so research is concerned with material aspects, such as construction, energy supply, heating or cooling system, and appliances. Accordingly, studies of the house have been undertaken mainly by building scientists, engineers and architects (Lutzenhiser and Shove, 1999) who typically employ quantitative and applied methods (e.g. large quantitative surveys, modelling and statistics). For example, modelling designs to improve efficiency or estimating energy demand based on building features and the local climate (Kelly *et al.*, 2012; Natarajan and Levermore, 2007; Reeves *et al.*, 2010).

These contributions are important to regulation and development of policy instruments (Murphy *et al.*, 2012), making buildings, heating/cooling systems and appliances more efficient as well as reducing carbon emissions and inefficiencies in the supply system. Indeed, examples of improvements in energy efficiency are prolific. According to modelling of national energy consumption in the UK, the mean average energy use per home fell from 23,900 to 16,700kWh between 1970 and 2011 (DECC, 2013). Yet, what energy is used for has changed dramatically in the past 40 years with the heating of more rooms to higher temperatures, as well as an increase in the number and use of appliances (Ibid, 2013). Further, developments in economics, law, public policy, business and urban planning has contributed to the development of mechanisms for the delivery and uptake of building improvements (Sovacool, 2014). Again, this research is generally underpinned by quantitative methods, such as large-scale surveys and analysis of secondary data sets although qualitative post-occupancy evaluation is also used (Zimmerman and Martin, 2001), albeit modestly.

By focusing on only physical elements, studies of the house are, at best, reliant on unsophisticated understandings of the role of occupants, and, at worst, assume that building users are passive. Typically, householders are recognised as contributing to the performance gap, but addressing this variance is seen as the responsibility of other disciplines (Summerfield and Lowe, 2012). In part, this may be explained because positivist methodologies may struggle to make sense of or account for these complexities. Evidence of householders being perceived as passive is derived

from the expectation that householders ought to use the house as 'intended' or designed to be used (Kelly *et al.*, 2012). If modelled demand does not match actual performance the response is to adapt design rather than engage householders. For instance, there is considerable literature on the importance of designing an appropriate level of control, on making sure interfaces are user-friendly, and in determining what level of control makes occupants most tolerant of their indoor climate (Leaman and Bordass, 2001; Li and Lim, 2013). Indeed, the intention of building performance models is to give a measure of energy efficiency which is independent from the influence of occupant's behaviours (Kelly *et al.*, 2012).

Building standards assume that several criteria are needed in combination to achieve a comfortable indoor environment: air and radiant temperature, humidity, air movement, individual clothing and level of activity all play a part (e.g. ASHRAE and ISO standards[1]). Furthermore, there is a dominant focus on thermal comfort and temperature in particular; with comfort becoming commonly defined according to Fanger's (1970) "comfort equation" which demonstrated that 21°C is the optimal temperature for thermal comfort. While Fanger (1970) clearly understood comfort as the result of complex interaction between multiple criteria, his work helped lead to the perception and acceptance of comfort as a definable condition and establishment of universal standards for the indoor environment (Shove, 2003).

By considering building users as passive and occupant satisfaction as a clearly defined standard, it follows that the strategy for intervention (for affordable, secure and low-carbon domestic energy) would be to target the house and pursue mechanical solutions. As Chappells and Shove (2004: 11, emphasis added) argued "if comfort is thought of as a *definable* condition, the aim is to *design* indoor environments that deliver it". Studies of the house assume that comfort is universally definable (i.e. the comfort zone, 18 to 21°C) and the main goal thus is to make houses that can most efficiently deliver these conditions. This standardisation of comfort is part and parcel of the 'house approach' because it centres the goal of reducing energy demand around design and technical innovation ignoring that material and social elements of the home are co-constructing. The result is a growing worldwide industry in heating and cooling technologies, and comfort standards for homes that are hard to achieve without such technology. Part of this includes research on policy mechanisms or how to encourage uptake of insulation or micro-generation technologies but the target of intervention is still the house and 'house researchers' are not concerned with understanding how people use energy or what energy is for (Keirstead, 2007; Mitchell and Connor, 2004; Shove and Walker, 2014).

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[1] ASHRAE (American Society for Heating, Refrigeration and Air-Condition Engineers) and ISO (International Organisation for Standardisation) are both examples of organisations setting 'standards for thermal environmental conditions for human occupancy' which are becoming increasingly recognised and adopted internationally.

This section has set out the dominant approach to domestic energy research, and the implications of theoretical and methodological assumptions of positivist lines of enquiry that are focused on physical drivers of energy demand. These methodologies are undoubtedly valuable, for instance, in designing, and assessing new technologies and more efficient buildings. However, a performance gap between modelled building performance and actual energy demand is widely recognised (Druckman *et al.*, 2011; Kelly *et al.*, 2012) and this approach is not suited to incorporating the complexity of social drivers of demand, for instance issues of rebound or increasingly energy-intensive expectations for indoor environments (Chappells and Shove, 2005). Therefore, this thesis was interested in finding a locus of investigation that captures the complexity of interaction between both physical and social drivers of domestic energy demand, and the next section turns to literature on the home to inform this conceptual development.

2.3.2 The importance of home in relation to domestic energy research

Researchers have increasingly recognised that there is more to housing than the material house and attention has shifted to the concept of home. Yet this transition remains implicit in domestic energy research. This section first outlines literature on the home and then explains the relevance of this body of scholarship to domestic energy research.

The subject of home constitutes a considerable body of interdisciplinary academic work with contributions from researchers in architecture, geography, sociology, social-psychology, anthropology, history, philosophy, law, and housing studies. This section provides a brief discussion of key themes and debates related to home (for more comprehensive reviews of this work see Blunt and Dowling's (2006) seminal book *Home* and Mallett (2004)) to orient the reader. Briefly, Brickell (2012) proposed that research on the home comprises three distinct periods. In the 1970s and 1980s, the home was presented as a place of privacy, security, control, independence and belonging in response to an increasingly alienating world. In reaction to this portrayal of 'home-as-haven' was a period of critique in the 1990s, particularly attacking the binaries (e.g. inside/outside, male/female, work/home, public/private and safe/unsafe) that had supported these optimistic notions of home. Finally, since the early 2000s research has stressed the ambiguity and multitude of co-existing meanings of home (Ibid, 2012). While this is an oversimplification of an immense and exponentially growing area of research, Brickell's (2012) account can nonetheless be usefully interpreted as demonstrating a key element of home research which is related to an agreement on the difference between house and home.

Despite the fact that there is a move away from strict definitions of home, there is wide agreement of the distinction between house and home as a starting point for further exploration and

development (Blunt and Dowling, 2006; Easthope, 2004). Home is more than physical/material objects or artefacts; it is connected to emotions and relationships, as well as social and cultural expectations (Mallett, 2004). By contrast, the house is just physical; it's the 'brick and mortar' (Easthope, 2004). House and home stand in circular relation; interaction with physical elements, such as building, decorating, and home-making are integral to attaining a sense of home (Gorman-Murray, 2007; Heidegger, 1971). However, at times the house can be what is most important to feeling at home; as Parsell's (2012) discussions with homeless people in Australia would suggest. One can live in a house and yet not feel 'at home', consider transitory accommodation such as prison, boarding school, hospital, and university (Blunt and Dowling, 2006). Thus, "home is a series of feelings and attachments, some of which, some of the time, and in some places, become connected to a physical structure that provides shelter" (Blunt and Dowling, 2006: 10).

There are also temporal dimensions to home, it is not static and may be actively created/achieved (e.g. cooking is often connected to a sense of homeliness); it likely changes throughout an individual's life in relation to both physical (e.g. moving out of the parental home) and social (e.g. domestic violence, living with friends or strangers, marriage) circumstances. Importantly, work has considered at what point a house becomes a home: highlighting the utility of more attention to processes of home-making, often related to immigrants and refugees (George, 2014; Hammond, 2004; Soaita, 2014), and understanding how control, privacy, and ownership relate to belonging and feeling 'at home' (Imrie, 2004). There is clearly much to consider from such scholarship and the extent to which these ideas are incorporated into domestic energy research, as will now be discussed.

This section now unpacks and explores an alternative approach, distinct from the 'house' framework, to research domestic energy which aims to capture the relationship between both social and physical elements of energy demand. The term 'home' is employed to recognise greater complexity and socio-material lines of enquiry. As discussed in the preceding section, there is recognition that the home is both a social and physical unit (Blunt and Dowling, 2006; Saunders and Williams, 1988). As a result domestic energy research which awards the ontological priority to home is concerned with material *and* social elements of domestic energy and the extent to which these are co-constructive. Sociologists, anthropologists, social-psychologists, geographers, designers and historians have all contributed to understandings of the home in multifaceted ways, often exploring how routines and everyday activities shape domestic demand (Shove *et al.*, 2012; Wilhite *et al.*, 1996), how occupant activities explain the performance gap (Druckman *et al.*, 2011; Sunikka-Blank and Galvin, 2012) and how to shift unsustainable lifestyles (Jackson, 2005). A range of qualitative (e.g. ethnographies, interviews, focus groups, participant observation, content analysis) and quantitative methods (e.g. modelling and large scale surveys) are employed to address these socio-material topics.

In such scholarship, householders are integral to the management of their home; their routines and expectations shape and create demand (Caird *et al.*, 2008; Gupta and Chandiwala, 2010; Shove, 2003). Everyday activities are not simply structured in order to use appliances or features of the building as they are designed; how the home is managed is the result of complex social conventions. Householders are viewed as actively reproducing and transforming the norms of how the building and technologies in the home are used (Hand *et al.*, 2005).

Research on the home does not take occupant satisfaction or comfort to be universally definable or measurable. Understanding comfort as a social construct raises a concern that "in determining what people 'need', the science of comfort has allowed designers to produce buildings and systems that meet and at the same time create expectations of comfort" (Shove, 2003: 34). Indeed, the increase in mechanical solutions often means that expectations of comfort are becoming increasingly energy demanding (Hitchings and Lee, 2008). In relation to literature on the home, comfort is understood as a social phenomenon that varies historically and spatially (Chappells and Shove, 2005) and much of this literature (Nicol, 2011; Nicol *et al.,* 1995) advances adaptive strategies and how householders *make themselves* comfortable as an alternative discourse to thermal standards. The value of further research to find other ways of conceptualising comfort (e.g. including physical and psychological aspects) becomes readily apparent because it challenges the dominant perception of the 'comfort zone' and mechanical solutions which have led to more energy-intensive social practices world-wide.

By considering householders as active in shaping energy demand and comfort as contested, the range of intervention strategies increases because they are not just about targeting the physical aspects of a house. Instead of trying to make the same process more efficient or do 'more with less,' strategies to reduce domestic energy demand include challenging social conventions and targeting unsustainable elements of activities. Modelling national energy and efficiency improvements is only part of the story, as for instance, it says nothing about growth in the housing stock or how energy is used in homes. The trend towards smaller households, which DECC (2013) and Wilson and Boehland (2005) both suggested is a driver of a rise in domestic energy demand in the UK and US, is an issue that is better understood in terms of the home. Simply improving the energy efficiency of the house perpetuates and encourages these sorts of trends because it sends the message that these are reasonable standards of living to expect (Mcmanus *et al.*, 2010). A small house built to moderate energy performance standards generally requires less energy than a large house built to very high standards (Clune *et al.,* 2012; Wilson and Boehland, 2005) and hence targeting these social norms and expectations could make huge reductions in domestic energy demand. Studies focusing on 'what energy is for' try to find other ways to meet these expectations (Kuijer, 2014), often highlighting historical activities that reduce

the need for mechanical heating or cooling (Shove *et al.*, 2013) or encouraging reflection on moments of disruption as opportunities for change (Marsden and Docherty, 2013). In short, research on the home opens up a huge potential for a greater understanding of what drives energy demand.

2.3.3 Summary

This section has sought to critically consider *what* is being investigated in domestic energy research, distinguishing the theoretical and methodological implications of awarding priority to the 'house' or the 'home'.

The term 'house' was used to signify the dominant way of approaching the topic of energy demand that is concerned primarily with material aspects. These contributions are important to regulation and development of policy instruments, making buildings, heating/cooling systems and appliances more efficient as well as reducing carbon emissions and inefficiencies in the supply system. While undoubtedly valuable, this approach is not suited to incorporating the complexity of social drivers of demand, for instance issues of rebound or increasingly energy-intensive expectations for indoor environments.

Whereas, the home is both a social and physical unit and domestic energy research would benefit from adopting this as the focus for investigation because it indicates an appreciation for the socio-material nature of domestic energy demand. The 'home' approach recognises greater complexity and socio-material lines of enquiry, such as exploring how everyday activities shape domestic energy demand, how occupant activities explain the performance gap, and how to shift unsustainable lifestyles. Adopting a 'home approach' to domestic energy research compliments the 'practice turn' in sustainable consumption scholarship due to common areas of interest such as assuming the social and material are co-constructing and exploring ordinary, commonplace activities like homemaking.

Following on from a practice-informed approach (section 2.2) that explicitly takes the home as the locus of analysis (section 2.3), the next section focuses in on scholarship on comfort, contributing to RQ1a (section 2.4). The move to explore the meanings of comfort compliments both a practice and 'home' approach. For instance, there is a growing body of literature on comfort by practice theorists in energy scholarship as a way to understand and challenge 'normal' expectations, including in the home, that are becoming increasingly energy demanding (Walker *et al.,* 2015). Moreover, the concepts of home and comfort are often linked (Blunt and Dowling, 2006; Crowley, 2001; Pickerill, 2015; Rybczynski, 1986) as "comfort is a vital component of what we expect a home to provide and is core to the success, or perception, of a house as home"

(Pickerill, 2015: 4). Thus, this is a potential area that home literatures can be drawn on to inform development of the concept of home comfort and is the focus of section 2.5.

2.4 Home and Comfort

Section 2.4.1 explains the importance of comfort in the context of sustainable consumption literature, before considering what more general scholarship on comfort might add to understanding domestic energy demand (section 2.4.2).

2.4.1 Comfort and sustainable consumption scholarship

Comfort is a common term that might be used to describe pleasant furnishings, a sense of cosiness or mental satisfaction (Chappells and Shove, 2004). Despite its everyday usage, comfort is a complex and contested concept and one that has attracted considerable attention in academic and grey literature (Ibid, 2004). Investigation into the experience, conditions and attributes of comfort has long been a concern of architects, ergonomists and engineers striving to design desirable products. However Shove's (2003) *Comfort, Cleanliness and Convenience* sparked interest in the study of comfort by social scientists particularly in consumption, energy and sustainability research. The publication of multiple special issues of *Building Research and Information* (2008, 2013, 2015) and numerous international Windsor Conferences on 'Making Comfort Relevant' (2006, 2010, 2012, 2014, 2016) attests to this increasing attention to comfort, especially to how it is defined and achieved.

The aim to define comfort has created a point of tension in sustainability and energy discourses. On one hand, setting basic standards of comfort provided a useful benchmark for humanitarian reforms to tackle social inequality and fuel poverty (Crowley, 2001). For example, in order to ensure that householders have an adequately warm home requires first defining what the minimum indoor temperature for health standards is. Contributions from building, natural and engineering sciences are useful in refining the biological, physical and physiological factors of comfort and explaining differences related to age or gender. On the other hand, social scientists have raised concerns that standardisation of comfort leads to a reliance on design and technological solutions as the main way to achieve comfort (Chappells and Shove, 2004; Hitchings and Lee, 2008; Shove, 2003). Accordingly, the main contribution by social scientists in sustainable consumption scholarship, and particularly in home heating and cooling research, has been to challenge this standardisation of comfort in buildings (i.e. based on Fanger's (1970) "comfort equation" which indicated that $21°C$ is the optimal temperature for thermal comfort).

A universal definition of comfort is problematic because converging conventions and globalised standards distract from cultural ways of coping with local climactic conditions. There are a

substantial number of studies evidencing that the proliferation of air conditioning and central heating has changed expectations of 'normal' indoor temperatures as well as strategies for thermal regulation (e.g. layering clothing or siesta) (DECC, 2013; Hitchings and Lee, 2008; Rudge, 2012; Shove, 2003; Walker *et al.,* 2014). For instance, around 1965 there was a major shift in the UK from open fires to central heating systems which represents an improvement in efficiency. However it has also changed householder's expectations of the domestic environment (Rudge, 2012). For example, some sources have suggested that indoor domestic temperatures have risen from 12°C to 17.5°C between 1970 and 2011 (DECC, 2013)(although there is some debate over the evidence required to support this finding (Shipworth, 2011)). These changing expectations offset energy savings from efficiency improvements; in 2011 a greater percentage of domestic energy was used on heating UK homes than in 1970 (Figure 2.4)(DECC, 2013).

Figure 2.4. End use of energy demand in UK homes between 1970 and 2011 (DECC, 2013)
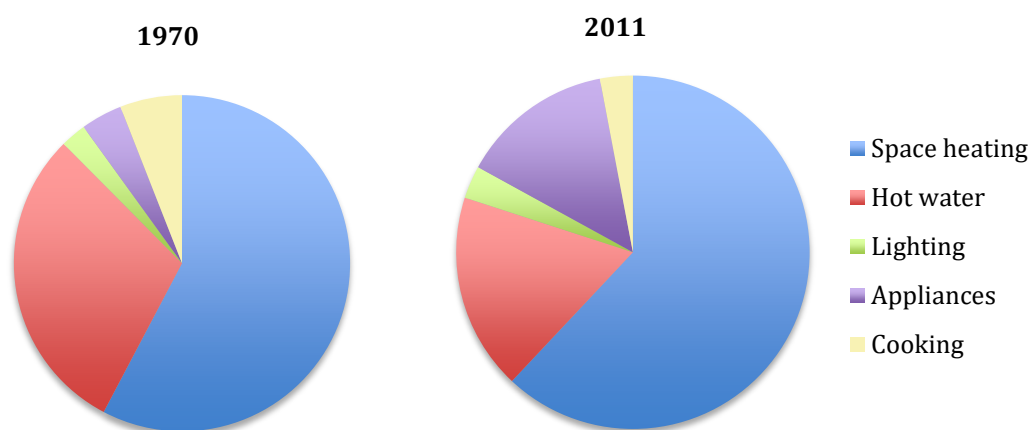
Similarly, numerous studies have documented that the introduction of air-conditioning in hot climates has redefined expectations, transforming the experience of previously acceptable temperatures into ones that are no longer perceived to be comfortable (Hitchings and Lee, 2008; Shove, 2003; Walker *et al.,* 2014). Nevertheless, since the 1970s, architects and physicists have demonstrated that a huge range of temperatures are comfortable in different climates (Nicol and Humphreys, 1973; Oseland and Humphreys, 1994). Therefore, instead of narrowly defining comfort, some authors (Cole *et al.,* 2008; Pickerill, 2015; Nicol and Humphreys, 1973; Shove, 2003) suggest that comfort is a process, not an attribute, and the need is to build homes that enable people to negotiate comfort through adjustment and adaptation.

Exploring expectations of comfort are important because what householders want and do in their homes has changed (Figure 2.4). Space heating accounts for roughly two-thirds of energy demand from the housing sector in the UK (DECC, 2013) and heating is the main reason for domestic energy consumption in almost every country (Staffell *et al.,* 2015). Subsequently, understanding

heating systems and expectations of thermal comfort are undoubtedly important in discussion of domestic energy demand. Changing expectations of home are not simply about thermal comfort, for example, the increase in energy demand for space heating is also the result of homes being extended (e.g. increasing the volume of space to be heated)(DECC, 2013). Further, energy consumed for appliances is the fastest growing area of domestic energy demand in the UK (increasing from 4 to 14 per cent between 1970 and 2011) (DECC, 2013) and is not simply a matter of thermal experience but also changing activities related to convenience and relaxation (Kuijer *et al.*, 2016). The emphasis on thermal comfort potentially underestimates other comfort meanings (domestic wellbeing, privacy, companionship, relaxation) that may be useful to understanding energy demand and expectations of 'normal' everyday life.

Notably, even though the meanings of comfort have increasingly become a topic of interest in sustainable consumption literature, the concept has been narrowly defined by both social and natural scientists as thermal comfort. Social scientists in home heating and cooling research have critiqued mainstream definitions of comfort, which underpin the development of standards, by contextualising meanings of comfort spatially and temporally, yet these criticisms may not have gone far enough due to conflating comfort generally with *thermal* comfort. This narrow framing of comfort has resulted in other potential meanings of comfort, such as privacy, companionship or relaxation, being ignored. Identifying other potential meanings is the purpose of this thesis and will be considered further in section 4.3.

This section has briefly explored key contributions from literature on comfort in dominant sustainable consumption scholarship. The review indicated that comfort has been a rallying point for social scientists critiquing mainstream techno-economic thinking in sustainable consumption scholarship and home heating/cooling research . However, comfort has been narrowly defined as thermal comfort resulting in other potential meanings of comfort being trivialised. These other meanings might also be significant in understanding patterns of energy demand and the next section investigates literature on a broader conceptualisation of comfort.

2.4.2 Moving beyond thermal comfort in domestic energy research

Whilst there is a considerable body of literature on comfort-as-thermal-comfort in the home (Chappells and Shove, 2004; Hitchings and Day, 2011; Hitchings and Lee, 2008; Pickerill, 2015; Nicol and Humphreys, 1973; Shove, 2003) there is much more to home life and home management than being sufficiently warm or cool. Importantly, the term 'home comfort' is introduced here to signal a move beyond thermal comfort towards understanding expectations of home as multiple and co-existing. The dictionary definition of home comfort is "any of the comforts which make being in one's own home pleasant; a domestic amenity which contributes to

physical ease and wellbeing" (OED, 2016b). The mention of 'physical ease and wellbeing' points to an acknowledgement that home comfort is not just physical (i.e. thermal comfort). Like the concept of home (section 2.3), home comfort has *both* material and social elements. In fact, the dictionary definition of comfort is a state of physical and material wellbeing or satisfaction of bodily needs (OED, 2016a), again demonstrating that there is often recognition that comfort can be both mental and physical satisfaction. Yet the term 'comfort' has generally been conflated with thermal comfort in sustainable consumption scholarship (section 2.4.1) and thus 'home comfort' is deliberately used to indicate an interest in developing understanding of comfort more broadly (RQ1d). Developing the concept of home comfort begins in this chapter with a review of literature that explored meanings of comfort in the home beyond thermal comfort, followed by presentation of the empirical findings from this thesis on meanings of home comfort (Chapter 4) and the development of a conceptual framework drawing householder's understandings of home comfort in this thesis with relevant literature on home and home comfort (Chapter 5).

This section reviews the limited number of studies investigating home comfort (i.e. meanings of comfort in the home that go beyond thermal comfort). Table 2.2 summarises other meanings identified in this scholarship.

Table 2.2 Literature on 'home comfort'

Source	Meanings of comfort
Rybczynski 1986 Home: a short history of an idea	Convenience, efficiency, leisure, ease, pleasure, domesticity, intimacy, and privacy
Crowley 2001 The Invention of comfort: sensibilities and design in early modern Britain and early America	Comfort was a moral term indicating personal support, material connotations were more likely to be negative from Christian and classical disparagements of luxury. Part of 18th century consumer revolution was redefining comfort as a right and obligation to improve people's physical circumstances.
Pineau 1982 The psychological meaning of comfort	Ordered most to least important in empirical study of interviews of French women: personalisation, freedom of choice, space and warmth
Heijs and Stringer 1987 Comfort as a property of the dwelling: a conceptual analysis	Physical: visual, auditory, olfactory, tactile, kinaesthetic Psychological: privacy, freedom of choice, extent of control, opportunities for establishing a recognisable place, quietness, social contact
Burris *et al.* 2012 Exploring comfort in the home: towards an interdisciplinary framework for domestic comfort	Ordered most to least important in empirical study of English households: thermal comfort, surroundings (tidiness/cleanliness, security/familiarity, aesthetics), physical comfort (sitting, changing clothing), entertainment (TV, reading, socialising, hobbies/self), food, state (peace/quiet, stress free), visual (lighting)

There are only a few studies (Burris *et al,* 2012; Crowley, 2001; Heijs and Stringer, 1987; Pineau, 1982; Rybcznski, 1986) that explored broader meanings of residential, domestic, or dwelling

comfort. For convenience, hereafter this small body of work will be labelled as 'home comfort' literature. This review of 'home comfort' literature is distinct from previous domestic energy scholars who have argued that we "cannot explain private energy use without understanding the diverse meanings of home" (Aune, 2007: 5458). Whilst this thesis draws on writings that connect the symbolic meaning of the home with explaining domestic energy demand (Aune, 2007; Wilhite *et al.,* 1996; Wilk and Wilhite, 1985), this thesis differs because it aims to develop a holistic framework of home comfort and then connect this to understanding patterns of energy demand. Topics of comfort, cosiness, and the Norwegian *koslignet* are important to these authors and in these studies, but participants are not asked primarily about the meaning of home comfort. Rather the meanings of typical energy uses are discussed with householders to explain their cultural significance and contribution to homeliness. For example, Wilhite *et al.* (1996: 798) compared Norwegian and Japanese household space heating, lighting and hot water habits; their findings emphasised that in Norway "the strong social significance of cosinesss causes overheating and over lighting as insurance against social failure". A fascinating cross-cultural study that demonstrated the utility of investigating social and cultural norms in domestic energy research, yet discussion is framed around energy uses instead of starting with meanings and expectations of home (as this thesis does). By stepping away from discussing the meanings of home improvements (Aune, 2007), investing in energy efficiency (Wilk and Wilhite, 1985) and meanings of energy use (Wilhite *et al.,* 1996) to the more basic enquiry about the meaning of home comfort, this thesis makes a different contribution from the few studies that already convey the importance of interrogating expectations of home in order to understand patterns of energy demand.

These home comfort texts indicated some potential avenues to expand understandings of home comfort (Burris *et al.,* 2012; Crowley, 2001; Heijs and Stringer, 1987; Pineau, 1982; Rybczynski, 1986). Firstly, all of the studies mentioned thermal comfort as an important, or the main (Burris *et al.,* 2012; Heijs and Stringer, 1987) expectation of the home. Yet all of these studies also suggested that home comfort was not just one thing; expectations of the home are complex and layered (e.g. Rybczynski's (1986) 'onion theory of comfort'). Thus, while Pineau (1982) found warmth to be a key aspect of home comfort, it was not simply physical or thermal but also linked to the home being relaxing (which will be returned to in section 2.4.2 on the home and hearth). Certainly, all of these studies identified both physical and psychological meanings of home comfort. Other physical comforts beyond thermal comfort were grouped around the senses, (e.g. visual, auditory, olfactory, tactile (Heijs and Stringer, 1987)) and also included having somewhere comfortable to sit, and the physiological need for food (Burris *et al.,* 2012; Rybczynski, 1986). Numerous psychological comforts were identified: expectations of the home being a place of leisure, ease and entertainment (Burris *et al.,* 2012; Rybczynski, 1986); with personalisation and freedom of choice being important to establishing the home as a recognisable and familiar space

(Burris *et al.,* 2012; Crowley, 2001; Heijs and Stringer, 1987; Pineau, 1982, Rybczynski, 1986); and the home being a place of comfort through socialising and social contact (Burris *et al.,* 2012; Heijs and Stringer, 1987; Rybzynski, 1986). Moreover, the two key texts (at the time of writing Rybczynski's (1986) book has been cited over 800 times and Crowley's (2001) roughly 150 times) report on how expectations of home comfort have changed over time, noting how these expectations evolve alongside changes in the socio-material characteristics of the home (e.g. changes in design due to building regulations, development of heating systems, plumbing, electricity).

Rybczynski's (1986) book *Home: a short history of an idea* is responsible for bringing the home to a much wider disciplinary audience, and it inextricably links comfort and home. Rybczynski (1986: 232) is referenced for pointing out that comfort was a topic overlooked in architectural schools and tried to remedy this in his writing: "we must rediscover for ourselves the mystery of comfort, for without it, our dwellings will indeed be machines instead of homes". Thus, Rybczynski (1986: 231) documented how comfort has meant different things at different times:

> In the seventeenth century, comfort meant privacy, which led to intimacy and, in turn, to domesticity. The eighteenth century shifted the emphasis to leisure and ease, the nineteenth to mechanically aided comforts- light, heat, and ventilation. The twentieth-century domestic engineers stressed efficiency and convenience. At various times, and in response to various outside forces- social, economic, and technological- the idea of comfort has changed sometimes drastically.

This account indicated that home comfort is about more than being warm and introduces a much wider range of attributes (e.g. convenience, efficiency, leisure, ease, pleasure, domesticity, intimacy, and privacy) to consider in explaining the evolution of domestic energy-demanding practices and expectations of the home. Rybczynski (1986) explains his understanding as the 'Onion Theory of Comfort' because of the complexity and multiple meanings and interconnections of these expectations of the home. His account also acknowledged the importance of a socio-material framing of change. For instance, he draws attention especially to the years between 1890 and 1920 as marking a dramatic transformation in expectations of home comfort due to the arrival of central heating, indoor plumbing, running hot and cold water, electric light and power (Ibid, 1986). Connecting homes to these networks of water, sewage, gas and electricity unsurprisingly transformed domestic life and the layout of homes.

Crowley's (2001) book on the history of comfort is referenced in home heating and cooling research as a way to critique the standardisation of comfort because his book documented the shift to a physical emphasis placed on comfort. Until the eighteenth century, comfort was far less

about physical pleasure than spiritual satisfaction, wellbeing and consolation (Ibid, 2001). Seating was designed to aid sitting respectfully with a refined posture. The equivalent of today's reclining 'La-Z-boy' chair was created on medical grounds for invalids, pregnant women, and men with gout; an example demonstrating that what is thought of as comfortable today was not even intended for normal able-bodied people in the past. According to Crowley, the shift to a physical emphasis on comfort occurred for two key reasons. The eighteenth century consumer revolution and humanitarian reforms, which resulted in the cultural construction of basic needs and a realisation that comfort was "culturally progressive rather than physically natural" (Crowley, 2001: 292). Humanitarian reformers began to see comfort as a basic human need and gave it a more physical emphasis. Basic standards of comfort came to be seen as a benchmark for social equality, elevating an adequately heated home to a basic right for instance. Crowley's (2001) writing thus highlighted an important moment in understanding the standardisation of comfort and presents evidence that expectations of normal indoor environments has evolved.

At the very least then, these home comfort studies (Burris *et al.,* 2012; Crowley, 2001; Heijs and Stringer, 1987; Pineau, 1982; Rybczynski, 1986) hinted at expectations of the home which were much broader than thermal comfort. Comfort is an 'elastic' term yet these other considerations have received little attention in academic literature. Evidence of expectations of home comfort varying temporally and spatially, evolving alongside material changes in the home, (Crowley, 2001; Rybczynski, 1986) supports an approach informed by social practice theory as this indicates a socio-material framing of change. For example, asking how/why the practice of comfort-making and expectations of home comfort change and whether these have become increasingly energy demand. This study makes a contribution to domestic energy research, not just home heating/cooling scholarship, because broadening out understanding of home comfort has the potential to bring into focus expectations related to lighting, water and space per person for example.

2.4.3 Summary
This section has reviewed literature on comfort (section 2.4.1) and home comfort (section 2.4.2) in order to explore how the concept currently informs domestic energy and home heating/cooling research (e.g. changing expectations of thermal comfort shape demands for space heating and cooling) and how comfort could be expanded to offer new insights into how everyday expectations of home influence demand (e.g. expectations of personal space may also impact space heating and cooling demands)(Kuijer *et al.*, 2016). Comfort was found to be a complex and contested concept that has attracted considerable attention in academic and grey literature. Cultural studies of domestic space heating/cooling have raised concerns that standardisation of comfort leads to a reliance on design and technological solutions as the main way to achieve comfort. Subsequently some researchers emphasised adaptive comfort and designs that enable

people to negotiate comfort through adjustment (Cole *et al.,* 2008; Nicol and Humphreys, 1973; Shove, 2003).

Nonetheless, changing expectations of the home, which influences energy demand, are not simply about thermal comfort. For instance, decreasing household sizes impact demands on space heating per person but may be more related to expectations of privacy and control than thermal comfort. Arguably, understanding comfort as only thermal comfort then misses an opportunity to understand what householders expect from their homes and how these understandings of home comfort relate to everyday activities that use energy.

The term 'home comfort' was introduced to demonstrate an interest in developing understanding of comfort more broadly as being both physical and psychological. This section therefore reviewed studies that took an interest in investigating home comfort as having more than thermal properties (Burris *et al.,* 2012; Crowley, 2001; Heijs and Stringer, 1987; Pineau, 1982; Rybczynski, 1986). Indeed, the review highlighted some useful avenues for developing the concept of home comfort further. There was often an appreciation that meanings of home comfort evolved alongside changes in the materiality of the home that were influenced by much wider shifts occurring outside of individual householder's control (e.g. development of heating systems, plumbing, electricity)(Crowley, 2001; Rybczynski, 1986). This framing of experiences and expectations of the home being shaped by both social and technical changes, and the relationship between the two, compliments the decision to adopt a practice-informed approach to research (section 2.2). Moreover, whilst all of the studies mentioned thermal comfort as an important expectation of the home, it was generally also understood that home comfort was not just one thing. Expectations of home comfort are complex and layered; and both physical and psychological meanings of home comfort were identified in all of these studies. However, while this review of home comfort began to indicate the utility of understanding home comfort as more than thermal comfort, it is unclear how comfort-making and home comfort may inform understanding of domestic energy demand (RO2) or home heating and cooling research.

To address this, the next section explores the much more extensive literature on the home and homemaking as a way to contribute to understanding home comfort and to identify potential links to domestic energy and home heating/cooling research (section 2.5).

2.5 Homemaking and domestic energy research
This section proposes that in order to understand domestic energy, particularly space heating/cooling demand, researchers need to consider key themes in the making of home (RQ1b). Homemaking is important for domestic energy researchers because it emphasises that homes do

not simply change as the result of householders making rational and functional renovations (Aune, 2007; Sunikka-Blank and Galvin, 2016). Certainly, decisions to change the home are not solely motivated by the potential to save money, reduce one's environmental impact, or improve thermal comfort. Yet, homemaking is a complex practice to investigate, as Dowling and Power (2012: 77) suggested:

> homemaking is not a one-way process where people simply appropriate objects, furnishings, colours and textures to achieve feelings of homeyness. Rather it is a multi-directional relation where the materiality of the house also shapes and potentially surprises, disturbs and alters residents' sense of home.

The idea of this 'multi-directional relation' hints at the need for a socio-material investigation of everyday home life because making changes to the home and creating a sense of homeliness are not simply due to householder's perceptions or homemaking activities but are also influenced by the materiality of the home (Gram-Hanssen, 2014; Sunikka-Blank and Galvin, 2014, 2016). For example, when householders move into a new home with features that their previous home did not have (e.g. wood-burning stove, large south-facing windows, cornicing), they may be surprised by how important these become to their sense of homeliness.

In order to demonstrate the utility of exploring homemaking in domestic energy and home heating/cooling research this section is organized around five key themes: home-as-ideal (section 2.5.1), hearth (section 2.5.2), family (section 2.5.3), privacy (section 2.5.4), and gender (section 2.5.5). These themes emerged from analysis of key texts on the evolution of our homes as social and physical units (Blunt and Dowling, 2006; Crowley, 2001; Flanders, 2015; Hardyment, 1992; Rybcznski, 1986; Valentine, 2001), and were also reflected in wider literature on the meanings and expectations of home (Brickell, 2012; Mallett, 2004; Perkins et al., 2002; Sixsmith, 1986; Somerville, 1992). Considering the complexity of housing and the importance of home in people's lives, there are likely other themes important to homemaking. Nevertheless, these five appear in much of the scholarship on the meanings and makings of home and, as this section demonstrates, have clear implications for domestic energy demand.

2.5.1 Home-as-ideal

The home is entangled with all sorts of ideal representations and models of 'homeliness' (Blunt and Dowling, 2006; Brickell, 2012; Chapman and Hockey, 1999; Flanders, 2015; Gorman-Murray; 2007; Hardyment, 1992; Lancaster, 1939; Mallett, 2004; Perkins *et al*, 2002; Rybcznski, 1986; Sixsmith, 1986; Sommerville, 1992; Valentine, 2001). Positive connotations attached to home, as well as critique of this assumption, remain an underlying and important area of discussion

(Gilman and Kimmel, 2002; Gorman-Murray, 2007; Gurney, 1997; Imrie, 2004; Parsell, 2012). Many studies problematize these understandings of ideal. For instance, linking home to something intangible; a nostalgic longing of a childhood home or pursuit of a future fantasy. Others have argued that the ideal home is often conflated with the nuclear family, excluding other household organisations as well as gay men and lesbians from common notions of home (Gorman-Murray, 2007). Furthermore, by regarding home as an ideal, Imrie (2004) argued that planning and designing overlooks illness, impairment and disease as part of domestic living, resulting in homes that are places of exclusion and entrapment for some (e.g. the front step makes accessibility hard for wheelchair users, sometimes to the point of not being able to leave without assistance). Such studies indicated that representing the home as a positive concept may in fact exclude certain groups or ideas which are connected to home. Moreover, several researchers (Gorman-Murray, 2007; Imrie, 2004; Sixsmith, 1986; Somerville, 1992) have recommended that construction of the 'home-as-ideal' is the result of the majority of research being relatively abstract; whereas, more empirical studies reveal the meanings and experiences of home to be much more variable. Yet, considering the multiple dimensions of home, the notion of the 'home-as-ideal' is likely to continue to be a fundamental, and even instinctive, aspect of colloquial understandings (e.g. as an ideal future form that can be pursued, a present space of comfort or security, or as an idealised past perception of a childhood home). Thus, the home-as-ideal theme indicates that homemaking is often driven by nostalgic and aspirational aims or that householders try to (re)create past and future ideals of the home.

Past norms of homemaking structure current and future practices. Architect Rybczynski (1986: 9) observed that in homemaking there is an "acute awareness of tradition [...] that reflects a desire for custom and routine in a world characterized by constant change and innovation". Idealising the past has been suggested to be an important part of homemaking since the Industrial Revolution because householders attempt to return to past simplicity and the 'good life' by preserving symbols of homeliness thereby creating a sense of continuity and connection with (this romanticised view of) the past (e.g. Tudor façade, fireplaces and mantles)(Chapman and Hockey, 1999; Flanders, 2015; Mallett, 2004). This theme is important to home heating/cooling research because preserving symbols of past homeliness may not align with modern 'needs' (Flanders, 2015). For example, the aesthetic appeal of a stone cottage or wooden framed Victorian windows can clash with modern expectations of indoor environments being warm, dry and draught-free.

Retrofitting existing homes is often cited as a key way to reduce energy demand and carbon emissions, but there is empirical evidence of UK householders choosing to maintain heritage features over saving money or making their homes warmer (Sunikka-Blank and Galvin, 2016). In the UK, 40 per cent of homes were built before 1939 (Sunikka-Blank and Galvin, 2016) and only

13 per cent of the housing stock was built after 1991 (DECC, 2013). Thus, the vast majority of homes are already built and will need some efficiency retrofitting to meet the UK's ambitious commitment to reduce emissions by 80 per cent by 2050. A large proportion of these homes have traditional or aesthetically pleasing features which householders may be reluctant to compromise for the sake of thermal comfort or energy saving. Subsequently, Sunikka-Blank and Galvin (2016) recommended the development of a new/special 'warm heritage' label for energy advisers, where householders are offered an assessment that prioritises architectural characteristics, even if the proposed measures do not reduce energy use as much as possible. This sort of energy advice thus acknowledges the complexity of homemaking and the way in which aesthetic aspirations influence thermally retrofitting the housing stock.

Turning from looking at how nostalgic visions of past homes can shape current practices, this section continues by exploring the other side of the home-as-ideal theme: the impact of aspirations for a future 'ideal' home. The home-as-ideal is not meant to ignore the varied experiences, forms, and meanings of home but to illustrate that broader cultural norms exist about what characteristics an ideal home should have (Chapman and Hockey, 1999). There are cultural perceptions about the 'right' number, and look, of bedrooms and bathrooms and the 'ideal' size, type and tenure of home that is appropriate for someone of a particular age (Chapman and Hockey, 1999). Nonetheless average household size and housing characteristics are on the move (Williams, 2009) implying that the 'ideal home' is a moving target.

Building and designing a house is always an intervention in the lives of future inhabitants and these assumptions about what is 'normal' deserve investigation. For instance, developers repeatedly downplayed the zero-carbon aspects in their marketing, "doing all they could to make it immaterial to the space of home living and hidden from view" (Walker *et al.,* 2015: 9). The zero-carbon developer's justification that people "buy a house not a cause – a life for my family versus an ecological statement" is unsurprising. What Walker *et al.*'s (2015) study highlighted and is also reflected in wider literature on marketing energy retrofits and zero-carbon homes (Palm, 2010; Sunikka-Blank and Galvin, 2016; Wilson *et al., 2015*), is that policy-makers, developers, and energy advisers worry that activities to reduce energy demand will be dismissed by householders because they clash with 'normal' expectations. For example, challenging the assumption that the home should be sufficiently warm so that householders do not need to wear extra layers of clothing. Yet there is limited domestic energy research that even considers homeliness and what these expectations of 'normal' home life actually are.

The rest of this section identifies some avenues for understanding some of these key expectations, as hearth, family, privacy, and gender are arguably all shaped by some idealised vision of

homeliness and home comfort. The next key theme is related to the centrality of the hearth in meanings and making of home.

2.5.2 The hearth

The hearth is central to the home, connected to ideas of warmth, relaxation, comfort and a welcoming atmosphere for visitors (Crowley, 2001; Flanders, 2015; Sommerville, 1992; Valentine, 2001), pointing to this notion of the home-as-ideal. The hearth is the second theme because it was literally, as well as figuratively, the centre of the home until at least the 16th century as the common design of European domestic spaces was a hall with a central fire (Crowley, 2001; Flanders, 2015).

Despite modern heating systems there is still evidence of an attachment to the hearth today. For instance, Sunikka-Blank and Galvin (2016) found that householders balanced aesthetics and functionality in their decisions to thermally retrofit: "a traditional open fire was seen as impractical and wasteful of energy, but old fireplace surrounds and mantelpieces were valued" (Sunikka-Blank and Galvin, 2016: 103). Thus, the hearth may not be preserved for its original heating purposes yet remains in some form because it is a symbol of homeliness. The obduracy of the hearth is also reflected in the popularity of stoves and several studies have documented that households have stoves for the ambience, cosiness, and glow with thermal comfort or cost being secondary considerations (Devine-Wright *et al.*, 2014; Pineau, 1982). The hearth's importance in the home therefore goes beyond warmth and relates to the home being comfortable, welcoming and a place of relaxation.

The development and marketing of new heating systems may therefore benefit from greater consideration of the centrality of the hearth, homing in on aspects that contribute to cosiness beyond thermal comfort. The UK's (relatively recent) shift away from solid fuels and open fires is a prime example that householders do not upgrade their heating systems because of thermal comfort or energy saving considerations. Though most of the United States, Europe and Scandinavia had shifted to heating more efficiently with stoves in the 18th and 19th centuries (Crowley, 2001; Flanders, 2015), the main form of heating in UK homes was from solid fuels and open fires until 1965 (Rudge, 2012). The shift to central heating in the UK was not driven by householder's hope for financial savings or warmer homes but instead by the 1965 Clean Air Act and post war fuel shortages (Ibid, 2012). These external conditions forced heating away from burning wood/coal to the much cleaner fuel of gas and subsequently central heating (Ibid, 2012). The hearth theme usefully highlights that there is more to heating systems than thermal comfort (e.g. symbol of homeliness, ambiance, cosiness). Indeed, rather than being triggered by a desire

for warmer homes, changes to 'normal' heating systems altered expectations of 'normal' indoor temperatures.

Although gas central heating is now the most common way of heating in UK homes, some householders still prefer the feel of radiant heat (Devine-Wright *et al.,* 2014). Consequently, even if central heating has led to, and allows for, higher indoor temperatures there is nonetheless some resistance to these new(er) more efficient and cheaper forms of heating (Devine-Wright *et al.,* 2014; Fanger, 1970). For example, (older) householders switching from radiant heat sources to heat pumps have complained about being cold even though their homes were a higher constant base temperature (Devine-Wright *et al.,* 2014). The obduracy of the hearth may also help attempts to reduce the environmental impact of domestic energy, for instance, when wood, pellets, or other solid fuels are sustainably sourced. Furthermore, considering that more energy is required to heat the volume of a room (i.e. space heating and heating air) than the surfaces of the same room, it is arguably useful to draw attention to attachment to the hearth and the desirability of the 'feel' of radiant heat sources. Infrared heaters (i.e. an electric heater which works like the sun to heat objects rather than air) can be operated at lower air temperatures than convection heaters (e.g. radiators) whilst still providing the same levels of thermal satisfaction and require roughly a third less energy (Roth *et al.,* 2007; Sarbu and Sebarchievici, 2015).

Heating is a major area of research in domestic energy scholarship because of its significant contribution to overall household energy demand (approximately two-thirds in the UK (DECC, 2013)) and the obduracy of the hearth can affect efforts to reduce energy demand for heating. The centrality of the hearth in meanings of home is thus important to domestic energy research because past practices and infrastructures influence current designs. Moreover, an attachment to having fires is a reminder that there is more to expectations of homeliness than thermal comfort.

The next section considers the opportunities for domestic energy scholarship in discussion of the family and home life.

2.5.3 Family

The family comes as the third theme because, like the hearth, it is rooted in the meanings and making of the home. Indeed, the family is such an important aspect of home (Blunt and Dowling, 2004; Flanders, 2015; Moore, 2000; Perkins *et al*., 2002; Smith, 1994; Soaita, 2014; Sommerville, 1992; Valentine, 2001) that the two are often conflated in housing literature (Gorman-Murray, 2007; Mallett, 2004).

The definition of the family, and its relationship to the 'household', has evolved. The 1850 census in Britain defined the family as "the wife, children, servants, relatives, visitors, and persons constantly or accidentally in the house" (Flanders, 2015: 30). The notion that the family included people who are 'accidentally' in the house hints at the prevalence of lodgers, servants and extended family households in past homemaking practices. Changing boundaries between family and household thus reflect wider shifts in the design of the house and everyday life. For example, the trend towards smaller household size creates different home 'needs' (Williams, 2009; Ozaki and Lewis, 2006). Nonetheless, smaller houses and household size have still resulted in more space per person, increasing demand for space heating and creating duplication of appliances (e.g. fridge-freezer, washing machine, boiler), increasing base loads per person (Williams, 2009). Today's narrower definition of the household and family may hide that past home life was much more communal and required energy-demanding practices to be shared to a greater extent. Certainly, drawing attention to the 'family' in home heating/cooling research emphasises the importance of dynamics of negotiation and compromise to household management and understanding everyday practices.

The family should be a priority in home heating/cooling research considering that the increasing number and decreasing size of households is understood, in part, to be due to changing family structures (DECC, 2013). Furthermore, smaller households are associated with rising affluence, longer life expectancies and increased mobility (Williams, 2009). The average size of households has been diminishing for a majority of the world's countries since 1950 (Mackellar *et al.,* 1995) and around a third of households in North America, Europe, and Japan are now one-person households (Jamieson and Simpson, 2013). Household size significantly affects energy use per person, 'two can live as cheaply as one' (DECC, 2013). For example, in the UK electricity-demanding practices in a single-occupancy household can result in nearly twice as much energy use per person than multiple-occupancy homes (Ibid, 2013). The family theme is not meant to ignore the growing number of single-occupancy homes, rather it highlights that households exist as part of wider networks and the family is one that can create certain practices of homemaking. For instance, a person's memories and experiences in their childhood home may shape activities in their current home (Head *et al.,* 2016). Furthermore, the family impacts on certain expectations of features of the home, such as the 'need' for a guest bedroom to ensure that family members that are not permanent residents can still visit. Arguably, there is considerable scope to explore how household energy practices are influenced, and compare to, the wider family unit (Collins, 2015; Head *et al.,* 2015; Hitchings *et al.,* 2015a).

Yet home heating/cooling research generally has given insufficient attention to dynamics within the household (Ellsworth-Krebs *et al.,* 2015), a criticism also made of housing studies (Easthope *et al.,* 2015; Winstanley *et al.,* 2010). Expectations of privacy within the home, and between

householders, impacts the physical form of homes, which has implications for domestic energy demand. For instance, Dowling and Power (2012: 616) proposed that attempts to reduce house size may need to engage with concerns related to family life, good parenting, privacy, and maintaining tidiness because "bigger houses are a spatial accommodation of the complexity of contemporary middle-class family life". In their study more space was justified by parents as a way to create privacy, alone time and contain children's mess from overwhelming the tidiness and aesthetics of the entire home (Dowling and Power, 2012). More generally, understanding family dynamics and expectations of family life may shed light on ways to develop sustainable housing that is more nuanced and dynamic than simply making houses more energy efficient or assuming that householder's home choices will be motivated by money or energy saving. Certainly, there is potential for more domestic energy research involving 'whole household' interviews and forms of investigation to observe dynamics within the home.

Exploring the importance of family in the making of home may present useful avenues for future domestic energy and home heating/cooling research; such as engaging with expectations of house size and space per person in family homes, explaining attachment to (large) family homes that may no longer suit householder's needs, or aligning (idealized) notions of family life with energy reduction campaigns by stressing the utility of sharing energy-demanding practices. The next section investigates this link between (increasing) expectations of privacy and domestic energy demand further.

2.5.4 Privacy

The fourth theme is privacy because the home is generally expected to be a place of control and stability (Aune, 2007; Blunt and Dowling, 2006; Brickell, 2012; Mallett, 2004; Perkins *et al*., 2002; Rybczynski, 1986; Saunders and Williams, 1998; Sixsmith, 1986; Soaita, 2014; Sommerville, 1992; Valentine, 2001). This sense of constancy and control, or ontological security, is a base around which identities are constructed and in housing research this is understood to be a significant psychological necessity in life (Giddens, 1991; Dupuis and Thorns, 1998; Saunders, 1989). There are two facets of the importance of privacy and the home: independence from the outside world and creating personal space within the home.

The public/private dimension of the home is already discussed in domestic energy and home heating/cooling research, with several studies indicating that there is a tension or concern about governments and home energy advisers infringing on householder's autonomy by telling people how they 'ought' to live (Palm, 2010; Walker *et al.,* 2015). For instance, a common comment from the energy consultants in Palm's (2010: 2861) study was that "as long as householders can afford to pay for high energy consumption, they will. [The consultants] cannot interfere with any

investment decision [as] household finances are a private issue". The importance of privacy then is apparent in the assumption that the home is a place of autonomy for householders (Flanders, 2015). Although it would be naïve to propose that governments have not or do not intervene in home life and the design of homes (Shove, 2010; Walker *et al.,* 2015). Again, the Clean Air Act of 1965 in the UK is a prime example of governments intervening in the 'normal' features and rhythm of home life (e.g. part of initiating the shift from solid fuels and open fires to gas central heating) (Rudge, 2012). Governments are essential to maintaining the many networks that connect the home to the world and therefore significantly influence the evolution of our homes and the (re)defining of basic needs and expectations of the home. Indeed, there is extensive scholarship articulating how standardisation of comfort (reproduced in part through government regulation) has led to increasingly resource intensive expectations of home life (Shove, 2003; Hitchings and Lee, 2008; Walker *et al.,* 2015).

Privacy has also been a driving force in (re)shaping home, layouts, everyday activities and relationships within the household (e.g. from the home being one room in which various everyday activities were carried out to increasingly more rooms in order to afford householders privacy and different spaces for different activities (Crowley, 2001; Flanders, 2015)). Expectations of increasing personal privacy hint at an Anglo-Saxon framing of homemaking. Ozaki (2002) explained that these multi-functional spaces are desirable in Japanese homes which are more family-centred and seek familial-privacy rather than individual-privacy. Individualism, independence, and self-reliance are emphasised in studies of British homes, yet other cultures are more group-oriented emphasising family, collectivism and interdependence. Thus, the degree of personal privacy sought within the home is not universal (Ozaki, 2002). Prioritising personal privacy, as opposed to familial privacy, likely requires more space per person (e.g. more space heating, more lighting), tends to result in duplication of electronic devices (e.g. multiple TVs, computers, phones) and similar energy demanding activities that might once have been shared are dispersed around the home (e.g. watching TV as a group verse householders all watching individual programmes at the same time) (Klocker *et al.,* 2012).

Expectations of privacy, as a basic home comfort and critical aspect of homemaking, may be useful in understanding changes in household and house size, and engaging with the trend towards more space per person has arguably received insufficient attention in domestic energy research dominated by interventions designed to deliver similar services, but with less energy. The final section considers how another topic that is fundamental in housing and home literature may influence domestic energy demand and research: gender.

2.5.5 Gender

In housing and home scholarship the expectation and experience of the home is widely accepted to be highly gendered, in the sense that where the home is a place of rest for a man, it is a place of work for women (Flanders, 2015; Mallett, 2004; Perkins *et al.,* 2002; Valentine, 2001). If women are (traditionally) charged with the responsibility of making and maintaining the home as well as the wellbeing of the family (Brickell, 2012; Flanders, 2015; Valentine, 2001) then their choices and activities are particularly important for understanding everyday practices (which affect energy demand) in the home. Gender is the final theme therefore because it impacts upon householder's experience and expectations of the home.

Although the home is a key site of feminist scholarship, gender is an underexplored area in domestic energy research (Head *et al.,* 2016; Organo *et al.*, 2013; Raty and Carlsson-Kanyama, 2009). Ryan (2014) recently called for energy researchers to rethink gender on the grounds that it affects access to resources, exposure to pollutants, and opportunities to engage with resource management and policy. However, Ryan's (2014) focus, like the majority of energy scholarship that touches on gender (Batliwala and Reddy, 2003; Permana *et al.,* 2015; Ryan, 2014), is based in 'developing countries' where issues of gender, (in)equality and energy consumption are different (e.g. burning solid fuels and indoor air pollution). In fact, at the time of writing there is only one study (Organo *et al.,* 2013), that explicitly sets out to draw together gender and household sustainability in 'developed countries' and clearly identified both opportunities and constraints for reducing domestic consumption that gendered analysis may shed light on.

Organo *et al.* (2013) empirically investigated who did the 'work' to make a home sustainable in Australian nuclear family households. Their study concluded that gender differences matter because "women, as homemakers, implemented sustainable practice through making most of the decisions regarding household purchases and organising the household rhythms" (Organo *et al.,* 2013: 568). One adult was generally seen as the driver of sustainable household practices, though this was not gender specific, and then both adults supported this intention. Their study found that men and women contributed to sustainability practices in different ways (Ibid, 2013). For men, household sustainability practices were understood primarily as leisure activities (e.g. bread making, home brewing, building chicken coops, cycling). Whereas, women spent more time on sustainable practices (e.g. shopping for sustainable products, turning off lights, recycling, gardening) shouldering expectations of sustainability as part of their habitual roles as mothers and household managers (Ibid, 2013). Certainly, Organo *et al.'*s (2013) findings relate to domestic consumption are complimented by previous feminist and home literature which has evidenced that women are the instigators of changes in household practices because of their role as homemakers and household managers (Pink, 2004). However, Organo *et al.'*s (2013) is an example of a study that is biased towards the 'nuclear' family and again there is more potential to

explore how participants in other kinds of households – (same sex) couples, single parent families, solos, other arrangements – manage or share domestic labour and gendered divisions.

Moreover, several studies would indicate that active engagement with the cooking, cleaning, and childrearing aspects of domestic labour are still less common for men than women (Isaksson and Ellegard, 2015), although the work of maintaining and fixing the home most often falls on men (Blunt and Dowling, 2006). In emphasising gendered differences the intention is not to reproduce stereotypes, but to emphasise that this is an area of study deserving greater attention in domestic energy scholarship. If the home is the 'women's sphere' and a disproportionate amount of domestic chores are undertaken by women (Isaksson and Ellegard, 2015; Klocker *et al.,* 2012) then understanding energy demand may be enhanced by making a point of speaking to women about their everyday practices or relating energy-saving advice to home-making (e.g. generalised as feminine) rather than cost, maintenance, or gadgets (e.g. generalised as masculine). In fact, greater consideration of gender in domestic energy scholarship might help to challenge stereotypes (e.g. construct alternative masculinities) (Organo *et al.*, 2013).

2.5.6 Summary

This section proposed that researching the home and uptake of energy efficiency improvements may require thinking more broadly about the process of homemaking in order to contextualise everyday activities. Key themes that emerged from analysis of homemaking highlight some areas deserving further investigation in domestic energy and home heating/cooling research. While specific recommendations have been offered within each theme above, two key suggestions for future research are presented to summarise and bring the themes of home-as-ideal, the hearth, family, privacy and gender together.

Firstly is the need for a more nuanced framing of the household. How do interactions between householders, sharing the home, and negotiating individual preferences affect house layout (related to family and privacy)? Who makes decisions about, and carries out, everyday household management, which partly determine the energy-intensity of practices (e.g. women/man (gender), children's 'power' to affect everyday routines (family))? These concerns are returned to in developing an appropriate methodology for this thesis in the next chapter (section 3.3.1).

Secondly, these themes evidenced the socio-material complexity of intervening in the materiality of the home. Thermal retrofitting or energy efficiency improvements may be halted if these improvements take away from 'idealised' historical features of the home (related to home-as-ideal and hearth). Authors who interviewed householders on their experience of making energy efficiency improvements found that for the most part these activities also increased floor size and the number of rooms (Judson and Maller, 2014; Maller and Horne, 2011; Maller *et al.,* 2012).

These material changes are (often) contrary to improving the energy performance of the home. Thus, it is important to remember that householders invest in home improvements in response to daily routines and those expected in the future (related to home-as-ideal, family and privacy), not simply to save energy or improve thermal comfort. Indeed, UK householders invest billions of pounds annually in home improvements (EST, 2010), which are predominantly intended to improve 'amenity' features (e.g. kitchens, bathrooms, living areas). These 'amenity' home improvements may be understood as part of the process of making a home, which goes far beyond financial rationalisation.

What constitutes 'normal' home life is undoubtedly a moving target and investigating homemaking offers insight into how/why homes, daily life, and expectations of home comfort evolve.

2.6 Conclusion

The chapter began by situating the aim of developing a concept of home comfort in the context of wider debates on theories of change in sustainable consumption scholarship. Section 2.2 discussed how current approaches to bringing about change for sustainability are dominated by theories of behaviour. Mainstream environmental policy and research separates social and technical strategies to reduce consumption (Shove, 2010) and a key debate about these policies has been the extent to which social change is within the capacity of individual agents or whether it requires more fundamental structural change in society (Shove, 2003). Framing sustainability around behaviour change leads to a specific understanding of the world; emphasising actors' agency to bring about change and placing responsibility onto individuals, their identity and values. Shove and colleagues' (2012) social practice theory was also discussed to offer an alternative way of understanding and explaining change. Shove (2003) demonstrated the importance of understanding the systemic redefinition of 'normal' life and argues that rather than taking individual behaviour as the central unit of analysis, researchers should attend to the construction and transformation of collective conventions. Since Shove's (2003) publication there has been a considerable body of academic work on social practices in order to understand how the social, practical and material elements of everyday life intersect.

This shift to an explicit interest in the ordinary, rather than the extraordinary, compliments the argument made in section 2.3 for 'home-ing' in on domestic energy research. This thesis thus aims to contribute to the current agenda to theorise 'energy cultures' (Stephenson *et al.*, 2010 in Hargreaves *et al.,* 2013) of particular contexts, such as homes or workplaces, moving beyond the decision-making processes of individual energy users. A practice-informed and inspired investigation of domestic energy demand underpins investigation of everyday home life, as

opposed to focusing on pro-environmental values and efficiency improvements. The current failures in reduction of domestic energy is indicative of a research and policy focus on improving energy efficiency in the 'house', which does not support a full understanding of what drives energy demand. Despite several decades of a dominance of research on the house, these methods have failed to adequately explain variation across populations and reduce energy demand, making the utility of studying the interaction between social and physical elements of the home increasingly apparent. Section 2.3 demonstrated that the depth of scholarship on the concept of home, as compared to the house, is significant for domestic energy because it helps researchers understand the complex social expectations (beyond control of temperature, air quality and lighting for instance) that are attached to everyday activities and to what energy is used for.

Certainly, the broader scholarship on the home brings interesting insights and debates to enhance understandings of domestic energy demand. Research on 'home' energy then contributes to a growing body of literature that analyses energy consumption, particularly space heating and cooling, in the context of daily life and changing expectations in relation to different standards of living. Section 2.4 therefore presented a review of key literature on comfort, a topic that has received increasing attention in energy scholarship. Yet while there is academic literature that explored how meanings of comfort have evolved and offered comfort as an explanatory variable for increasing energy consumption (e.g. Shove, 2003), comfort has been defined narrowly as thermal comfort. The term 'home comfort' was introduced to demonstrate an interest in developing understanding of comfort more broadly as being both physical and psychological. The review of literature on home comfort therefore highlighted a gap in home heating and cooling scholarship because there was much more to home life and home management than keeping bodies sufficiently warm or cool.

In order to inform development of the concept of home comfort and connect these expectations to domestic energy demand, section 2.5 explored key themes in the making and meanings of home. Homemaking is important for domestic energy researchers because it emphasises that homes do not simply change as the result of householders making rational and functional renovations. Certainly, the key themes of home-as-ideal, hearth, family, privacy, and gender added a depth of understanding to studies of home heating/cooling. Highlighting, for example, some areas deserving further attention such as a desire to preserve historical features, including an attachment to fireplaces, potentially being evidence that critiques the idea that investing in energy saving improvements is simply rational or financial. Furthermore, the importance of family and privacy in the home also suggested other considerations that influence everyday life more than environmental values. Finally, a difference in gender impacting an individual's experience and role in the home was raised, a consideration that has been surprisingly absent from the majority of domestic energy research.

This chapter thus set out a justification and foundation to develop the concept of home comfort and explore its implications for understanding domestic energy, especially home heating/cooling research. The dominance of the positivist 'house' approach means that there is an important opportunity for the development of innovative methodologies to capture both social and physical elements of domestic energy demand. Developing research methods appropriate to the task of studying home energy is explored further in the next chapter.

3: Methodology: Developing a home approach

3.1 Introduction

This chapter introduces the methodological approach used in this thesis. The previous chapter identified areas of further study and highlighted some important gaps in understanding domestic energy demand. Having established the aim, ROs and RQs it is then necessary to situate them within an appropriate methodology for this thesis. This chapter is organised accordingly: section 3.2 explains the criteria used to choose a qualitative methodology. Section 3.3 outlines the justification for the development of whole-household interviews, house tours, and using drawings for data collection. Then the details of the research process (section 3.4), rationale of the sampling strategies and description of the samples (section 3.5) are presented. The chapter is focused on developing an appropriate methodology for engaging householders in order to develop the concept of home comfort and interviews with home energy advisers are therefore given less attention.

3.2 A qualitative 'home' approach to investigating domestic energy research

A practice-informed approach indicated a move beyond a narrow focus on the decision-making processes of individual energy users, which is generally informed by large-scale quantitative survey methods (Jackson, 2005; Stern, 2000) and is a priority of ABC-informed sustainable consumption scholarship (Hargreaves *et al.,* 2013; Shove, 2010; Shove *et al.,* 2012). Instead of an interest in pro-environmental values or individual's rationalisation of their activities, practice theorists attend more to understanding how energy demand has changed, is changing and will change. This means that rather than focusing on actors, their intentions or sense of control, it is recognised that actions are materially scripted and technologies matter (Shove and Walker, 2014). The intention to study the socio-materiality of everyday practices or describe, explain and interpret social life points to the suitability of a qualitative approach.

Considering the reasons for adopting a practice-informed and 'home' approach set out in chapter two (sections 2.2 and 2.3, respectively), together with the nature of the research objectives (Figure 1.1), illustrated that a qualitative methodology is appropriate for this thesis. This section explains the reasons for this decision in more detail. A qualitative approach would be less appropriate than a quantitative one if a key aim was to represent, or generalise to, a population. However this is not the objective of this thesis, which aims for theoretical generalisation. Qualitative research is associated with an interpretivist approach, which began as a countermovement to the positivist tradition (Creswell, 1994) (Table 3.1).

Table 3.1 Quantitative and Qualitative Paradigm Assumptions (Creswell, 1994: 5)

Assumption	Question	Quantitative	Qualitative
Ontological assumption	What is the nature of reality?	Reality is objective and singular, apart from the researcher	Reality is subjective and multiple as seen by participants in a study
Epistemological assumption	What is the relationship of the researcher to that researched?	Researcher is independent from that being researched	Researcher interacts with that being researched
Methodological assumption	What is the process of research?	Deductive process Cause and effect Static design –categories isolated before study Context free Generalisations leading to prediction, explanation and understanding Accurate and reliable through validity and reliability	Inductive process Mutual simultaneous shaping of factors Emerging design- categories identified during research process Context-bound Patterns, theories developed for understanding Accurate and reliable through verification

An interpretivist approach maintains that natural science methods are not adequate to study the social world because social phenomena are fundamentally distinct from the physical reality studied by natural scientists (Lee, 1991). Interpretivists stress that human experiences and explanations are subjective, requiring a different set of methods to interpret and make sense of this complexity (Robson, 2002). Accordingly, reality is subjective, interpreted social action (Robson, 2002). On the other hand, quantitative research generally rests upon positivist assumptions and uses methods, which can be quantified such as questionnaires and surveys. The term positivist refers to a philosophy of science which maintains that natural science methods (e.g. hypothesis testing, experimental controls, falsifiability) are preferable for explaining social phenomena (Burrell and Morgan, 1979; Lee, 1991). Both approaches have particular strengths and weaknesses which drive their selection and use in research. Although these contrasts are largely heuristic as studies seldom exemplify all the ideal characteristics of either paradigm (Creswell, 1994). This thesis therefore is underpinned by the ontological, epistemological and methodological assumptions of qualitative research (Table 3.1), including that reality is subjective with the researcher constructing knowledge alongside what is being researched.

A practice-informed approach does not necessitate a qualitative methodology, and some practice theorists are usefully employing quantitative methods to investigate social conventions and their relationship to energy demand (Durand-Daubin and Anderson, 2014). Yet considering that the 'practice turn' is relatively new in sustainable consumption scholarship, much of this research is exploratory and thus a qualitative methodology is most appropriate. This is because (in comparison to quantitative studies) qualitative methods are employed when little information

exists on a topic, the variables are largely unknown and the researcher wants to focus on the context that may shape the phenomenon being studied. This is significant to this thesis because of the interest in understanding the meaning of home comfort (RO1). This is because investigation of the meanings of home comfort is limited (section 2.4), subsequently the purpose is not to validate or test an existing framework of home comfort. A qualitative methodology allows meanings of home comfort to be identified by participants through the research process instead of relying on quantitative methods which may impose inappropriate categories (Cresswell, 1994). The choice of a qualitative methodology indicates the ontological and epistemological stance of the researcher: because reality is subjective and constructed by the individuals involved in the research, knowledge is co-constructed between participants and the researcher (Creswell, 1994). This stance compliments the thesis' interest in understanding the construction and transformation of collective conventions; acknowledging the complexity of social change and that individual activities are inseparable from broader social processes.

The objective of this thesis therefore to explore how the social organisation of the home (e.g. expectations of home comfort)(RO1) might influence material features that impact domestic energy demand (RO2) is more suited to a qualitative methodology in order to make sense of the complex, dynamic and contextual nature of everyday activities.

3.3 Developing a qualitative methodology to study home comfort and energy

An in-depth qualitative approach seemed necessary to fully understand what shapes domestic energy demand as increasingly the dominance of behavioural theory driving policy interventions is questioned (Shove, 2010) and there is recognition that energy demand is significantly affected by a building's occupants (Kelly *et al.,* 2012). The literature review in chapter two also suggested that research needs to move beyond standardised models and explore how everyday activities are shaped by changes in the physical features of our homes. In fact, the choice to study the meanings of home comfort, as opposed to householder's pro-environmental behaviours, also signals a socio-material line of enquiry informed by practice theory (Shove *et al.,* 2012).

Other practice-informed studies of domestic energy have utilised a range of documentary data sources to investigate cultural conventions and how these are physically manifested (e.g. online discussions about heating and adaptation, customer review of products, Home Décor magazines, technical literature, historical accounts, consumer reports, advertisements)(Hand *et al.,* 2005; Royston, 2014; Shove, 2003; Shove *et al.,* 2007; Shove *et al.,* 2012). However, this thesis draws primarily on semi-structured interviews with households (section 3.4), following Hitchings' (2012) recommendation that individuals can talk about their everyday practices. Moreover, in the context of studying the meanings of comfort, documentary data on the home, such as Home Décor

magazines, often present idealised notions of everyday life and 'normal' home comforts. Furthermore, the majority of documentary data on comfort assumes that this has mainly thermal parameters (section 2.4). Thus, speaking to householders, including a drawing activity and visiting homes was considered more appropriate to address the aim of this thesis.

Considering that the household has been relatively recently highlighted in sustainability discourses as a key scale in which to contextualise an individual's activities (Collins, 2015; Gorman-Murray and Lane, 2011; Reid *et al.,* 2010) there has been relatively little methodological reflection on how to capture the complexity and shared reality of domestic life. That is not to propose that some domestic energy studies have not effectively used whole-household interviews (e.g. Chetty *et al.,* 2008; Head *et al.,* 2013; Hitchings *et al.,* 2015b; Wilhite *et al.,* 1996). Rather that discussion of the methodological impact of doing a whole-household interview is lacking (e.g. the household is a complex unit that cannot be represented by interviewing only one representative member of the household)(Reid *et al.,* 2010). Similarly, despite the growing body of practice-informed energy and sustainability scholarship there has been arguably little written on how to collect data on the 'elements' that make up a social practice (i.e. how best to study the materials, meanings and competencies of an activity)(Greene and Westerhoff, 2014; Gram-Hanssen, 2015). Especially, investigating how social norms affect, and are affected, by physical infrastructures. Therefore, this section argues why whole-household interviews (i.e. developing a methodology to observe and analyse household dynamics (3.3.1)) complimented by house tours and ideal drawings (i.e. connect the materiality of the home to everyday activities (3.3.2)) are appropriate for studying domestic energy broadly, and specifically for understanding the meanings of home comfort.

3.3.1 Studying the shared reality of the household: whole-household interviews

In contrast to the normal policy approach that typically considers the household as a single unit, one member representing the whole (Winstanley *et al.,* 2010), a whole-household interview was chosen for this thesis as part of developing an appropriate methodology for a new conceptual understanding of 'home' energy demand. Interviewing all members of the household provided greater insight into management of the household and daily routines since these topics are influenced and interwoven with the activities of other householders. Research focused at the household scale enables a broader and more relevant research agenda as most individuals live in households, and interventions to reduce energy demand are generally targeted at this scale (Lane and Gorman-Murray, 2011). Further, the household is a valuable scale to contextualise individual's action because "[m]ost household reality is a shared reality, in which household activities and patterns are negotiated jointly" (Valentine, 1999a: 68). The suggestion that researchers need to pay more attention to processes of compromise and negotiation in order to

gain a fuller understanding of how the household operates is not new (Campbell, 1995; Valentine, 1999b). But very little research has been devoted to developing a methodology for observing and analysing these household dynamics.

Other authors (Åstedt-Kurki *et al.*, 2001; Eggenberger and Nelms, 2007; Kinston and Loader, 1984; Lewis, 2008; Valentine, 1999b) have remarked on the lack of whole-household interviews and it is challenging to find literature on whole-household interviews discussed as a method. The most relevant literature is limited largely to family (Harden *et al.,* 2010; Lewis, 2008; Valentine, 1999a; Warin *et al.,* 2007) and nursing research (Astedt-Kurki *et al.,* 2001; Eggenberger and Nelms, 2007). Even within these two fields, it is a minority of studies that employ a method that interviews the whole-family at the same time (Gabb, 2009). While families are distinct from households (e.g. student flats are examples of multiple-occupancy households that are unrelated) (Yanagisako, 1979), reviewing literature on whole-family interviews is relevant because it provided discussion of some of the personal dynamics missing from focus group literature. Subsequently, the development of whole-household interviews for this thesis draws heavily from the family and nursing literatures mentioned above. However, transferable lessons need to be considered carefully because family and nursing research is developed with a different purpose from this thesis. For instance, speaking about sensitive subjects, such as coping with family members who are critically ill (Eggenberger and Nelms, 2007) or working through family 'problems' (Watzlawick, 1966). Nonetheless, the literature from nursing studies is particularly useful because there is explicit discussion of the benefits and limitations of whole-family interviews.

Focus group research was another source of literature reviewed to inform the development of the whole-household interview method (see Stewart *et al.,* 2007 for a comprehensive review). Some of the principles of focus group research are applicable to household research but there are notable differences between households and groups that generally take part in focus groups. For instance, although some studies interview 'natural' or existing groups (Warr, 2005), focus group members typically do not know each other, nor are they related to each other (Eggenberger and Nelms, 2007). Compared to group interviews with strangers the depth of the relationship and shared experiences between household members will alter the dynamics. For example, participants can relate each other's comments to actual events in their shared daily lives or shyer participants may be encouraged by other group members to join in discussion (Kitzinger, 1994). This interaction is one of the strengths of the focus group method because participants work off each other, adding their own insights or stories, to develop the meaning of a concept (Warr, 2005).

Group interviews have several advantages over individual interviews. In particular they help to reveal consensus views and may generate richer responses by allowing participants to challenge one another's views (Valentine, 1999a; Warr, 2005). There are, however, difficulties in facilitating group interviews and they require skilful and sensitive guidance by the interviewer (Leshed and Hakansson, 2014). Nonetheless, several authors argued that the family is more than the sum of its individual members and can and should be studied as a whole (Eggenberger *et al.,* 2007). Interviewing the family as a whole allows the tone and personality of a family to be revealed in a way that interviewing individual family members cannot. Family interviews illuminate how families interact with one another, and together families reveal their concerns, issues, problems, and the history they share as a family. Family interviews, while allowing for individual perspectives, reveal a common core or essence of a family as a whole. Thus the data revealed in family interviews are family level data rather than individual data (Eggenberger *et al.,* 2007). Similarly, if the couple is seen as a system that consists of two mutually influencing partners, then the aim is not to distinguish between each partner, but to learn from the collective, shared meanings attributed to the experiences of the couple (Bjornholt and Farstad, 2014; Taylor and Vocht, 2011).

Conducting joint interviews therefore provides opportunities for researchers to understand the collective perspective of the couple, and provide insights into the dynamics of the couple that are harder to identify in one-to-one interviews. When interviewing members of a household alone, the researcher hears "his story" and "her story". Instead when interviewing couples and families together, Taylor and Vocht (2011: 1584) proposed that what is uncovered is the story they tell each other or "their story". This does not mean that joint and group interviews are necessarily superior, just that they produce different data. One-on-one interviews certainly offer their own benefits (such as allowing individual units within the family to be heard), but it cannot capture the relational nature of families in the same way (Starkweather, 2012). Due to the acknowledgement that the home is a shared space, the decision to investigate the collective understanding of home life and home comfort suit the aim of this research.

3.3.2 Bringing materiality into data collection: house tours and ideal drawings

The literature review in chapter two highlighted the importance of a socio-material perspective, a recognition that the social and the physical are co-constructing (Rip and Kemp, 1998) (Section 2.2). This means moving away from explaining individual's activities in terms of intent and instead focusing on the social, practical and material structures that shape everyday routines (Scott *et al.*, 2012). For this thesis, a methodology was chosen that enabled exploration of both the social and the physical features of everyday activities in the home. Subsequently, this section draws on the (limited) methodological reflection in practice-informed studies relevant to socio-

material research methods (Foulds *et al.*, 2013; Greene and Westerhoff, 2015; Gram-Hanssen, 2015) and reviews literature relevant to developing a house tour method (Carpiano, 2009; Pink, 2004, 2006, 2007, 2013) and drawing activity (Rollins, 2005).

Despite the expanding body of practice-informed research on sustainable consumption, there has been relatively little methodological reflection or 'standard' recommendation for how to investigate practices. This is unsurprising in some ways because even though taking the 'practice' as a central conceptual unit of enquiry generates a range of distinctive questions, the choice of methods still depends on the kinds of questions being explored. Using practice theory is thus not directly tied to certain methods; the choice of methods is dependent upon the specific research question. Nonetheless, Foulds *et al.* (2013) suggested that this lack of methodological reflection may also be the result of relevant methods being developed in isolation, with technical sciences largely dominating attempts to understand how buildings are used (e.g. surveys and quantitative descriptions of occupants activities or satisfaction). On the other hand, a few researchers commented that practice-informed studies may have moved too far away from methods that study individuals or practitioners (Greene and Westerhoff, 2015; Gram-Hanssen, 2015; Ho, 2015). These authors critiqued that the explicit intention to move away from economic and (social) psychological approaches has led to a 'fear' of individualistic methodologies. Instead, they proposed for phenomenological and innovative qualitative methods (e.g. sensory ethnography and videos) to have a place within social practice theory (Greene and Westerhoff, 2015; Gram-Hanssen, 2015; Ho, 2015). The main point that can be drawn from these methodological writings on social practice theory and sustainable consumption is again a lack of discussion on how to bring together, and collect data on the relationship between, social and physical elements of everyday life.

Certainly, there are numerous practice-informed investigations of home energy demand that have demonstrated the utility of interviews to inform understanding of practices (e.g. material, competencies and meanings)(Hards, 2013; Hitchings *et al.,* 2015b; Ho, 2015). Even so, this thesis used house tours and a drawing activity in order to give more attention to the built environment and materiality. There are numerous examples of practice-informed domestic energy researchers incorporating a house tour, or at the very least the interview taking place in the home, in their methodologies (Hitchings *et al.,* 2015b; Ho, 2015; Klocker *et al.,* 2012; Pickerill, 2015). These studies offered some insights into the development of a house tour method for this thesis; for example, by highlighting the utility of including photography and videotaping as part of recording data. The researcher is not aware of any other practice-informed studies using drawings to speak about the materiality of the home. Drawing an 'ideal' room in the home was deemed important because it required participants to consider physical features that are important to comfort in the home. Thus resulting in householders connecting social and material aspects that influenced

everyday life; for example, explaining that having couches or cushy chairs (i.e. material element) related to relaxing, socialising and being a good host (i.e. competencies and meanings). While drawings are extensively utilised for research with children and in schools (Rollins, 2005), this is a relatively novel method to be included in social practice theory or domestic energy research. Admittedly, there has been some critique of analysing meanings and views from drawings (e.g. the ability of clinical studies to assess a child's wellbeing based on their drawing of an apple tree)(Backett-Milburn and McKie, 1999). Yet this is a concern generally of qualitative research, that there needs to be greater methodological reflection and development of visual analysis (Dowling *et al.,* 2016).

To observe the materiality of the home a full ethnography was not deemed necessary or suitable for this thesis because it would likely reduce the sample size since it is a relatively intrusive and time-demanding method of data collection for participants. Indeed, in another practice-informed study on domestic energy demand, Ho (2015) noted that he had to shift his data collection to 'ethnographic interviews,' which took place in the home because participants had rejected taking part in a full ethnography. This may not be unexpected considering that privacy is such an important aspect of the home (section 2.5.3), a point recognised in sociological and anthropological writings on studying the home (Pink, 2004; Pink *et al.,* 2010). Doing interviews in the home and a house tour are less intrusive for householders and still allows for multi-sensory observations of the home by the researcher. Certainly, the setting of an interview is important as highlighted by the literature on visual ethnographies (Pink, 2007) and walking tours (Carpiano, 2007; Evans and Jones, 2011; DeLeon and Cohen, 2005; Pink *et al.,* 2010). Walking can prompt participants to discuss meanings and connections with the surroundings, which organically draws attention to features the participant finds significant in a different way than an interview question does (Klocker *et al.,* 2012; DeLeon and Cohen, 2005). Including walking as part of data collection has long been considered an effective way to study participant's understanding of their surroundings (Evans and Jones, 2011). Yet writing a review of 'walking across disciplines', Pink *et al.* (2010) indicated that walking has only more recently been explored in a methodological context.

3.3.3 Summary

To sum up so far, this section has reviewed literature relevant to developing a methodology appropriate to a practice-informed 'home' approach to domestic energy research interested in both social *and* physical aspects of demand, stressing the importance of social intervention strategies and acknowledging that a building's occupants significantly affect domestic energy demand. Moreover, novel ways of investigating the complexity of shared home life and negotiation between householders were deemed necessary. A full ethnography offers in depth

observation of everyday activities and householder's interaction, but this method was deemed too intrusive and unnecessary for the purpose of this thesis. For instance, another practice-informed study failed to recruit householders for a full ethnography, yet participants were willing to take part in interviews and house tours (Ho, 2015). Subsequently, the methods for this thesis combine whole-household interviews with house tours and ideal drawings. What is novel about the methodology for this thesis was the decision to interview all members of the household together. Furthermore, the house tour and ideal drawing were considered important to understanding how the built environment and materiality of the home influence expectations of comfort and everyday activities. There is very little written about both these methods, the whole-household interview, house tour and drawings, in domestic energy research and beyond, and the utility of these methods are reflected on further in the discussion (section 5.6). With the justification for a qualitative methodology (section 3.2) and methods (section 3.3) set out for the research approach, the next section turns to explaining the specific development of a research instruments to answer the ROs and RQs.

3.4 Research Process

The development of methods was informed by the ROs and RQs. The research instruments were designed before the sampling strategy and subsequently are presented first. This section documents the rationale, design and reflection on the use of each of the methods (Table 3.2).

Table 3.2 Overview of the research instruments

Method	Purpose
Whole-household interviews	• Explore meanings of comfort and comfort-making activities • Discuss activities to save energy • Observe householder's interaction and shared reality
Ideal drawings of room in the home	• Icebreaker • Way to include and engage children • Opportunity for individuals to distinguish their opinions • Explore meanings of comfort and comfort-making activities • Connect material features of a room to activities and comfort
House tours/ walk through	• Create a common frame of reference between interviewer and participants • Observe the materiality of the home and energy saving improvements • Discuss normal activities and home life
Expert (home energy adviser) interviews	• Explore how domestic energy is approached in practice • Investigate the understanding of comfort by practitioners providing home energy advice

3.4.1 Whole-household interview

The purpose of the whole-household interview was to discuss the meanings of home comfort, householder's activities to save energy and to observe interaction between household members. Whole-household interviews were the primary method for data collection. The previous section indicated the suitability of interviews to a practice-informed investigation of sustainable consumption and methodological papers from family and nursing studies informed the development of a whole-household interview method.

As noted in the previous section, a few considerations arose from the decision to interview all members of the household at the same time. For instance, attaining consent from all members of the household is not as simple (e.g. the topic of study may be interesting to one member and boring to another, may struggle to find a convenient time for all to attend)(Astedt-Kurki *et al.,* 2001; Eggenberger and Nelms, 2007). Furthermore, including children, because they are important members of the household, can present some challenges and several authors suggested that paper and pens or a drawing activity were important ways to make younger members feel comfortable and involved in the interview (Eggenberger and Nelms, 2007). Similarly, the use of a group activity is a common recommendation in focus group studies because at the very least it is an icebreaker and encourages participants to respond to each other. This was part of the decision to begin the interviews with the drawing activity, which is discussed in detail in the next sub-section (3.4.2).

While other studies highlighted that it can be difficult to ensure all householders are available at the same time (Ho, 2015; Starkweather, 2012), this was rarely an issue for this thesis. There were only two interviews where the two men 'represented' their households because their wives were not at home. In both cases, it may not have been sufficiently clear that the intention was for the whole household to be present. The other case where members of the household were not included related to lodgers. This was a decision made by the participants, as the researcher was unaware in both cases until doing the interview. Despite the fact lodgers do influence everyday activities and household management, their absence in interviews is indicative of participant's understanding that lodgers are not part of the 'household' *per se* and could be a point to be clearer on in future studies*.*

The whole-household interviews were semi-structured (see Appendix A for interview guide), beginning with a drawing activity (section 3.4.2), followed by a set of questions on comfort and energy saving, and ending with a house tour (section 3.4.3). There were 5 main questions in the semi-structured interview guide:
1. Describe your ideal room:

    What is in it?

What would you do in this room?

2. What does comfort mean to you?

3. What do you do to be comfortable?

4. What have you done to save energy?

5. Are there any changes you would like to make to your home in the future?

The focus of the research was on home comfort, therefore, the interviews began with questions about expectations of the home and comfort rather than home energy or saving energy. There were more questions related to home and comfort than home energy demand, again, signalling that the interest was on understanding what energy was used for (section 2.2.2). Further, social practice theory decentralises the individual and this is often achieved through a focus on the details of 'doing' (Watson, 2012). Therefore, many of the interview questions were about describing activities (e.g. what would you do, what do you do, what have you done) rather than intentions or justifications for an action (e.g. 'why do you want to save energy?').

3.4.2 Ideal drawing

The whole-household interviews began with each householder drawing a picture of an ideal room in the home. In terms of addressing the ROs and RQs, the purpose of the ideal drawings was to begin to discuss what participants wanted from a home because this related to expectations of home comfort. Drawing a room also required participants to consider physical features that are important to comfort in the home, connecting back to the intention of a practice-informed methodology to bring together social and material aspects that influence everyday life. Moreover, the ideal drawings served a function in facilitating a whole-household interview, acting as an icebreaker and allowing each individual an opportunity to present their own perspective. Drawing was also a useful tool to involve children and is highlighted in research with children as a non-threatening and enjoyable activity (Rollins, 2005). While drawings are extensively utilised for research with children and in schools, this is a relatively novel method to be included in social practice theory or domestic energy research.

After filling out consent forms and providing an opportunity for participants to ask questions about the interview process (section 3.4.4), participants were told briefly that the research was about home energy demand and trying to understand everyday activities that shape consumption. Participants were then offered paper and felt tip pens and asked to draw an ideal room in the home, clarifying that the drawing did not need to relate to energy and that they could choose which type of room in the home (e.g. bedroom, kitchen, living room). The drawing activity took anywhere from 5 to 40 minutes, depending on the size of the household and participant's enthusiasm. Then each household member explained what they had drawn and what they would want to do in their ideal room. This was an important way of setting norms for the interview by

allowing each individual to express their own preferences and perspective. Whereas for the rest of the whole-household interview participants generally built off of each other's responses.

Often participants decided to draw something similar to their current home, sometimes addressing constraints that existed in reality (e.g. wanting only skylights, instead of windows, to ensure privacy because a neighbour could see in to their current bedroom). Others allowed their drawings to become more fantastical and extravagant, for example including hot tubs or a house made entirely of windows. The location of the whole-household interview thus likely affected the ideal drawing activity because some householders drew a version of the room the interview took place in. For the most part, participants engaged with the activity. Three participants did not want to do the ideal drawing activity because they had recently (within five years) moved and explained that they would rather walk around and describe their ideal room (i.e. because it already existed in their current homes). One other household refused, but had also been upset by questions about comfort, which is explained further in sections 4.4.4. The effect of interviews taking place in the home is explored further in the next section on the house tour.

3.4.3 House tour and photographs

There were three purposes for the house tours. First and foremost was to observe the materiality of the home and this has already been a method employed in other practice-informed domestic energy studies (Hitchings *et al.,* 2015b; Ho, 2015; Klocker *et al.,* 2012; Pickerill, 2015). Secondly, the house tour created a common frame of reference between the interviewer and participants. If there was a feature of the home participants particularly (dis)liked they could actually show the researcher exactly what they were talking about. For example, one participant had designed a tiny eco-house, but a verbal description did not fully capture the scale and space optimisation that was immediately apparent from doing a house tour. Finally, the house tour acted as a prompt for discussion of 'normal' home life because objects and rooms prompted responses that may not have necessarily arisen during the semi-structured interview questions.

The house tour took place after the whole-household interviews. This way the participants already knew the topics of interest (e.g. comfort, comfort-making activities and energy saving) and could relate their comments back to previous discussion if appropriate. Walking around the home, participants were asked to explain what they normally did in each room and any energy saving features. The house tours were audio-recorded and (to an extent) photographed. This followed other practice-informed domestic energy studies, which have effectively used photographs to demonstrate material elements of everyday practices (Dowling and Power, 2012). Whilst some of the photographs taken are included in the results (chapter four), photos were

supplementary to the primary data collection method but are deserving of more methodological development for use in social practice theory.

Sections 3.4.1, 3.4.2, and 3.4.3 have described the main data collection related to investigating the meaning of home comfort and the next section explains the design of interviews with a separate sample, home energy advisers.

3.4.4 Expert (home energy adviser) interviews

The purpose of the expert interviews was to explore how domestic energy demand was approached in practice, including investigating the extent to which comfort was considered and how it was understood by home energy advisers. In this context, home energy advisers were interviewed as representatives for a wider group (i.e. hold a key position in an organisation) (Bogner *et al.,* 2009), their understandings and experiences reflecting (to an extent) the way in which energy policies are carried out in practice. The interviews with home energy advisers were undertaken after the main data collection with householders as a way to discuss and explore the novelty of this thesis' findings on connecting home comfort with understanding energy demand.

Home energy advisers were targeted in their role as 'experts' or someone who is responsible for the development, implementation or control of solutions, strategies or policies (Meuser and Nagel, 2009). There is a considerable body of literature on expert interviews (see Bogner *et al.,* 2009 for overview) and unsurprisingly an ongoing debate about defining and identifying certain individuals as 'experts' (including different classifications of experts, such as 'elites')(Bogner and Menz, 2009; Smith, 2006). For the purpose of this thesis and to answer the ROs and RQs, home energy advisers are distinguished as experts because they were interviewed in the context of their role as trained and specialised professionals.

Energy adviser interviews were semi-structured (see Appendix B for interview guide) and there were 5 main questions:

1. What do you think the main goal of your energy advice centre is?
2. How does your work seek to address these goals?
3. What do you think is the most important recommendation to reduce home energy (or meet X goal identified in question 1)?
4. Have you thought about comfort in your work?
5. Do you think there are any other meanings of comfort?

Essentially, the intention of these questions was to confirm the contention and characterisation in domestic energy research of a techno-economic approach to reduce demand and to corroborate (or not) that home comfort is understood largely to be about thermal comfort. Moreover, part of

the interview was to present and get feedback on an early version of the framework of home comfort developed from the discussion with households (presented in Sections 4.3 and 5.5).

With each method explained the chapter now turns to explaining ethics, confidentiality and data protection considered in data collection for this thesis.

3.4.5 Ethics, confidentiality and data protection

Ethical approval was sought and awarded by the University of St Andrews Ethical Committee before recruitment began (Appendix C). As households were initially contacted through an organisation, consent to approach the households was sought from that organisation. After consent to approach households was gained, householders were given information detailing what would be involved, the confidentiality with which any information they provided would be treated, and information about the study. The letter also made it clear that participation in the study was entirely voluntary and they could withdraw at any time without giving a reason. At the beginning of the whole-household and home energy adviser interviews, the information about consent, data storage, confidentiality, and anonymity was reviewed again and written consent was gained from every household member (parents/guardians gave consent for children under 16).

3.4.6 Analysis

All interviews were recorded and transcribed. The whole-household interviews (including the drawing and house tour) were generally 45 to 120 minutes in length; in total 32 hours of interview material was transcribed, comprising approximately 250,000 words. The energy adviser interviews were also 45 to 90 minutes in length; in total 5 hours of interview material was transcribed, comprising approximately 6,000 words. Transcription is generally seen as part of the analysis (Elliot, 2005). A high level of detail was not generally required for this research, as the main focus was on content. Therefore, initial transcription included only a rough indication of the length of pauses and not every hesitant sound was transcribed. Recordings were retained so that data could be re-examined if the evolving analysis revealed this would be useful. The interviews were transcribed in full and no attempt was made to force speech into a written or grammatical correctness.

Although verbatim transcription is time consuming, it allows the researcher to become fully immersed in the interviews. Certainly, one difficulty of conducting whole-household interviews is the potential for participants to interrupt and talk over one another. Comments that can be missed or go unheard during the interview were still captured on the tape and it was therefore helpful to re-listen to participant's discussion. Transcription by the researcher has many benefits

(e.g. familiarity with the data and allowing the researcher to make decisions on pauses and level of detail) and fully transcribing the interviews meant that analysis could be iterative. Comments that might in initial stages of analysis appear irrelevant were therefore not discarded (which might occur in selective transcription) and could be understood as more important in later analysis. Furthermore, transcribing allowed the researcher to present quotes in the results and discussion chapters, which means that the reader has an opportunity to make their own interpretation of the data without having to solely rely on the interpretation of the researcher.

Many researchers have suggested that the first part of analysis occurs during the interview from listening and reflecting on participant's accounts (Elliot, 2005) and notes were made immediately following the interviews to capitalise on these initial thoughts (e.g. detailed summary, initial reflections and considerations for future interviews). Analysis of the transcripts went through a number of stages and strategies to 'make sense' of the data. A number of different approaches were brought in as each research question was considered and as emerging concepts identified new directions (Creswell, 1994).

The first step involved answering RQ1d (i.e. what does home comfort mean?) because the thesis is based around connecting a new conceptual framework of home comfort to informing understanding of domestic energy demand. Determining participant's understandings of home comfort was therefore the starting point in analysis. This was done by coding for common themes and responses to "what does comfort mean to you?" and "what do you do to be comfortable?" as well as analysing the drawings of ideal rooms for common features. Interview transcripts were imported in the qualitative analysis software Nvivo to facilitate the coding process, including being able to roughly quantify the mention of certain meanings of home comfort in order to establish their relative importance. The analysis of ideal drawings was relatively straightforward because the intention was to draw attention to physical features in the home and explore similarities across the sample. For instance, children commonly drew their bedrooms which might indicate the importance of control and personal space for children, whereas parents more often drew communal family spaces. The results of these analyses are discussed in sections 4.2 and 5.2.

Analysis then turned to linking investigation of home comfort to understanding domestic energy demand. This started with first determining what householders did do to reduce domestic energy demand (RQ2a). Answering RQ2a was a relatively straightforward process as analysis was more descriptive than thematic. Nvivo was used to code and quantify participant's responses to "what do you do to save energy?" and the results of this are discussed in sections 4.4 and 5.4. Connecting understanding of domestic energy demand with the meanings of home comfort that emerged in stage one of analysis (RQ2b and RQ2c) proved difficult. Leading to a review of literature on key

themes in homemaking to inform development of the concept of home comfort (i.e. related to 'comfort-making')(RQ1b). The homemaking themes then structured another round of analysis that drew together discussion from the interviews (e.g. including ideal drawings and house tour) that had not been incorporated in the first stage (which had mainly analysed answers to explicit questions about comfort). Analysis of the evidence of themes important to home and homemaking enabled the research to connect home comfort to understanding domestic energy demand (RQ2c) and is presented in sections 4.3 and 5.3.

Finally, interviews with home energy advisers were analysed to contribute to exploring the implications for future research and policy of this thesis (RQ2d). The volume of data from home energy advisers was much smaller and Nvivo was not considered necessary for analysis. Rather interviewees responses to questions were grouped together in a Word document in order to compare and summarise interviewee's discussion. Analysis focused on interviewee's responses to questions about the goal of home energy advice, the strategies employed to meet these goals, and how comfort was understood in their role. The results of this are presented in sections 4.5 and 5.4.

In summary, the analysis was inductive and exploratory, meaning that codes were themed according to the literature and RQs.

3.5 Recruitment and Participants

Building on the methodological approach, a purposive sampling strategy was seen as the most suitable to answer the ROs and RQs of this thesis. This section outlines the sampling strategy that was used, reflecting upon the complications encountered and how ethical standards and consent were accounted for. A description of recruitment and the sample follows, first for the householders (section 3.5.1) and then for the home energy advisers (section 3.5.2).

3.5.1 Rural home-owners living with microgeneration technologies and/or in 'low-carbon' homes

Recruitment for this thesis targeted homeowners in rural areas that had made efforts to save energy and this strategy was chosen for a variety of reasons.

Firstly, owner-occupiers are an important group to investigate and target in domestic energy research. Owner-occupiers account for over half of the housing stock in the UK (ONS, 2013), are more difficult to regulate than housing associations or the private rented sector, and in comparison to housing associations have worse building standards (DECC, 2013; DCLG, 2012). However, a considerable amount of related domestic energy research recruits from housing

associations (partly reflecting the energy vulnerability and fuel poverty agenda). In terms of reducing energy demand for environmental reasons or carbon emissions, housing associations are not the biggest emitters or targets. Owner-occupiers are generally more affluent and therefore consume more energy (Williams, 2007). Engaging owner-occupiers is thus an important group to investigate and the recruitment strategy reflects this.

Secondly, there was an initial interest on the extent to which the materiality of living in a 'low-carbon' home may affect householder's expectations of comfort. Technology is the centre of intervention for reducing energy demand and these 'low-carbon' homes represent the homes of the future as building standards ratchet up. As the case of thermal comfort highlighted (Shove, 2003), improvements in building standards can be counteracted by changing expectations of indoor environments. Yet there has been very little research on how living with microgeneration technologies affects everyday routines and this was explored further outwith this dissertation (see Ellsworth-Krebs and Reid, 2016). Recruiting from rural areas followed on from this interest in 'low carbon' homes and microgeneration technologies. This is because microgeneration technologies are both likely and appropriate in rural areas not connected to gas mains. For instance, domestic microgeneration may be more suited to rural areas (e.g. air flow not affected by other buildings for wind turbines, more likely to have garden space needed for installing ground source heat pumps) where other renewable production options are less easily shared (e.g. district heating, combined heat and power for a block of flats). Moreover, switching from gas to a heat microgeneration technology is a substantial cost hurdle (Connor *et al.,* 2014). Subsequently, the recruitment strategy targeted rural areas and homeowners who had made efforts to save energy, either by investing in improving the efficiency of their house (e.g. double/triple/secondary glazing, insulation, low energy lighting, new/condensing boilers) and/or microgeneration technologies (e.g. solar thermal panels, photovoltaic panels, biomass boiler, heat pumps, wood stoves and wind turbines).

Finally, targeting this group was aided by a personal and professional contact with two organisations in Fife, Scotland that advise locals about energy saving and were willing to help with recruitment. Recruitment began with the help of these energy advisers and snowballed as households that participated often knew other households with energy saving improvements or microgeneration technologies. Furthermore, targeting households that had invested in saving energy ensured that (at least) one member of the household would be able and willing to speak about energy saving activities (RQ2a). Certainly, participants for this thesis were keen to show off their homes (especially their microgeneration technologies) and recruiting participants willing to do a house tour and whole-household interviews may have been more difficult without this enthusiasm. In terms of investigating the meanings of home comfort (RQ1d), sometimes the householders least interested in energy saving spoke in the most detail about comfort, ideal

rooms, future improvements, and their everyday lives. Whereas, the participants most focused on technical improvements to save energy did not see the point in speaking about these more mundane topics. This is a reminder of the utility of a whole-household approach, as the interests of the household was not homogenous. Therefore, future research on home comfort may benefit from recruiting participants without mentioning energy (see for example Dowling and Power, 2011). Yet for the purpose of this thesis being able to speak to householders about energy saving improvements was helpful for the researcher to be able to make recommendations related to domestic energy demand (RQ2d).

The recruitment was successful with 21 households and 45 participants interviewed. To give a sense of the participants and housing type involved in this thesis, this section now provides an overview of the characteristics of the sample. Basic information was collected on participants, including age, employment, approximate annual energy costs, energy efficiency improvements as well as house type, age, and size. Table 3.3 summarises information about all the householders and Table 3.4 presents the information related to the house and energy demand. All household members, including children and lodgers that were not interviewed, are included to give a sense of household sizes. To protect anonymity, all participants have been given pseudonyms.

Interviews took place between February and June 2014. Seasonality was considered important in this thesis and thus the month that interviews took place is recorded in Table 3.3. Initially, the intention was to interview participants during the winter because this is when the most energy is consumed and participants would be likely to be thinking more about their energy-demanding activities. However, developing an appropriate methodology, receiving ethical approval and recruitment all took more time than expected, resulting in interviews spread throughout the end-of-winter, spring and summer. This in fact may have been beneficial because as the interviews advanced alongside days becoming longer, sunlight, the outside and the importance of the view from the home were given increasing prominence in discussion. Thus, having interviews only in the winter may have missed out on the importance of home comforts related to natural light and a connection to the outdoors (section 4.3.6). The majority of interviews took place in the evening to fit participant's work schedules and because it was a time when the whole household was together. Even though some of the first households stressed that sunlight and the view was important because it was dark during interviews the researcher was not able to experience this aspect of participant's homes. It was not until actually seeing and experiencing the view and walking around gardens during house tours in later months that importance of seasonality to householder's experience of their home became more evident.

Table 3.3 Participants by household, age, relationship, employment, and when interviewed

Home	Names	Age	Relationship	Employment	Interviewed
1	Katie	61	Wife	Retired	February
	Steve	61	Husband	Full-time employment	
2	Amy	47	Wife	Part-time employment	
	Simon	55	Husband	Full-time employment	
3	Michael	85	Single	Retired	
4	Emma	40	Wife	Part-time employment	
	Andrew	41	Husband	Full-time employment	
	Alice*	7	Daughter	Student (primary)	
	Jason*	5	Son	Student (primary)	
5	Sarah	54	Wife	Full-time employment	March
	Harold	53	Husband	Retired	
	Ailsa	16	Daughter	Part-time employment	
	Elizabeth	85	Grandma	Retired	
6	Lisa	69	Single	Retired	
7	Kelly	64	Single	Self-employed, part time	
8	Louise	53	Mother	Sick/disabled	April
	Helen	24	Daughter	Self-employed	
9	Pat	65	Wife	Retired	
	Oliver	66	Husband	Retired	
10	Fiona*	53	Wife	Part-time employment	
	Sean	50	Husband	Full-time employment	
11	Sharon	55	Wife	Part-time employment	May
	Aaron	57	Husband	Part-time employment	
12	Stacy	81	Wife	Retired	
	Darren	87	Husband	Retired	
13	Sue	55	Wife	Part-time, self-employed	
	Brian	60	Husband	Full-time, self-employed	
	Jan*	23	Lodger	Student (higher)	
14	Rachel	46	Mother	Full-time employment	
	Phil	64	Father	Part-time employment	
	Rory	8	Son	Student (primary)	
	Richard	8	Son	Student (primary)	
15	Rhona	72	Wife	Retired	
	Keith	72	Husband	Retired	
	Esther*	25	Lodger	Student (higher)	
	Isaac*	25	Lodger	Student (higher)	
16	Mandy	42	Wife	Student (higher)	
	Rob	44	Husband	Full-time employment	
	Ben	11	Son	Student (primary)	
	Stuart	9	Son	Student (primary)	
17	Maggie	80	Single	Retired	June
18	Shona	36	Wife	Self-employed	
	Bill	34	Husband	Self-employed	
	Gabriel	8	Son	Student (primary)	
	Isolde	6	Daughter	Student (primary)	
19	Mary	69	Wife	Retired	
	Arnold	71	Husband	Retired	
20	Catriona	70	Partner	Retired	
	Lucy	70	Partner	Retired	
21	Nancy	63	Wife	Retired	
	Jack	62	Husband	Retired	

* indicates householders that were not interviewed but are part of the household and will influence aspects of comfort or energy demand: It was easiest for the parents of Home 4 to do an interview after their children went to bed, in H10 the wife spent part of the week at another residence for work purposes and was not available on the interview day, lodgers were not seen as part of the household (H13 and H15) although they were commented on during the interviews and did impact management of the home.

Table 3.4 House and energy data of the sample

Home	Household size	House Age	House Type	Annual energy per home (£)	Technology
1	2	1964-2004	detached	1200-1680	PV, ST
2	2	before 1964	semi-detached	720-1200	ST, WBS
3	1	2004-2014	semi-detached	240-720	Eco-build
4	4	before 1964	semi-detached	720-1200	PV, WBS
5	4	1964-2004	detached	1680-2160	PV, ST, BB, Eco-build extension, MHRV
6	1	1964-2004	semi-detached	720-1200	AHP, ST
7	1	before 1964	detached	1680-2160	PV, ST, WBS, Eco-build extension
8	2	before 1964	terraced	240-720	new storage heaters
9	2	before 1964	detached	720-1200	PV, ImmerSun
10	2	before 1964	detached	>3120	PV, ST, WT, WBS
11	2	before 1964	detached	1200-1680	PV, ImmerSun
12	2	1964-2004	detached	1200-1680	PV, WBS
13	3	before 1964	detached	1200-1680	WBS
14	4	before 1964	detached	720-1200	BB
15	4	before 1964	terraced	1680-2160	Thermodynamic
16	4	before 1964	terraced	1200-1680	WBS
17	1	2004-2014	detached	720-1200	PV, new build
18	4	2004-2014	detached	720-1200	Passive house, MHRV, ST, WBS
19	2	1964-2004	detached	1200-1680	WT, WBS, PV, GHP, MHRV, Eco-extension
20	2	before 1964	detached	>3120	PV, WBS
21	2	2004-2014	detached	1200-1680	Eco-build, WBS, WT, ST, PV, AHP

WBS = wood-burning stove, WT, = wind turbine, ST = solar thermal, PV = photovoltaic panels, AHP = air-source heat pump, GHP = ground-source heat pump, BB = biomass boiler, ImmerSun = diverts surplus electricity to hot water from PV panels

This thesis is not meant to be representative of the UK population, however to give the reader a sense of the average household and housing in the UK this section provides some comparison to national statistics. Household size varied: the majority were couples (9 households, 1 household mother and daughter, 2 households with lodger(s)), with families of four (5 households) and single occupants (4 households) making up the rest of the sample. Two people households are the

most common in the UK (34%, ONS, 2013). The UK's average household size is 2.3 (ONS, 2013) and the average household size for this thesis was 2.1. Approximately half of the participants were retired and this may be in part due to the sampling strategy being targeted at 'low-carbon' homes. For instance, several participants mentioned investing their pension in microgeneration technologies in order to keep energy costs down in the future. Furthermore, being able to afford your own home, let alone invest in significant energy saving improvements and/or microgeneration, is more common for older age groups (76% of those aged 65-74 owned their own homes, compared to 40% of those aged 25-34; ONS, 2013). This is similarly reflected in the fact that roughly half of the sample was between 40 and 80 years old (under 20 (22%), 20-39 (16%), 40-59 (26%), 60-79 (26%), over 80 (10%)).

Even though the sampling strategy led to roughly half the sample being retired and over 40 years old, the house age and annual energy costs are much more reflective of the general UK housing stock. The majority of homes in this sample were built before 1964 (57%, 1964-2004 (24%), 2004-2014 (19%)), fitting with the UK housing stock profile which is made up of a little over half of homes being built before 1960 (DECC, 2013). Broadly, older homes tend to have poorer thermal performance than newer homes and having one of the oldest housing stocks in Europe is a major part of the challenge to reduce domestic energy demand in the UK. Thus, although the sampling strategy did not specifically target older houses, this is an important group to study. Interestingly, even though participants were recruited for living in 'low-carbon' homes the sample was spread evenly with half above and below the national average for annual energy costs. Annual energy costs are used as a rough proxy for actual consumption as it was deemed unnecessary and overcomplicated to measure actual consumption. Participants were asked to provide a rough estimate of their annual energy costs (£240-720, £720-£1200, £1200-1680, £1680-2160). The sample reflected a range of energy costs, with half below and half above the national average annual costs in the UK (£1130, Ofgem, 2013), although participants were predominantly white professional couples who were relatively advantaged in terms of income and health. This is important because the meanings of comfort discussed by these participants is likely to go beyond 'necessary energy uses' (Walker *et al.,* 2016), which are explored to a greater extent in the context of fuel poverty, and instead represents more 'ideal' notions of home comfort.

The preceding paragraphs give a flavour for the type of housing and homeowners, but ultimately these are reflective of a cultural and historical landscape specific to Scotland (e.g. climate, building materials, government regulations, etc.). While this sample is representative of an advanced western society's understanding of home comfort at this moment in time, this does not overlook that meanings depend on the context, which varies temporally and spatially. The relative importance of these meanings may vary if Norwegian or American homeowners were involved in a similar investigation because their norms and expectations are shaped by a different cultural

and historical context. However, the development of the concept of home comfort in this thesis (Chapter 5) combines the empirical findings of these Scottish householders with extensive writings about home and homemaking, which draw on wider geographical and historical studies in advanced western societies (see for example Crowley (2001) and Flanders (2015)). The conceptualisation of home comfort then aims to present overarching meanings of importance that at the same time can capture variation. For example, olfactory comfort is arguably a common aspect of home comfort (sections 4.2.12 and 5.2.12). In Scotland this may be because rooms get 'fuggy' and need airing due in part to building design and heating systems. Whereas, in a home in the United States heated by a furnace that circulates air throughout the entire house (i.e. as opposed to typical radiator heating in Scotland), this fugginess may be of little concern, however air freshness may still be valued with an emphasis placed on products (e.g. soaps, washing up liquids, air fresheners) instead of the need to open windows/doors to air out rooms. To make the findings of this thesis more generalizable it would be interesting to undertake similar studies in other countries, however this was deemed out of the scope due to the exploratory nature of this thesis.

3.5.2 Scottish Household Energy Advisers

The recruitment of home energy advisers was designed to capture experiences in different geographical areas in Scotland and various scales of advice centres. The recruitment was based on professional and personal contacts, and in order to preserve anonymity, specific organisations and locations are not identified in the description of the sample.

All the interviews with home energy advisers took place in March 2015. The recruitment was successful with 5 participants interviewed, representing a range of energy advice centres from around Scotland; including Fife, Edinburgh and southeast Scotland, and the highlands and islands. Participants also represented organisations that ranged from small, local advice centres to national bodies, and all the centres received some government funding.

3.6 Conclusion

This chapter has documented the methodological approach, design, execution and analysis of this thesis. The chapter began by explaining the criteria for developing the research methods. The literature review in chapter two suggested that research needed to move beyond standardised models and explore how everyday activities are shaped by changes in the physical features of homes. Furthermore, the household has been relatively recently applauded in sustainability discourses as a key scale in which to contextualise individual's activities. Thus, sections 3.3 and 3.4 focused on developing a methodology to observe and analyse household dynamics and connect the materiality of the home to everyday activities.

The household reality is a shared reality and household activities are jointly negotiated. The household is a complex unit that cannot be represented by simply interviewing one member of the household. Subsequently, a whole-household interview method was developed. Moreover, a methodology was chosen that enabled exploration of both the social and the physical features of everyday activities in the home. Therefore, interviews involved a house tour and drawing activity. House tours created a common frame of reference between the interviewer and participants, enabling more engagement with the materiality of the home as objects and rooms prompted responses that may not have arisen during semi-structured interviews. Participants were asked to do a drawing of their ideal room, which complimented the whole-household interviews (acting as an icebreaker and opportunity for each participant to distinguish their opinions) and were also a way to connect material features to householder's activities. The whole-household interview, house tour, and ideal drawings were all part of contributing to a socio-material and practice-informed line of enquiry.

Finally, the chapter detailed the sampling strategy and sample of both householders and home energy advisers. Homeowners were targeted as an important group to engage with and understand in the context of domestic energy because owner-occupiers account for over half of the housing stock and are a difficult group to influence (i.e. as opposed to regulation on housing associations). Moreover, households were recruited with the help of two energy advice organisations in Fife, Scotland and thus these households had invested in saving energy, which ensured that (at least) one member of the household would be able and willing to speak about energy saving activities (RQ2a). Certainly, participants were keen to show off their homes, especially their microgeneration technologies, and recruiting participants willing to do a house tour and whole-household interviews may have been more difficult without this enthusiasm. In total, 21 households were recruited and 45 participants interviewed. This sample is not meant to be representative of the UK population, yet the sampling strategy resulted in an interesting group to understand and engage with. The majority of the sample were owner-occupiers, living in homes that were built before 1964. Upgrading older buildings is a major part of the challenge to reduce domestic energy demand. In order to explore the extent to which comfort is considered by Scottish home energy advisers, five home energy advisers were also interviewed and recruited from a range of advice centres around Scotland.

The next chapter presents the results from discussing home, comfort and energy with this sample.

4: Results: Analysing meanings of home comfort and their relationship to energy demand

4.1 Introduction

This chapter presents the results of this thesis, exploring how householders understood energy saving and relating this to their expectations of home comfort. As chapter 2 highlighted, domestic energy demand is not simply shaped by householder's intentions to conserve, but the mundane socio-material evolution of the everyday and changing expectations of home life. This thesis takes a novel approach as few studies have endeavoured to inform understandings of domestic energy demand through whole-household interviews, house tours, and ideal drawings. Even fewer studies have collected data on expectations of home alongside householder's discussion of energy saving. Sections 4.2 and 4.3 present evidence on meanings of comfort and home, respectively (contributing to RO1). In so doing, a new framework to understand occupant satisfaction or home comfort is developed. Section 4.4 explores the findings in relation to what householders did to save energy, specifically how energy retrofitting related to moments in homemaking (contributing to RO2). Then section 4.5 considers the extent to which comfort is considered by Scottish home energy advisers in order to gauge the novelty of a broader framing of home comfort in a practical and policy energy context (contributing to RO2). Section 4.6, the conclusion, brings together common themes within each of the sections, identifying areas for discussion in the next chapter.

4.2 What does comfort mean to householders?

This section explores what these other expectations of home are in order to understand how home improvements and homemaking influence domestic energy demand. This is a particularly novel aspect of this thesis and no existing energy research has investigated broader meanings of home comfort (i.e. as more than thermal comfort). Section 4.2.1 presents the findings on multiple co-existing meanings of home comfort (addressing RQ1d). These meanings are organised into physical, physical-psychological and psychological categories to highlight that home comfort is both physical and psychological (section 2.4) (location in these categories are based on the way participant's spoke about a meaning and will be explained further below). All participants have been anonymised and are identified by a pseudonym (their age and household number).

Participants were asked "what does comfort mean to you?" and "what do you think is most important to comfort?" and the data presented in this section is primarily confined to participant's responses to these two questions and discussion of ideal drawings. Twelve common meanings of home comfort emerged and these have been organised from most to least discussed and begin to create a framework of home comfort. Table 4.1 summarises these twelve meanings,

their relative importance and examples of what these aspects of home comfort meant to householders to help orient the reader.

Table 4.1 Meanings of home comfort, organised vertically from most to least discussed

Meanings	Category	Rough % of interviews	Examples from interviews (number of participating household)
Thermal comfort	Physical	All	*Not too hot, not too cold (12). A draft free house (4). Woolly slippers (4).*
Relaxation	Physical-psychological	Two-thirds	*Where you are at peace or where you are at rest (16). A nice place to sit and relax (17).*
Companionship	Psychological	Half	*Watching the kids being happy (4). The right company (12).*
Control	Physical-psychological	Half	*Being able to do what you enjoy (8). Having my own room (14)*
Tactile comfort	Physical	Half	*Soft furnishings (11). Fluffy blanket (H14). Warmth and softness (18).*
Visual comfort	Physical-psychological	Half	*Looking at nice things (9). Appropriate lighting (19).*
Mental wellbeing	Psychological	Third	*Comfortable in your own skin (11). Not feeling too rushed or overwhelmed (16).*
Auditory comfort	Physical-psychological	Third	*Quiet [...] background of peace [and to] choose whether I have music on or not (13).*
Familiarity	Physical-psychological	Third	*That feeling of relaxation [...] which is due to having familiar things around you (2).*
Contributory comfort	Psychological	Fifth	*Not costing the earth (19). Benefit other people (12).*
Physiological comfort	Physical	Fifth	*Not being hungry (20). Not being injured or experiencing physical pain (10).*
Odour & Fresh Air	Physical	A few	*Simply hot can be very uncomfortable [for example] some sort of sealed fuggy box (5).*

4.2.1 Thermal comfort

Thermal comfort, or warmth, was the most commonly discussed meaning of home comfort and was mentioned in all the household interviews:

> *Rachel: Do you know what comfort is?*
> *Rory: Yeah, like being warm* (45 & 8, H14)

> *Enough warmth to not be sort of sitting around shivering, I get quite miserable when I'm cold, miserable and cranky* (Sue, 55, H13)

> *I think warmth, a draught free house* (Andrew, 41, H4)

The focus on thermal comfort was not really a surprise considering the Scottish climate, the relatively old and inefficient UK housing stock, and policy and international standards that emphasise thermal comfort. Participants often defined comfort in terms of temperature: "comfort

means being the right temperature" (Sean, 50, H10). Moreover, for some it was the main (or only) meaning of comfort: "warmth must be one of the prime reasons" (Maggie, 80, H17). However, there was a general understanding that the 'right temperature' and thermal comfort preferences varied in relation to the function of a room or a householder's activities. The most common distinction being that bedrooms were more comfortable at cooler temperatures than sitting rooms; for instance, Nancy asserted that "you certainly don't need to heat bedrooms" (63, H21) and this was also voiced in several other household interviews. Furthermore, participants clarified that "it is a sort of balance of what you are doing and how warm you need it to be to be comfortable" (Sophie, 54, H5). While thermal comfort was an essential component of home comfort, there was debate amongst householders about thermal comfort preferences. For example, Lucy accused Catriona of keeping her study too hot: "she has a different thermostat to me as well, I tend to be down here and Catriona is upstairs in a sauna" (Lucy, 70, H20). These sorts of debates about different preferences and ways of managing thermal comfort were common in the whole-household interviews.

The emphasis on defining thermal comfort in terms of temperature preferences may be because this is arguably perceived to be a socially acceptable way of talking about warmth. For example, some participants felt that talking about activities to stay warm beyond setting the thermostat was embarrassing or personal. Nancy had said being warm enough was the most important aspect of comfort, and when pushed to explain what she did to be 'warm enough' she exclaimed:

> *Oh dear, I'm going to have to bear my soul here. What I do, is I put the kettle on, fill a hot water bottle and shove it behind me in a chair. And if it is really seriously cold, I would light the fire* (Nancy, 63, H21)

Even when she was only describing how she liked to use a hot water bottle or build a fire if the under-floor heating from their heat pump was not 'warm enough', Nancy appeared embarrassed to speak about these activities. One participant even refused to discuss comfort; Keith could not see how it related to energy consumption:

> *I don't think that I can handle that* (Keith, 72, H15)

By the end of the interview, Keith apologised for being inflexible and negative (i.e. he got up to leave the room when asked 'what does comfort mean to you'), but other householders shared his reservations (albeit less vocally). The point is that temperature may not necessarily be the most important consideration for thermal comfort, rather talking about comfort in other ways is more personal, embodied and intimate than talking about temperature. Some participants highlighted

the complexity of thermal comfort discussing other considerations beyond temperature. For instance, layering clothing was often part of regulating thermal comfort:

> *I have had a sort of lifetime of being trained to sort of put an extra sweater on. You know we lived in very cold houses as a child and you know I just got used to the fact that if you are cold you put a jumper on or you put a vest on or you put your slippers on […] So I don't really resent doing that but I must say there are times that it would be sort of nice to not have to be all muffled up in order to be warm* (Sue, 55, H13)

> *I think there is a difference between what you would like to do, and what you actually do. Because I might come home with the kids in the winter and try not to put the heating on straight away, because this house costs so much money to heat, so it is that trade off. I usually light the fire so that the kids are warm-ish and keep on extra layers* (Emma, 40, H4)

Furthermore, some participants emphasised wrapping up in blankets or using hot water bottles as part of thermal comfort in the home.

> *I will often sit there with a hot water bottle and a fleecy blanket over me so the room itself won't be necessarily warm by someone else's definition, like someone who wants to wear a t-shirt, but I will be warm* (Amy, 47, H2)

> *We do have an electric blanket […] because getting into ice crystally sheets was no fun for anybody"* (Mandy, 47, H16)

Primarily, thermal comfort was discussed in a physical sense, with more psychological benefits of warmth being described separately. For example, both Amy and Shona commented on psychological benefits of having a stove which were separate from its use as a space heater:

> *Well it is a bigger sense of comfort than you get from a radiator. It may be a bit smellier and less convenient but there is something hypnotic about watching flames* (Amy, 47, H2)

> *When it's the winter we want to have the fire on anyway for the cheer of it. It makes this room warm, but most of the energy of the fire goes into the hot water* (Shona, 36, H18)

This distinction between physical warmth and more psychological comforts was common, indicating that thermal comfort was understood mainly in a physical sense. While thermal comfort was explained to be the first and/or most important meaning of comfort, it was interlinked with other aspects of comfort, such as odour and fresh air (section 4.2.12), visual

(section 4.2.6) and tactile (section 4.2.5) comforts as well as connected to relaxing (section 4.2.2) and being a familiar aspect of home (section 4.2.9), which are explored in more detail below.

4.2.2 Relaxation

Relaxation was discussed in roughly two-thirds of the household interviews. For some participants, relaxation was a key part of initial answers to "what does comfort mean to you?":

> *Comfort for me is the right temperature and being relaxed* (Sean, 55, H10)

> *Feeling relaxed […] it is as much about mental relaxation as it is necessarily physical* (Amy, 47, H2)

Furthermore, being able to 'relax' was the main purpose that arose when householders explained what they would use their ideal rooms for:

> *Just somewhere that I could relax and use the computer to work or to play and then also just relax and enjoy* (Helen, 24 H8)

> *A nice place to sit and relax, watch television, listen to music, read, that sort of thing* (Maggie, 80, H17)

> *Sense of comfort and sense of not everyday activity, this is the room where you don't do things* (Stacy, 81, H12)

> *I would use it to relax in, and in the evening to read, maybe TV* (Lucy, 70, H20)

> *To work if I wanted to, to relax if I wanted to, to watch TV if I wanted to, space for friends as well so that I could socialize in that room too* (Kelly, 64, H7)

> *It would be primarily pleasure, you know just relaxing, surfing the net or whatever. Meeting friends would be very important, like we entertained yesterday and that is really important to us* (Oliver, 66, H9)

In many ways, relaxation was mentioned as a synonym for comfort. Yet what activities householders considered to be 'relaxing' varied. As highlighted by the quotes above, common relaxing activities were watching TV, using the computer, sleeping, and reading. Even though

households often identified particular activities as 'relaxing', relaxation was more complex and was the most interconnected meaning of home comfort.

Relaxation was both physical and psychological. In the quote above, Amy in particular distinguished between 'mental relaxation' (i.e. mental health, section 4.2.8) and 'physical' comforts (i.e. thermal comfort, section 4.2.1), but many of the other quotes hinted at relaxing having both physical and psychological sides. For instance, relaxing was often connected with comfortable furnishings or sitting:

> *Having somewhere comfortable to sit in the evening when you want to relax is kind of a big thing for me* (Brian, 60, H13)

> *Comfort for me is also about being able to sit and read a book or do my crossword or suduko or whatever* (Catriona, 70, H20)

> *I tend to come [home] and go into the kitchen and either start pottering about and getting stuff ready for tea or go and sit in the dining room area with a chair, sit down in the window, have the music on, my radio on, maybe a cuppa tea in my hand so I am relaxing and chilling out before you have to get on with the next thing* (Sarah, 54, H5)

> *To relax? My ideal chill moment would be sitting next door in front of a fire, with some music on, read the paper with a drink of some kind, probably alcoholic. That would be my kind of ideal end of the week chill moment* (Sean, 50, H10)

> *For like relaxing comfort, nothing sort of beats being in bed [...] You know curled up, with a cuppa tea or a glass of wine [...] A good day is a Netflix marathon or at least 2 or 3 films* (Helen, 24, H8)

> *We don't do an awful lot of sitting down relaxing as a family. Even on the weekend or on a holiday they will sit down quite happily for a couple of hours and just chill [...] There is not much sort of sitting around relaxing. Sometimes if it is raining or something we might come and watch a movie together but we very rarely do that as a whole family* (Rachel, 45, H14)

By stressing that her family did not do much 'sitting down relaxing' Rachel draws attention to the assumption in many of the other participant's explanations of relaxation being dependent on having somewhere comfortable to sit. Whilst comfortable seating (i.e. tactile comfort, section 4.2.5) was important, these quotes also indicate connections between relaxation and other meanings of comfort. For example, music (i.e. auditory comfort, section 4.2.8) was mentioned as a

component of relaxing or an ideal room. Having a drink (i.e. physiological comfort, section 4.2.11) also appeared important. The quotes above also indicated that householder's understanding of relaxation is similar to 'chilling' and when 'you don't do things'; and this relaxing comfort was associated with certain time periods: evenings, weekends, holidays. Moreover, these descriptions suggested that relaxing was about having time on their own and being able to choose to do whatever they wanted (i.e. control, section 4.2.4). At the same time an ideal room and relaxation could also be about socialising with friends and family (i.e. companionship, section 4.2.3). For example, Shona, who has two young children, described comfort being when the family is relaxing in the same room together, whether this is sitting by the fire or during bath time:

> *In the winter, there is a nice bit in the late afternoon when we light the fire and we [do] a lot of sitting around here near the fire. Like I said before, family, people having a bath, whether we are all taking turns having a bath or jumping in together* (Shona, 36, H18)

Similarly, relaxation was explicitly mentioned in terms of ensuring that guests felt welcomed (i.e. contributory, section 4.2.10):

> *Well I would like to think that anyone who comes in feels comfortable and relaxed [...] I hope that it would be warm and welcoming and people would feel at ease* (Elizabeth, 80, H5)

> *Being somewhere where you feel that other people are comfortable, I get very uncomfortable if I think the people I am with are not relaxed or are unhappy* (Catriona, 70, H20)

Here, both Catriona and Elizabeth emphasised the psychological side of relaxation or feeling 'at ease'. Relaxation was a ubiquitous term in the whole-household interviews, and arose spontaneously. For example, when householders were asked "what do you do to make yourself comfortable?" this was often interpreted as "what do you do to relax?". Relaxation was the most interconnected meaning contributing to the argument that understandings of home comfort may need to consider multiple meanings (section 2.4), and their interconnections, because narrowing onto one meaning of comfort (e.g. thermal comfort) may ignore other considerations of importance.

4.2.3 Companionship
Having "*the right company*" (Stacy, 81, H12) or "*the people that you care about*" (Sue, 55, H13) was mentioned in roughly half of the interviews and discussion related to this meaning of home

comfort has been brought together under the label of companionship. For many participants, companionship was a key part of their initial answer to "what does comfort mean to you?":

Comfort to me means being able to see people (Jack, 62, H21)

Comfort involves several things, its people, its comfortable enough facilities that they don't irritate or trouble you, too cold, too hot, too whatever (Stacy, 81, H12)

Just be surrounded by your family, possessions, pictures of your kids (Katie, 61, H1)

Kelly: What is important to comfort? People, animals, pleasant surroundings, it doesn't have to be luxurious but comfortable, pleasant
Interviewer: Why are people important to comfort?
Kelly: Well I think that they are part of social health and individual health (64, H7)

Definitely, for me, having my children around me, my family, my close family is a big part of comfort for me. I just love it when they are both at home and we are all together, and you know they have left home now so it doesn't happen often enough. But when all four of us are in the house it just feels totally right, it doesn't matter what is going on. But better still if it is warm and cosy (Sue, 55, H13)

You've got food in the fridge, you've got warmth, you've got heating and you've got friends, and you've got family as well. So what more do you want really? (Lisa, 69, H6)

These quotes indicated that 'people' and 'family' were a key aspect of home comfort and some participants even mentioned companionship before thermal comfort (section 4.2.1). Certainly, several of these quotes referenced being 'warm and cosy' or not 'too cold [or] too hot' only after emphasising the importance of companionship. In comparison to relaxation (section 4.2.2), companionship was much less interconnected with other meanings of home comfort. Kelly mentioned a link between companionship and mental health (section 4.2.8) and a few participants referred to having photos and 'reminders' of the family, which relates to visual comfort (section 4.2.6). Nonetheless, companionship is a relatively significant meaning of home comfort considering that in the majority of whole-household interviews there was some mention of the importance of friends and family. Pets were also part of the comfort of companionship in the home. For example, Kelly runs a B&B, but was technically a single-occupancy household, and spoke extensively about the comfort she gains from her dog and chickens. While in another interview, it was their dog barking that sparked a participant to reflect on the importance of companionship:

I suppose what makes a house a home, is all the things that go with it, including the dog I suppose, and the children (Phil, 64, H14)

In particular though, family influenced the feel and expectations of the home. Sue articulated this in terms of when the whole family was at home 'it just feels totally right, it doesn't matter what is going on' and mothers most often commented on the importance of children and family:

Watching the kids being happy (Emma, 40, H4)

Comfort probably involves having my kids and husband around me … being peaceful (Mandy, 47, H16)

I just love when my grandchildren come and comforting them, and them running up to me 'Granny' and all this sort of stuff, that makes me feel good as well (Lucy, 70, H20)

This may hint at a gendered difference in meanings and expectations of home comfort, with women placing a greater emphasis on family, but men also considered family to be important in their responses (even though in the quote above Phil mentioned the dog before the children). Moreover, ensuring that the home had a guest bedroom so that family members could visit was a common concern (returned to in section 4.3.3 on family) and grandparents as well as parents were particularly vocal about the comfort of having their children and grandchildren in their homes.

Furthermore, about half of the ideal room drawings featured lots of seating or large tables in order to accommodate having company around (Figures 4.1-4.4). These drawings demonstrate the importance of companionship because an ideal room in the home was often expected to be shared and had features that enabled householders to accommodate guests. Thus, the importance of companionship also emerged when householders described their ideal rooms and explained what they would want to do in this space:

People are probably more important to me, you know, who is in a room is probably more important to me than the room (Sean, 50, H10)

Meeting friends would be very important […] so the room would have to be comfortable (Oliver, 66, H9)

Figure 4.1. Katie's Ideal Room (61, H1)   **Figure 4.2. Sue's Ideal Room (60, H13)**
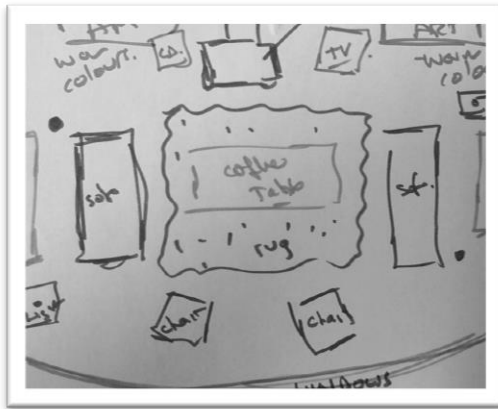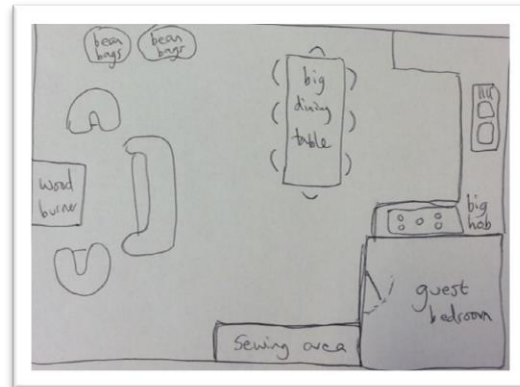
Figure 4.3. Jack's Ideal Room (62, H21)   **Figure 4.4. Brian's Ideal Room (55, H1)**
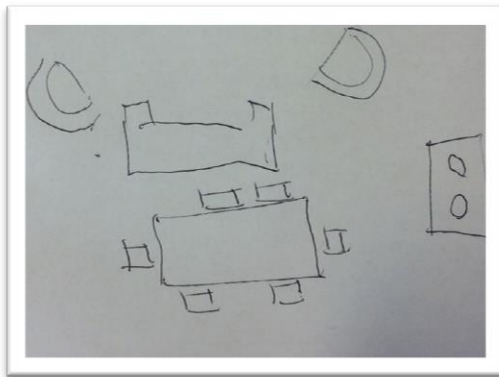
Sue: It is a place to hang out with family and friends that is really comfortable and warm and has loads of natural light

Brian: Mine is in some ways quite similar […] It has got nice things on the wall, pictures and so on, it has got music, it's got books, it's got reminders of the rest of the family, it's got nice squashy sofa that we can cuddle up together on, and it's got triple-glazed [windows]. A nice view of natural things outside that feel as if they are part of the inside (55 & 60, H13)

These quotes usefully highlighted that a key aspect of home comfort is that the home is shared. Sometimes this is with other householders but also being able to accommodate visitors is an important expectation of the home (related to contributory comfort, section 4.2.10).

Part of the discussion of family and communal living often led to reflection on managing communal spaces. Indeed, half the ideal drawings were of communal spaces, the other half were focused on personal bedrooms and creating personal space in the home. Therefore, while companionship was key, there was also a focus on control and personal space which was the next most discussed aspect of home comfort.

4.2.4 Control

Being able to 'do what you want' was an important aspect of home comfort and is brought together under the label of control. Householders most often used the term 'control' when referring to managing their heating systems:

> *You can control the temperature* (Lisa, 69, H6)

> *[Our storage heaters are] better and more efficient than the old ones and they are also more controllable because each unit can be controlled separately* (Kelly, 64, H7)

> *Our energy performance was marked down because we didn't have thermostatic controls* (Aaron, 57, H11)

Whereas, the label of control is used much more broadly to emphasise that home life is dependent on social (e.g. building regulations, builders and installers, funding schemes, other household members) and physical constraints (e.g. physical house, layout, size of rooms, energy infrastructure) both inside and outside of the home. In this sense, control was mentioned explicitly in roughly half the household interviews in the initial response to "what does comfort mean to you?":

> *Not just being physically comfortable but being mentally comfortable and happy. Being able to do what you enjoy in that space and being able to make the most of the space for what you enjoy doing, whatever purpose that is. So like, comfort I think depends on the room because obviously you needed a different sort of comfort in the kitchen to be able to cook than in the bedroom to be able to sleep* (Helen, 24, H8)

> *Being able to do what I want in my own house really. Just knowing that whatever I do, if I lay it down it will be there when I come back* (Sharon, 55, H11)

In this thesis, control then refers to the home being a space that affords householders a sense that they can do what they want.

Control was discussed implicitly as householders described their ideal rooms or future improvements. Phrases such as "I want" and "being able to" arose in nearly every interview as householders reflected on the extent of their control within the home and how this related to

home comfort. Referring back to quotes in the section on relaxation (4.2.2), for example, highlights this connection between control and comfort (underline added):

> *To work if I wanted to, to relax if I wanted to, to watch TV if I wanted to, space for friends as well* (Kelly, 64, H7)

> *Comfort for me is also about being able to sit and read a book or do my crossword or suduko or whatever* (Catriona, 70, H20)

Moreover, being able to 'do what you want' was often raised in acknowledgement of intra-household interactions. For example, controlling the type of music or lighting in communal spaces was mentioned as a point of contention in several household interviews (returned to in section 4.3). Children and teenagers spoke most about comfort in relation to having their own room, often elaborating on security systems and locks as integral features of their ideal rooms, because these features protect the space within the home that they have more control over. Stuart, Ben, and Ailsa all described ways to keep other household members out of *their* rooms, which was generally met with amusement by those being 'locked' out:

> *Imaginary room! Here we go! This will not be like what we are in; guard doors so no can disturb me (dad laughed). What, you guys always walk in at the most inconvenient times* (Stuart, 9, H16)

> *Ben: I have a freezer, a barred door so no one can disturb me, a giant bookshelf, an awesome computer that never glitches or lags, a few comfy chairs to sit on, a trapdoor leading to a secret bunker, a bed, a window made of bullet proof glass, a fluffy cat bed, his bowls, a cat flap*
> *Interviewer: So what do you want to do in your room?*
> *Ben: Have some peace from everyone else* (11, H16)

> *Ailsa: Mine wouldn't be people coming in and out, I don't like that (everyone laughed)*
> *Elizabeth: Draw up the draw bridge*
> *Sarah: All sociability would have to take place in our rooms*
> *Ailsa: It probably would have a locked door as well with a code that changes every day* (16, H5)

Certainly, the importance of control was not limited to children and many householders commented on a desire to have enough space so that householders did not disturb one another:

Room for different activities to go on within the [home] so there can be somebody being very noisy and it's not bothering anyone else (Shona, 36, H18)

This was a major consideration for Nancy and Jack designing their new eco-build for:

Two retired people who want to carry on doing their own thing, but living together as well. So that was reflective in the design of the house [...] The fundamental difference is that I am extremely messy and untidy and Nancy is extremely tidy (Jack, 62, H21)

Their upstairs was a mirror image (Figures 4.5 and 4.6), with two offices and two en-suite bedrooms. These rooms reflected the individual's tastes and character, with Nancy's space being less cluttered and simple (Figure 4.5) and Jack's space more cosy and filled (Figure 4.6).

Figure 4.5. Nancy's office (63, H21)   **Figure 4.6. Jack's office (62, H21)**
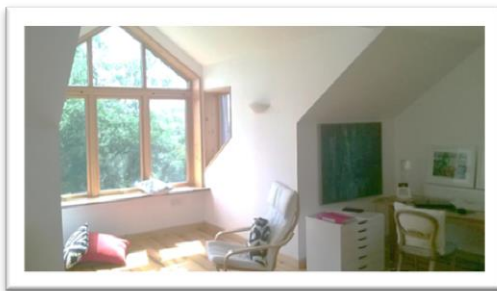
Householder's discussion of the meanings of comfort suggested that control or freedom to do what they liked in the home, and in specific rooms, was a particularly important aspect of home comfort. Indeed, this sense of control and being able to 'do what you want' was interconnected with many other meanings of home comfort. Householders had different preferences for temperature (i.e. thermal comfort, section 4.2.1), decorating (i.e. visual, section 4.2.6), taste in music (i.e. auditory, section 4.2.8), and activities to relax (section 4.2.2). Thus, whilst these considerations may be important aspects of home comfort, these are also significant because they are part of how a householder establishes a sense of control, makes a room their own or the home a personal space. This relates back to control standing in tension with the comfort of companionship (section 4.2.3) because householders may have to compromise and negotiate how they want the home to be managed. Having the control to establish a space of one's own, furthermore, related to the comfort of familiarity (section 4.2.9) which is integral to individual's mental wellbeing (section 4.2.7).

Control or being able to 'do what you want' is undoubtedly an important meaning of home comfort; the next most discussed meaning of home comfort was related to the sense of touch.

4.2.5 Tactile comfort

Participants drew attention to the desire for bedding, seating and clothing being pleasing to touch. This tactile comfort was mentioned in nearly half of the household interviews:

Comfort? Warmth, cosy bed, comfortable bed (Phil, 64, H14)

It's silly things I suppose, seats not being too hard. He likes hard seats; I like softer seats (Mandy, 47, H16)

Having somewhere comfortable to sit in the evening when you want to relax is kind of a big thing for me (Brian, 60, H13)

Having a comfortable place to sit was often a prerequisite for being able to relax (section 4.2.2) and was considered as part of being a good host (i.e. companionship, section 4.2.3) and ensuring that guests were comfortable (i.e. contributory, section 4.2.10). The significance of nice furniture was apparent from the drawings and discussion of ideal rooms, in which large armchairs and comfy couches were a feature in the majority of drawings (Figures 4.7-4.10).

Figure 4.7. Mandy's Ideal Room *(47, H16)*

Figure 4.8. Amy's Ideal Room *(47, H2)*
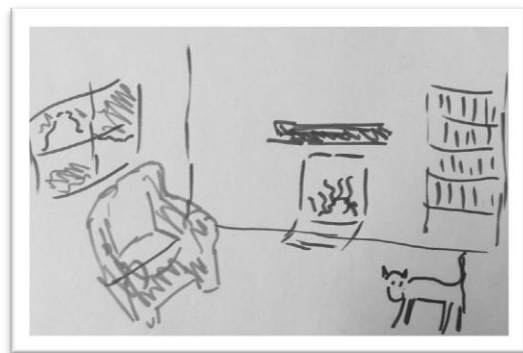
Figure 4.9. Andrew's Ideal Room *(41, H4)*
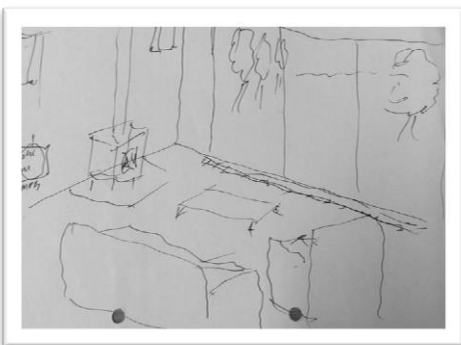
Figure 4.10. Stacy's Ideal Room *(81, H12)*

Tactile and thermal comfort (section 4.2.1) were also closely linked as householders commented on times where tactile considerations either undermined or enhanced thermal satisfaction. For instance, some participants talked about choosing clothes for warmth in the winter and complained about layers feeling confining or certain fabrics being itchy.

> *Sometimes I will say, "look I got socks on, it keeps my feet from getting crystally cold", but he [my husband] doesn't like the feel of socks* (Mandy, 47, H16)

> *When I came to Scotland, everybody in the world seemed to decide to knit me something, I even had knitted stockings in those days; I would never wear a pair of stockings again! They were just so uncomfortable [...] So I do not wear anything that itches these days, and everything that I have got has the label cut off* (Lucy, 70, H20)

Thermal comfort therefore was affected by other expectations of comfort, such as touch, and may not be understood in isolation. For example, blankets are not comfortable simply because of their potential to make someone warm, the feeling of fabrics and surfaces are also significant to home comfort.

Tactile comfort, or features of the home being pleasant to the touch, is part of a more holistic understanding of home comfort and was often mentioned in relation to thermal comforts and relaxation. The next section explores visual aspects of comfort which were discussed to a similar extent as tactile comfort by householders in this thesis (Table 4.1).

4.2.6 Visual comfort

Visual comfort related to lighting and aesthetics was discussed in approximately half of the household interviews. Participants spoke about visual comfort in a physical sense in terms of having enough, or the right, light for their eyes and the task (i.e. preferred lighting for reading was different than what was desired when socialising).

> *I guess you may have two different lights for different things, mood lighting and task lighting* (Amy, 47, H2)

> *I mean lighting is really important to your comfort, and I think that a soft yellow-y orange glow is much more comfortable and relaxing than a hard blue kind of tone* (Sue, 55, H13)

I think a main light in a room is quite depressing really. I mean people put it on because they have to see, but there is no atmosphere I think with the main light. It is nicer with lamps (Lucy, 70, H20)

I like the softer lamp lighting in a room like this that you are just sitting in the evening because I think it creates a better atmosphere than very bright overhead lights (Sarah, 54, H5)

These quotes indicated that lighting preferences vary temporally (e.g. what is desired in the evening or for particular tasks may vary) and spatially within the home as particular rooms have different functions (e.g. lamps and mood lighting for sitting and socialising). Furthermore, lighting appeared to affect householder's sense of relaxation (section 4.2.2) and ability to create the right atmosphere for guests (i.e. companionship, section 4.2.3).

In relation to lighting and visual comfort, there was also common discussion around the psychological benefits of natural light:

I think if I had to choose a house that didn't have adequate heating and insulation and face north or south, I would obviously choose the one that faced south because it has a much better psychological effect with the sun coming in (Maggie, 80, H17)

Following this line of reasoning, visual comfort was connected to mental wellbeing (section 4.3.7). Moreover, natural light and discussion of the importance of windows was also linked to the visual pleasure of having a view or a connection with the outdoors. Certainly, many participants mentioned a desire for a view when discussing their ideal rooms:

I have done a room that I would like to be in. It has got large picture windows, huge view, lots of light, lots of concealed storage, work area, and a comfy seating area (Nancy, 63, H21)

You have a window that is framed up as a picture. It is a room with a view and a room for daylight with the sun beating in (Simon, 55, H2)

It would have big windows, probably bay windows actually to get the maximum view (Sean, 50, H10)

Preferably with a big window with a view and also so it gets morning light as well as afternoon light (Phil, 64, H14)

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It's got to be near greenery and its got to be a nice view (Rachel, 45, H14)

Householder's discussion of lighting and aesthetics therefore suggested a blurring boundary between the two. For instance, windows were important for letting in sunlight, but they also related to comfort in terms of the view they afforded. Moreover, while artificial lighting was important in a functional sense to enable householders to carry out particular activities indoors, the atmosphere and mood of the room could also be affected.

Another aspect of visual comfort was related to aesthetics and "*looking at nice things*" (Oliver, 66, H9), with the task of decorating falling unevenly upon different householders (returned to in section 4.3.4 on gender). For instance, Katie teased that her husband Steve did not give enough attention to aesthetics and atmosphere:

> *Steve: You like the atmosphere*
> *Katie: I'm really into atmosphere. I like candles and things, Steve would just want one light bulb hanging*
> *Steve: Slander, slander! (joked outrage)* (61 & 61, H1)

Katie and Steve, also went on to explain that having mementos visible and 'out' in the home was part of comfort:

> *Interviewer: Is there anything else you think is important to comfort?*
> *Katie: Things I brought back from other countries*
> *Steve: I mean obvious things which make you feel relaxed, it is difficult to say precisely because you certainly like more artistic taste to these things than I have*
> *Katie: Yeah, just surrounded by your family, possessions, pictures of your kids* (61 & 61, H1)

Several other participants commented on the psychological comfort related to having familiar objects and pictures as reminders of past events and positive memories (i.e. familiarity, section 4.2.9). For example, during the house tour Lisa stressed the importance of her wall unit for displaying her mementos, "the ornaments and bits and pieces all mean something in my life" (69, H6). Brian also commented on having "reminders of the rest of the family" as part of his ideal room (60, H13). Displaying reminders of holidays, friends and families is an important part of visual comfort and related as well to control and being able to establish recognisable and personal spaces within the home (section 4.2.4). Certainly, being able to play a role in decorating was integral to householders feeling at home. Thus, while lighting was a more commonly discussed

component of visual comfort, there were other psychological facets such as artwork and mementos.

The next sections move onto explore meanings of home comfort that were discussed less than companionship, control, visual and tactile comforts (Table 4.1).

4.2.7 Mental wellbeing

The next meaning of home comfort was mental wellbeing, referred to in terms of being 'happy' or inner peace. Although only mentioned in roughly a third of interviews, mental wellbeing was explained to be more fundamental than other meanings of home comfort:

> *Not just being physically comfortable but being mentally comfortable and happy* (Helen, 24, H8)

> *Not having worries, there is obviously a major factor of comfort in that* (Stacy, 81, H12)

> *So internal contentment is far more important actually than this comfy sofa* (Darren, 87, H12).

> *Comfort is partly to do with heat or cool or being at the right temperature. But it is also about the kind of inner peace that comes with feeling one with your inner and the domestic environment* (Sue, 55, H13)

Mental wellbeing was discussed in terms of being happy, comfortable in your own skin and not "feeling too rushed or overwhelmed" (Mandy, 47, H16). Yet mental wellbeing was tricky to explain and thus participants often spoke about other types of comfort contributing to their mental wellbeing. Sharon and Rachel were particularly outspoken in stressing that psychological aspects of comfort were more basic than physical considerations. Sharon commented on mental wellbeing being fundamental to comfort, inside and outside the home; "I can feel really comfortable in lots of places, I could feel very comfortable on a rock by the sea. It is feeling comfortable in your own skin wherever you are" (55, H11). This came about when she clarified whether we were discussing "comfort on the basic level or comfort on the luxury level" (55, H11), indicating that her previous articulation of being able to do what I want or having a beautiful bed was secondary to mental wellbeing. Rachel made a similar point. While Rachel also emphasised 'mental comfort', she reflected on the psychological comfort tied to the physical home and having somewhere which felt safe and familiar (section 4.2.9):

It's more mental comfort, than physical I think. So physical yeah, but not just warmth, it's also about somewhere to curl up that feels good in terms of... feels balanced and feels safe... and feels like home (Rachel, 45, H14)

Rachel is not denying the importance of physical comforts; instead she considered how these are underpinned by psychological security found in the home. Mental comfort was understood to be related to experiencing and enjoying other home comforts. If you are sad, for example, then having a comfortable bed may not be your most pressing concern. Alternatively, if you are upset having good company or a cup of tea may help. Thus, mental wellbeing was interwoven with other meanings and experiences of home comfort.

The next section explores auditory comfort, which was discussed to a similar extent as mental wellbeing (Table 4.1).

4.2.8 Auditory comfort

Auditory comfort was also mentioned in a third of the household interviews. Some participants spoke about too much noise being a source of discomfort, but mostly participants suggested that "*music would be one of the attractions of a nice comfortable room*" (Oliver, 66, H9). A few participants also spoke about music being a source of comfort because it functioned as a companion:

It is just company in a sort of way, which makes me sound very sad, but I'm not lonely I just like it (Elizabeth, 80, H5)

I find if I want to listen to something on the radio and it is important I make a point of doing the washing up at that time because I have not fallen asleep washing up and when I wash up I can listen to the radio at the same time. But that is comfort to me, having a human voice around me (Michael, 85, H3)

Thus, auditory comfort was not simply physical but was also linked to wellbeing and psychological concerns. There were differences in auditory preferences and some households had members with different music preferences or preferred 'peace and quiet' in different contexts. Householders commented on the comfort that came from being able to control noise levels or music choices in their space. Catriona and Lucy, for instance, bickered a bit over music being left on, as Catriona preferred the radio and Lucy quiet:

Catriona: I use radio a lot, I like radio, I'm not good with silence, I like peace and quiet but not very good with silence. I leave the radio on

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Interviewer: So where do you leave the radio on?

Catriona: Upstairs in my study

Lucy: And in the shed

Catriona: Sometimes in the shed

Lucy: We have a kind of, she switches it on; I switch it off, kind of thing (70 & 70, H20)

However, who controlled music was not always a point of contention, partly because its importance was less significant for some householders. Nonetheless, as the previous discussion on control (section 4.2.4) indicated, other householders being noisy could also be a source of discomfort.

The next section explores the importance of familiarity, which was discussed to a similar extent as auditory comfort and mental wellbeing by householders in this thesis.

4.2.9 Familiarity

Part of home comfort was everyday life being (somewhat) consistent and stable, which was brought together under the label of familiarity. Having familiar routines and objects in the home was an important source of home comfort and was mentioned in roughly a third of the interviews:

Partly that feeling of relaxation, some of which is due to furnishings, and some of which is due to having familiar things around you (Amy, 47, H2)

This aspect of comfort was somewhat difficult for participants to explain because it is part of what *"feels like home"* (Rachel, 45, H14). For instance, Nancy explained that comfort meant having her things and some regular routines and systems:

I want to have my things around me and I want there to be systems to keep things going [...] systems to keep food in the house, meals appearing at the right time, that keeps me feeling comfortable (Nancy, 63, H21)

Wanting some consistency in home life links back to many of the other meanings of comfort. For example, preferred temperature settings are partly the result of what householders are familiar with (i.e. thermal comfort, section 4.2.1) and visual comfort from decorating and tidying is partially due to an expectation that home will look the same when you return (section 4.3.6). In the same way, familiarity then related to control (section 4.2.4). Thus, familiarity is an important component of home comfort that underpinned other meanings of comfort because having familiar

routines and objects is a key part of a sense of personal space, control and stability within the home.

The final three sub-sections review the meanings of comfort that were least discussed (Table 4.1).

4.2.10 Contributory comfort

Contributing to the wellbeing of someone or a cause was also mentioned to be important to home comfort and was brought together under the label of contributory comfort. Participants commonly described a sense of comfort that came from reducing their environmental impact or "knowing that you are not costing the earth" (Arnold, 71, H19). This was likely skewed to an extent by the sampling strategy because participants were recruited from 'low-carbon' homes (section 3.5), however other households (or samples) may also stress the feeling of satisfaction gained from contributing to a cause. This is because making others happy (e.g. family, friends, local community) was a source of comfort. For instance, Darren explained that for him and his wife, comfort was "Christian faith. It is active and using it to benefit other people and that gives you an internal content, which is different from external comfort" (87, H12). The home then was a space that householders wanted to 'use' for causes they valued. Furthermore, there was a sense of comfort from welcoming and sharing the home with friends and family. For Lucy, cooking for her children when they visited was important to home comfort:

> *Even though my kids have grown up, when they come back I like to make them something*
> *that I know is their favourite, because you know, there is something about using [food] in a*
> *comforting way* (Lucy, 70, H20)

Contributory comfort also related to discussions around the importance of being a good host (i.e. companionship, section 4.2.4) and was strongly connected to mental wellbeing (section 4.2.7), demonstrating that home comfort is not just about meeting personal and physical needs.

4.2.11 Physiological comfort

Part of comfort depended on meeting the physiological need for food and "not being hungry, being satisfied with what you eat and drink" (Lucy, 70, H20) as well as "not being injured or experiencing physical pain" (Sean, 50, H10). These physiological concerns were discussed in approximately a fifth of the household interviews. Participants mainly discussed food in relation to being physically healthy:

> *Just thinking in terms of general wellbeing, in terms of food input, diet and so on, access to*
> *healthy food* " (Phil, 64, H14)

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To be comfortable? Eat stuff that makes you feel good (Sharon, 55, H11)

Comfort food was only mentioned by a few participants, and not in relation to their own satisfaction but more as a way to contribute and ensure the comfort of others (section 4.3.10).

I think that food is part of comfort. I'm making people something that is tasty, that they like (Lucy, 70, H20)

Yet food was mainly mentioned as a physical need instead of for its psychological benefits, such as sentimental memories of and connection to past meals or places. Even Sue who claimed that "food is a huge comfort in my life, I'm a real sort of comfort eater" spoke most about the importance of food and cooking in terms of making "good, delicious, wholesome, healthy food" (55, H13).

Avoidance of pain or physical comfort was the other aspect of physiological comfort. Some (older) participants spoke about the importance of seating that was easy to get in and out of or had the ability to put legs up as a way to relieve and avoid aches and pains:

Catriona: Not having any pain, you know having discomfort. So having seats that you can sit in comfortably or get out of comfortably
Lucy: Get your legs up! (laughs) (70&70, H20)

Interviewer: What makes a chair comfortable to you?
Stacy: Oh… oh that is a good question
Darren: Well, it's got to be comfortable for old age people
Stacy: The right height, and one that you can get out of easily
Darren: Being able to get up and out of it
Stacy: One you can sit back and relax in (81& 87, H12)

The [couches] would need to be comfortable in terms of sitting or lying for relaxing in the evening because I have a bad back, I like to put my feet up, so a recliner is a good idea (Kelly, 64, H7)

Householder's making a distinction between physiological needs and other expectations of comfort is an important reminder that the same activities can have different meanings. For instance, seating was spoken about in a more luxurious way in the section on tactile comfort (4.2.5), yet here householders are focused on more basic 'needs'. Another example of this is that having a bath could be considered relaxing (section 4.2.2), yet some participants spoke about

bathing as a "kind of comfort thing to get rid of stiffness [and] ease off the pain of the day" (Jack, 62, H21). Just as participants singled out mental wellbeing being more fundamental than other home comforts, physiological comforts such as food and the avoidance of physical pain were similarly distinguished as more basic physical needs.

The next section explores the least discussed and final meaning of home comfort.

4.2.12 Odour and fresh air

The final meaning of home comfort was related to olfactory comfort or odour and fresh air. The importance of fresh air and odour were raised in only a few household interviews, yet these participants were adamant of its significance. Sarah stressed that a room which was "simply hot or heated can be very uncomfortable. So it has to be you know, pleasant warmth, that is right for what you happen to be doing and not this sense that you are in some sort of sealed fuggy box" (54, H5). Sarah and Harry spoke keenly about their dislike of stale air, which varied between rooms, depending on draughts and airflow around the home. For instance, Harry complained that their main sitting room "can become very fuggy," whereas he liked going into their new extension because it had mechanical heat recovery ventilation making it "very fresh" (53, H5). The other participants who had mechanical heat recovery ventilation also commented on the importance of odour and fresh air:

> *The air being circulated is so pleasant, like there is a guest room, but even if it hasn't been used for ages it is still totally fresh [...] You are used to a room going stale [...] but that just doesn't happen* (Shona, 36, H18)

Thus, odour and fresh air were perceived to be important on their own and in relation to thermal comfort (section 4.3.1). Participants did not go beyond this more physical understanding to connect odours with more social or psychological meanings of comfort. For instance, participants did not speak about satisfaction from the smells of cooking (e.g. coming home and smelling your favourite meal) or a sense of familiarity from everyday smells (e.g. the smells of home, such as laundry detergent and air fresheners). Interestingly, inclusion of this final meaning of home comfort resulted in all the senses being mentioned as part of home comfort: touch (i.e. tactile, section 4.2.5), taste (i.e. physiological, section 4.2.11), sight (i.e. visual, section 4.2.6), sound (i.e. auditory, section 4.2.8), and smell (i.e. odour and fresh air, section 4.2.12).

4.2.13 Summary

To sum up thus far, despite the mainstream focus on thermal comfort, the results presented above demonstrated that there are multiple and co-existing meanings of home comfort.

Furthermore, these meanings of home comfort were complex and interlinked. Building on the discussion of meanings of home comfort presented in section 4.2, Figure 4.11 visually presents the meanings and relationships of comfort from householder's descriptions.

Figure 4.11 Meanings of home comfort and their interconnections
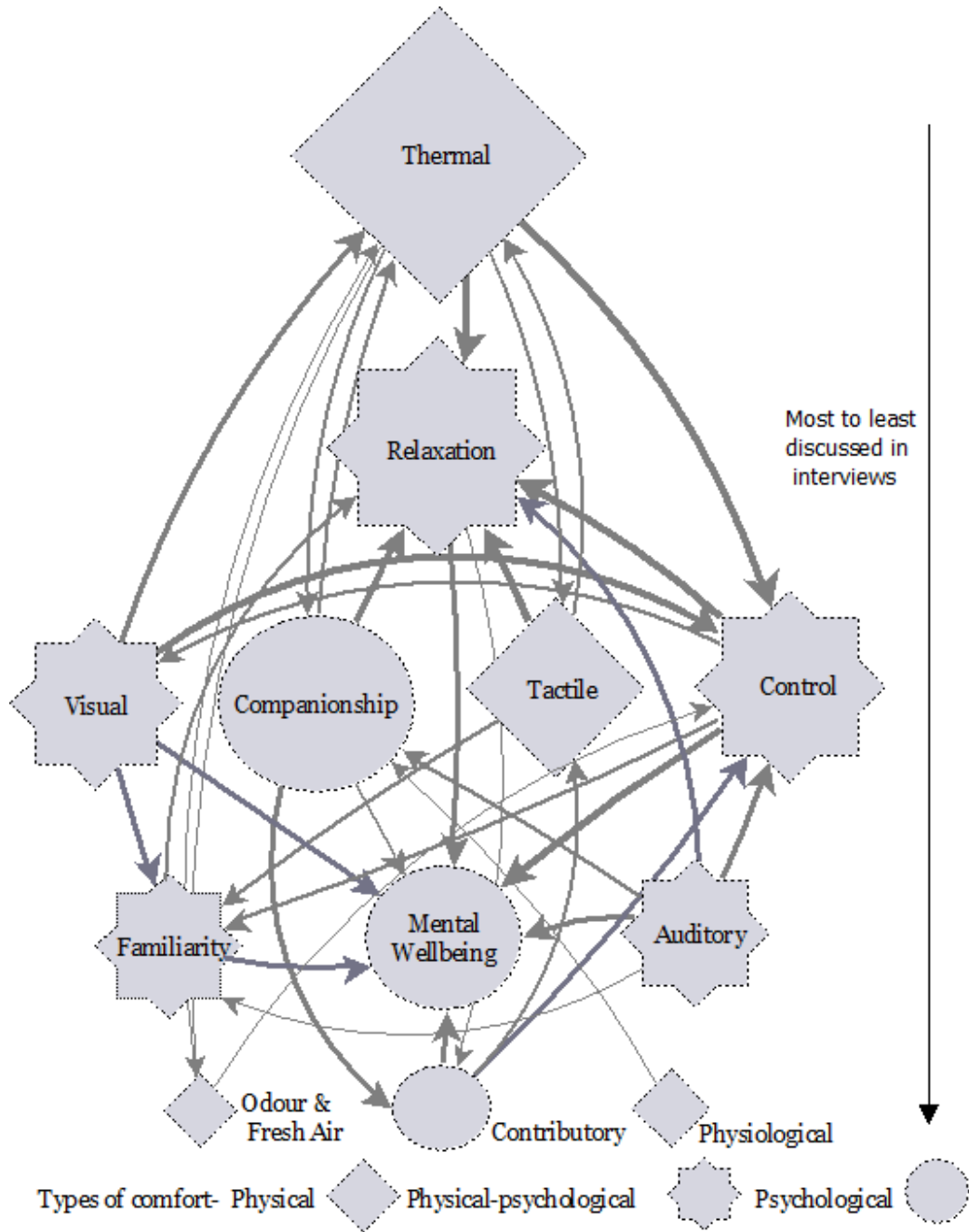
Types of comfort- Physical ◇ Physical-psychological ✦ Psychological ○

The size of arrows relates to how often participants referred to meanings influencing each other. The arrow direction suggests direction of influence.

The meanings of home comfort are organised vertically from most to least discussed in the interviews and the sizes of the shapes (e.g. diamond, star, circle) are proportionate to the number of households that mentioned each meaning of comfort (Table 4.1); with thermal comfort being mentioned in all the interviews; relaxation in two thirds; companionship, control, tactile, and visual discussed in roughly half; mental health, auditory, and familiarity in approximately a third; physiological and contributory in about a fifth, and odour and fresh air only in a few interviews. The different shapes in Figure 4.11 distinguish the categorisation of these meanings of comfort, with a diamond for physical, star for physical-psychological, and circle for psychological. The thickness of the arrows represents the number of references participants made about the interconnections between these meanings of comfort. The arrow direction suggests direction of influence.

Figure 4.11 begins to offer some direction for exploring and evaluating a broader conceptualisation of home comfort and a framework in which to (re)investigate what the home is for. While thermal comfort may have been the most discussed (represented by size and location at the top of Figure 4.11) it is not the *only* meaning of home comfort. Importantly, Figure 4.11 indicated that thermal comfort is interwoven with other expectations of home comfort; being a part of relaxation (e.g. being cosy and warm in bed to watch a show), control (e.g. being able to have heating the way that you want), companionship and contributory comfort (e.g. ensuring guests are sufficiently comfortable and warm), and odour and fresh air (e.g. if a room is too hot it can feel stuffy and 'fuggy').

Furthermore, thermal comfort may be affected by other meanings of home comfort. The feel of clothing and materiality of the home (i.e. tactile comfort); itchy socks or wooden floors may impact householder's ability and way of keeping their feet warm, for example. Thermal comfort may be influenced by visual considerations as well; having an 'inefficient' open fire for the 'cheer' of it, rather than the heat output. Familiarity may also influence thermal comfort, as householders set particular thermostat settings because they are part of the familiarity of the home, even though someone may be sufficiently warm or cool at a different temperature. Suggesting that thermal comfort is not the only expectation of the home or occupant satisfaction, and cannot be easily teased apart from other expectations, is a significant finding because this is an assumption and starting point in the majority of domestic energy research. Engineers, building scientists, and social scientists alike are singularly focused on thermal comfort in studies of sustainable consumption and in developing strategies to reduce domestic energy demand (section 2.3).

To sum up, section 4.2 has started to bring together data in order to offer a new concept of home comfort (RO1); however it is not yet (fully) clear how home comfort or Figure 4.11 enhances understanding of domestic energy demand (RO2). Other expectations of home comfort have

emerged beyond thermal comfort, with attention being drawn to relaxation specifically (represented by size and location at the second from the top in Figure 4.11). The size and direction of arrows may also raise the importance of relaxation, control and mental wellbeing (Figure 4.11). While the participants in this thesis have identified twelve meanings, there is much more work to be done to 'make sense' of and organise these into a framework of home comfort in the next chapter (section 5.4). Therefore, the rest of this chapter explores key themes in the making and meanings of home identified in section 2.5 because these helped inform the development of home comfort.

4.3 Evidence of key themes on the making and meanings of home

This section contributes to connecting meanings of home and comfort into a new concept to understand householder's expectations of home (RQ1d) and therefore the relationship between the themes of homemaking and meanings of home comfort are the focus of this section. Moreover, evidence for these homemaking themes is presented alongside some initial reflections on the implications for understanding or intervening in domestic energy (RQ2c), which will be expanded on in the next chapter (sections 5.3 and 5.4). This is an original contribution as few studies of domestic energy explain demand in relation to more fundamental expectations of what a home is for.

Two out of the five themes had strong parallels with two of the most prominent meanings of home comfort that emerged in section 4.3: the themes of family and privacy related to the home comforts of companionship and control. Subsequently, family and privacy were the most useful homemaking themes and dominate this section. These themes are presented together because householder's discussion revealed that these two may be better understood in relation to one another. While the previous section was primarily limited to analysis of householder's responses to "what does comfort mean to you?" and ideal drawings, this section incorporates more data from the whole-household interviews and house tours to develop understandings of home comfort.

4.3.1 Family and Privacy

The themes of family and privacy are presented first because they were the topic of a considerable amount of discussion. Householder's discussion of comfort, ideal rooms, energy-saving and desired future improvements presented these two themes to be in tension and thus excerpts related to the importance of family and privacy will be presented together in this section. As previously discussed, family and privacy are key themes in the meanings and making of home (sections 2.5.3 and 2.5.4) and this section will highlight some ways in which these influence everyday home life and house size.

Table 4.2 summarises some of the common topics related to family and privacy: the desire to share space in the home (i.e. home comfort of companionship/family), mention of issues arising over sharing spaces in the home (i.e. control/privacy), desire for personal space (i.e. control/privacy) and mentioning house size as an important factor for smoothing co-habiting and sharing household management (i.e. benefits of companionship in a family home also depends on the ability to ensure sense of privacy/control for individuals)(shaded boxes indicate households that mentioned these topics).

Table 4.2 Topics related to family and privacy

	Number of participating household																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1-person household			■			■	■										■				
Desire to share home	■	■		■	■			■				■	■	■	■	■		■	■	■	■
Issues over sharing space		■		■	■			■		■										■	■
Desire for personal space				■	■						■	■	■	■	■	■		■	■	■	■
Mention house size	■		■	■	■	■	■					■						■	■		■

Shaded boxes indicate households that mentioned common topics related to family and privacy: the desire to share space in the home, mention of issues arising over sharing spaces in the home, desire for personal space and mentioning house size as an important factor for smoothing tensions of co-habiting. Single occupancy households are indicated and included to explain why these topics were not mentioned in four interviews (H3, H6, H7, H17) considering that issues of sharing space were irrelevant. Excluding the single-occupancy households then, all but three of the multiple-occupancy households (H9, H10, H11) mentioned the importance of the home being a shared, communal space.

Single occupancy households are included in Table 4.2 because this helps explain why the topics related to privacy and family were not mentioned in four interviews (H3, H6, H7, H17). Wanting the home to be a communal space, as well as tensions arising as a result of sharing the home, arose spontaneously in nearly all the whole-household interviews (Table 4.2). Only three multiple-occupancy households did not mention the importance of sharing the home (H9, H10, H11). Interestingly, two of these interviews (H9 and H10) occurred with only one member of the household, because their partner was unavailable, and this may be an indication of the importance of the methodological choices made in this thesis. Considering that interviewing the whole household drew attention to negotiation and debates within the home that may not have come out in individual interviews (this is returned to in section 5.5). For instance, the parents in one interview emphasised the satisfaction of spending time together and regularly having dinner as a family. But this prompted their teenage daughter to challenge this as an example of 'family time' because they often watched TV rather than chatting during dinner:

Ailsa: I wouldn't see a big deal of not eating as a family kind of thing. But obviously they like to be in the same room or something, I'm not quite sure why

Interviewer: Why do you like having dinner together?

Sarah: Practicalities. Otherwise you know you're just cooking different meals all the time, for different people, at different times, so it becomes at times like a show order restaurant. There is the fact that you can catch up with news and talk to each other

Harold: Yeah, we are not just the lodgings for somebody

Ailsa: Yeah but we eat in here. We don't actually eat in the dining room. We watch the telly. We are not actually chatting. No we barely ever eat in the dining room, once a week at most and that is even rare. So a lot of the time we are just watching TV (53, 54, 16, H5)

Thus, if householders had been interviewed individually, or one member represented the entire household, the significance of sharing the home, and disagreement sharing could spark as well, may not have emerged in interviews. Whereas, in the majority of the multiple-occupancy households, the desire to share space (i.e. related to companionship, section 4.2.3) as well as have personal space (i.e. related to control, section 4.2.4) arose spontaneously without a set question to direct discussion to this topic (row 2, Table 4.2). Talking about sharing the home sparked debates and drew attention to tension between some householder's different preferences (row 3, Table 4.2) and desire for personal space (row 4, Table 4.2). Sharing space (i.e. family and companionship), tension of sharing space (i.e. control and privacy), and a desire for personal space (i.e. control and privacy) were common topics mentioned by householders in this thesis (Table 4.2) and are evidence of the importance of family and privacy in homemaking. Turning from these themes, the section focuses on linking discussion of family and privacy to understanding domestic energy research. Specifically, demonstrating that householder's discussion of family and privacy were closely linked to space and house size (row 5, Table 4.2), which significantly impact domestic energy demand.

House size was a topic discussed in interviews and householders often uncritically assumed that more space was preferable (Table 4.2). There was a perception of a 'need' for personal space, which arguably influenced householder's preference for larger homes:

Harold: I think the other thing which we probably haven't touched upon but would end up being important but we have just got it by default is the sheer size because it is a really large house, it may not feel it, but when you have been in smaller houses or flats then yes it is. So we can effectively all live in our individual zones without massively treading on each other. I'm not sure how we would cope if we all had to live in a more confined area

Interviewer: Do you all agree with that?

Sarah: Yes!

Elizabeth: Yes (Elizabeth and Sarah laughed)

Sarah: It is nice to have your own sense of space and times that you can be on your own

Ailsa: It just feels more comfortable, just go up to my room and watch something. Especially if you have been with people all day (53, 54, 85, 16, H5)

Thus, whilst Harold, Sarah, Elizabeth and Ailsa did mention eating meals together and having some family time to regularly play games, personal space was also important to home comfort. This was common in many of the interviews (Table 4.2). 'Family time' and spaces where householders were 'together' were commonly mentioned in the course of interviews. Often this was mediated through the design of the home, with particular rooms or features enabling these interactions:

Stacy: I love having a living area which includes kitchen, dining, and sitting. So that I didn't have to retreat from the company to go to the kitchen, everybody is in there together. That was very important to me

Darren: So family life was important to us, we had my wife's mother living with us for years

Stacy: And three daughters

Darren: And we could all knock around together and do things but the kids had the bedrooms upstairs where they could retreat if they wanted, which is nice (81, 87, H12)

If I'm bathing the kids before they go to bed, or if we all have baths, it is a really nice intimate family time. I love that Japanese thing of everyone being in the bath together and you wash, get out and then get in the hot water, all together, all clean. I love that (Shona, 36, H18)

We work most evenings, but we can do it where we are together and there is space (Rob, 44, H16)

All these quotes stressed the importance of being 'together' in the home for all sorts of families: whether it was a multi-generational family (H12), family with young children (H18), or a couple spending time together even if they both had to do work (H16). Indeed, half of the ideal drawings included lots of seating or large tables again demonstrating the importance of the home often being expected to be a communal space (Figures 4.1-4.4, section 4.2.3). Stacy and Darren's preference for an open-plan kitchen, which included seating so that everybody could be together was echoed by several other households and sixteen of the twenty-one households had open-plan kitchens. However, this emphasis on togetherness may reflect a somewhat romanticised or idealised view of family life. Certainly, discussion in some of the household interviews evidenced tension over sharing spaces within the home (Table 4.2) as already hinted at in section 4.2.

Tensions around sharing the home related to everyday activities (e.g. watching TV, napping) as well as household management of material features of the home (e.g. artwork, lighting):

> *I find it quite stressful some evenings when you are watching television and the house is full of inane noise and yet none of the other rooms are rooms that I actually want to go and sit in because they are rather cold or physically uncomfortable or this is the room with the fire and the cat* (Amy, 47, H2)

> *She refuses to sleep in her bed [and I] get chucked out of the room when you [mom] need a nap* (Helen, 24, H8)

> *Sarah: I like the softer lamp lighting in a room like this, that you are just sitting in in the evening, because I think it creates a better atmosphere than very bright overhead lights*
> *Ailsa: The rest of us would have them brighter, if it was up to us*
> *Harold: Yeah, the blind members of the family (Elizabeth and Sarah laugh)*
> *Ailsa: Well it's mom's choice* (54, 16, 53, H5)

> *When we first got married, we couldn't, our tastes in art was so polls apart and non-overlapping, that we actually couldn't agree for anything to go on the wall other than a mirror* (Sean, 50, H10)

> *Rob: When things get messy I get really agitated, I hate clutter*
> *Mandy: And then he married me (Rob laughed)* (44, 42, H16)

Togetherness and sharing space was important to many householders, but these excerpts also indicated that interactions within the home are complex and messy. These debates link back to participant's explanation of control as a key part of home comfort (section 4.3.2). Being able to 'do what you want' was partly mediated by what other householders wanted. For example, both Ailsa and Helen noted that their mom's preferences and routines could trump their own; whereas couples were more likely to negotiate and compromise because they were (more often) equals in managing the home (returned to in section 4.4.4 on gender). These debates suggested that home comfort is made up of trade-offs and balancing different co-existing desires and expectations.

There were a considerable number of comments about different preferences within households when discussing meanings of comfort:

> *I personally do not like it too hot. Pat does like it warmer than I do, but we have just come to a modus operandi in that sense* (Oliver, 66, H9)

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He likes hard seats; I like softer seats (Mandy, 47, H16)

I'm really into atmosphere. I like candles and things, Steve would just want one light bulb hanging (Katie, 61, H1)

We have a kind of, she switches it on; I switch it off, kind of thing (Lucy, 70, H20)

These debates are important because they highlighted a common finding in research on occupant satisfaction which is that individuals may be able to agree on what is important to comfort but what this means in practice is generally more difficult to pin down. For example, thermal comfort may be commonly recognised as important but the desired temperature or way of achieving this may be much more debated. The overall dialogue around comfort demonstrated that householders thought about home comfort in an individual way, rather than collectively in terms of what was necessary for the family or household to be comfortable. There was some attention to the sense of comfort gained by contributing to other's wellbeing. For example, being a good host and ensuring that guests felt welcomed and comfortable (e.g. comfortable furniture, cosy and warm, tidy and aesthetically pleasing, feeding guests) and discussion of companionship and relaxation highlighted that other people were a part of an individual's comfort. However, for the most part, home comfort was explained in terms of what individuals thought was important personally for them and part of achieving this individual comfort was actually negotiating and compromising with other householder's preferences in order to have things their way. For the most part, investigation of these household interactions was missing from energy studies and limited in housing research which is reflected on further in the discussion chapter (section 5.4).

One way of balancing this tension between togetherness and personal space was stressed by householder's discussion of the importance of individuals having their own space. Therefore even if someone did not control the lighting, décor or background noise in communal areas of the home they still had somewhere 'to retreat to'. The excerpts on control as a key meaning of comfort already emphasised the importance of personal space and individuals having their own room, especially children (section 4.3.2) and in householder's consideration when designing a newly built home (section 4.2.2.3):

I think you (16 year old daughter) would always be in your bedroom wherever the bedroom is. It's your zone; it's your nest (Harold, 53, H5)

Comfort to me is like TV and a fluffy blanket and summer when it is really sunny and having my own room (Rory, 8, H14)

We got the extension put in so I got a study (Arnold, 71, H19)

I said he [husband] needs a study to retreat to (Stacy, 81, H12)

This is relevant to understanding domestic energy demand because ensuring that all household members have some space of their own in the home impacts house layout and size. Table 4.3 provides some evidence of the importance of being able to accommodate guests and an abundance of spare bedrooms in this sample (shaded boxes indicate homes that spoke about the importance of being able to accommodate guests).

Table 4.3 Importance of being able to accommodate guests in the home

	Number of participating household																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Accommodate guests	▓			▓	▓	▓	▓		▓	▓	▓	▓			▓	▓	▓	▓	▓	▓	▓
Spare bedrooms	2	2	0	1	2	0	4	1	4	1	1	1	1*	0	0*	0	1	2	3	0	1

Shaded boxes indicate homes that spoke about the importance of being able to accommodate guests,
* indicates two households that filled their spare bedroom(s) with lodgers (H13, H15).

Interestingly, these expectations create a demand in space related to the peak household size, due to being prepared with extra bedrooms for when young children grow up (e.g. planning for the household to grow and ensuring the house is big enough to accommodate this future household size) or making use of extra space when children have grown up and moved out of the family home (e.g. household is smaller but house size stays the same):

Eventually the kids won't share a room, but just now they are more than happy to share. I like it when they are little to have each other (Shona, 36, H18)

Stacy: We had been telling him [the architect] all the things that we wanted and I think he thought, gosh this is going to be a much bigger house then they can afford. But he managed to fit it all in with the size
Darren: With the consequence that the rooms are small, but we are comfortable with that. And the ceilings are low, easy to heat
Stacy: And it has adjusted very well to being just the two of us from being a whole family home
Darren: For the first 25 to 30 years it was six people in the house (81, 87, H12)

It was our daughter's bedroom and I use it for sewing and if I have got a lot to do on the computer, I can come through here and be away from everything you know just get on with it and spread myself out. So I use it as a work room (Mary, 69, H19)

These quotes highlighted householders renegotiating the use of space in response to changes in the household size. Shona mentioned having two guest bedrooms at the moment because when their two children get older they will 'need' their own rooms. Yet the majority of participants had older children and thus explained how they managed living in a house that at one point accommodated a bigger family (i.e. legacy of accommodating the peak household). Stacy and Darren noted how well their home adapted from six people to just the two of them because of the small room sizes and use of the extra space for their individual activities (e.g. painting, piano, sewing): "different parts of the house are used for different purposes at different times of the day and then we come together at meals and things" (Darren, 87, H12). This repurposing of children's bedrooms and play areas was common and may be part of householder's justification for staying in larger family homes. In fact, only two participants had downsized (H6 & H17) and these were both single women who no longer felt they could manage larger homes on their own. This may be an important life phase that energy advice could target (although moving home is a complex decision) because these family homes may not suit the needs of aging occupants. For instance, requiring more effort to clean and maintain (not to mention affordability of heating):

It is a little bit beyond us as well, the thing about having the big house to keep it clean and tidy is quite an effort (Shona, 36, H18)

I like things to be compact. It takes me, what, to clean this place as far as I do clean it. It is about half an hour or three-quarters of an hour (Michael, 85, H3)

Five of the households had between one and four spare bedrooms but did not want to downsize (Table 4.3). Two households had taken on lodgers to fill rooms that were no longer occupied by their children and this connects back to more fluid definitions of the household in the past, in which renting a room in a home was more common (section 2.5.3). Taking on lodgers may be a novel energy-saving recommendation as household sizes decline, which counters energy savings from improvements in energy efficiency. Only a few households commented that their "house is probably actually too big now that the kids are gone" (Katie, 61, H1). Similarly, Mandy and Rob discussed wanting a separate office and guest bedroom in the future, but reflected that their children would actually be leaving home soon and therefore they would not need that extra space in the longer term:

Mandy: I'd like more space for having a separate office from guest room because we like to have folks stay but it makes it difficult for when we are both needing an office
Rob: First world problems
Mandy: I would love to have a guest bedroom but you know what I'm like these kids are 9 years away from being out the door to University (42 & 44, H16)

Mandy and Rob's dialogue indicated an opportunity to reduce domestic energy demand by questioning the space 'needed' during the peak household in relation to longer term use of the home. However, a desire to downsize was sometimes constrained by other considerations, such as the need to store children's possessions even when they had moved out of the home:

We have to wait for our two kids to get their own houses and then we can have a house a fraction of this size (Sue, 55, H13)

This is an example of the importance of thinking about family in domestic energy research because family members that are not even part of the current household can still impact the use and size of homes. Another example linked to family is the expectation to have a guest bedroom so that family members can visit. Only two households in this thesis did not have a guest bedroom (Table 4.3). Lisa's family had been happy when she downsized to a home that met her needs better (e.g. affordability to heat, ease to clean and upkeep), but Lisa commented on the difficulty of not having a guest bedroom:

My family are happy about it as well, bit of bind if more than two want to come up and stay because we have only got the one bedroom. I have the bed settee, so I'll sleep in here and then they will sleep in there. But I do have an airbed as well and there are sliding doors here so you can make it into a separate room, so when I had four of them, we just slid that and put the air bed here. So we had three bedrooms all of a sudden (Lisa, 69, H6)

Guest bedrooms were part of this demand for space linked to the 'peak household' because these are often rooms in the home that are underused for the majority of the year, but 'needed' to accommodate peak demands in space. Nonetheless, being able to accommodate guests was certainly important to householders as part of their expectations of what a home is for, and was mentioned in the majority of interviews (Table 4.3). Yet Lisa demonstrated that there are ways around this 'need' for a guest bedroom. Suggesting a somewhat unconsidered area in which energy advice could engage for example by offering creative solutions to accommodating guests that may not necessitate having a guest bedroom (e.g. more multifunctional spaces, privacy screens, desks that transform into beds). Introducing the idea of the 'peak household' presents a different angle in which to approach reducing domestic energy demand. Rather than focusing on

design and efficiency, understanding householder's expectations of the home and how it related to family life presents opportunities to engage with social conventions and norms that significantly impact overall energy demand.

The homemaking themes of family and privacy therefore offer some interesting insights into understanding domestic energy demand. Family time was an important aspect of home comfort (i.e. companionship); yet sharing the home (at times) could lead to tension because householders expected some privacy or having 'a say' on how the home is managed (i.e. a sense of control). The tension between the comfort of sharing the home with family and the 'need' for some personal space then influences the design of houses. For instance, householder's perception of house size and the space per person that is 'needed' is partly due to these expectations. Participants in this thesis assumed that bigger houses would improve home comfort and there is potential to engage with householder's assumptions around accommodating peak household and co-habiting that could reduce domestic energy demand but are not simply related to improving energy efficiency. Thus the themes of family and privacy highlighted new avenues for engaging with changing energy demands that are the result of shrinking household sizes and increasing space per person (returned to in section 5.4.3). Furthermore, the significance of family and privacy in the meanings and making of home informed development of the meanings of home comfort (Figure 4.11), by elevating companionship and control, which is discussed further in the new conceptualisation of home comfort presented in section 5.5.

The other themes of homemaking (home-as-ideal, hearth, and gender) did not appear as clearly linked to particular meanings of home comfort as privacy and family were, but are discussed because they still provide some insight into linking expectations and meanings of home with understanding domestic energy demand.

4.3.2 Home-as-ideal

The home is entangled with all sorts of ideal representations of homeliness (section 2.5.1) and there was evidence of the home-as-ideal theme as householders idealised historical features. For example, cornicing, curtains and fireplaces offered a sense of homeliness even if the latter were no longer due to their functions in making the home warm.

> *You get a sense of cosiness I think from curtains. Need, no; nice, yes* (Sarah, 54, H5)

Sarah was referring to having thick curtains in their home. Curtains are usually useful for reducing draughts and improving thermal comfort, in this case the curtains were in a new extension that had triple glazing and a 'tight' building fabric that required mechanical ventilation.

Curtains were not especially necessary for stopping draughts or reducing heat loss, yet they were retained for their 'cosiness'. Moreover, many householders were like Shona and mentioned that having a fire created a greater sense of homeliness beyond its heat output. While the importance of curtains and fires to thermal comfort have been diminished due to the proliferation of central heating systems and tighter building fabrics, these features remain significant to home comfort due to their aesthetic and symbolic utility. Another example of an attachment to historical features of the home was householder's discussion of preserving cornicing and other historical features (e.g. stone cottages, bay windows):

> *This room we can't really touch unless we want to ruin those lovely cornices, and that is problematic, we can externally clad the outside there but that is a few grand worth of work* (Andrew, 41, H4)

The point is not necessarily that householders will always choose to preserve heritage symbols, like cornicing, over thermal retrofitting and energy efficiency improvements. Rather historical aesthetics are considered when making home improvements and investing in energy efficiency. Furthermore, many householders living in heritage conservation areas complained that this hindered their attempts to improve the building fabric. Upgrading windows was particularly problematic as they needed to maintain the character of the time period, which they suggested dramatically increased costs. Maggie captured this frustration quite aptly, arguing that "homes are for living in, not looking at" (80, H17) because preserving these homes in their historical forms (e.g. leaky windows) does not mean they meet contemporary expectations and 'needs'.

Understanding other romanticised visions of the home may also be useful in highlighting expectations that may be unreasonable and impractical. In reality the home is not always comfortable or relaxing:

> *Interviewer: What do you do to be comfortable? When you get home from work or once the kids have been put down?*
> *Emma: Leave my coat on in the winter [...] I think there is a difference between what you would like to do, and what you actually do. Because I might come home with the kids in the winter and try not to put the heating on straight away, because this house costs so much money to heat, so it is that trade-off* (40, H4)

Exploring the home-as-ideal theme may be useful for intervening in domestic energy because it is a way to challenge some expectations of home. For instance, those living in inefficient old stone cottages may not realistically expect to have the same temperatures and draught-free rooms that are achievable in newly built homes. Rather than always improving the building to meet our

expectations, questioning some of these idealised visions of the home may be a way to alter expectations that fit within the existing form of the home – without being more energy demanding. Emma is a prime case, accepting that living in her century old solid-stone house means that there may be times when comfort means wearing a coat inside; instead of insisting that the home should always be in the 'comfort zone' (e.g. 18°C -21°C).

The home-as-ideal theme offered some useful insights into efforts to reduce energy demand, yet it was not as clearly connected to particular meanings of home comfort as the themes of privacy and family. The next key theme is related to the centrality of the hearth in meanings and making of home, which again reflects the importance of these ideal images of home.

4.3.3 The hearth

The hearth is central to the home, connected to ideas of warmth, relaxation, comfort and a welcoming atmosphere for visitors (section 2.5.2). The hearth was at the centre of the home until at least the 16th century and there was evidence of the obduracy of the hearth in British homes today. For example, while all the households in this thesis had some form of central heating (e.g. radiators, under floor heating, or storage heaters), the majority nonetheless also lived in houses with stoves or a fire of some sort (e.g. open or gas)(shaded boxes indicate homes that had a fire or stove)(Table 4.4).

Table 4.4 Homes with a fire or stove

	Number of participating household																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Has a stove or fire		▓		▓		▓	▓		▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓

Shaded boxes indicate homes that had a fire or stove; it was more common to have one, than not, in this sample (H1, H3, H5, H8).

Two of the households that did not have a stove wanted one and fires were one of the most common features in the drawings of ideal rooms. Indeed, 7 out of the 8 ideal drawings (Figures 4.1-4.4 and 4.7-4.10) included in the sections on companionship (4.2.3) and tactile comfort (4.2.5) included a fire. Furthermore, attachment to the hearth was not simply due to fireplaces being a legacy of an old housing stock; the four new builds, which were all less than three years old, had radiant sources of heating, two with wood-burning stoves and two with infrared heaters. Several householders had also commented on this, explaining that "having a wood-burning stove is quite nice, it is kind of luxury in a way" (Emma, 40, H4). Even the extra work and skill, compared to central heating, required to build a fire was generally part of the appeal for householders:

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You have to move a lot of logs, you have to chop a lot of logs, you have to bring it into here and clean the grate. You know, it's not like gas, the cost-benefits are, you know I think there is a bit of satisfaction in chopping and also having a fire is a lovely, lovely thing and it's a good room heater (Andrew, 40, H4)

I like practically, physically making it [the fire] happen; that is really satisfying. So it warms you several times: when Bill collects the wood, when you are doing the chopping, you take out all of your anger, I love that, and you are warmed again, and when you bring it into the house you get warmed up, and finally when you burn it (Shona, 36, H18)

It would be an over-generalisation to suggest that this extra effort is always desirable. However, the majority of households with fires and participant's discussion evidenced that there was still some attachment to the homeliness of the hearth (section 4.3.1).

This matters to energy demand particularly in relation to upgrading heating systems. For instance, the obduracy of the hearth may undermine savings from low-carbon heating technologies which cannot simply replace the other home comforts that a fire adds. The importance of the hearth should not be overlooked as it is strongly linked to ideals of home comfort and thus can hinder (e.g. prefer feel of radiant heat even if central heating more efficient) or help (e.g. wood can be renewable fuel source) strategies to save energy. Thus, the hearth theme contributed to the argument that householders do not simply invest in heating systems based on rationalisation or thermal comfort.

The final theme of homemaking relates to the importance of gender and the experience of the home, which is explored in the next section.

4.4.4 Gender

Gender is the final theme (section 2.5.5) and there was some evidence of women being (or feeling) responsible for managing and cleaning the home. For instance, Rachel's description of comfort as collapsing into bed (section 4.4.1) was distinct from her husband's description of comfort:

Phil: Watching the TV, maybe with a glass of wine, some Mock of the Week or something, a comedy
Rachel: I think that is a different level, I mean sometimes that happens, but often during the week even that doesn't happen. It is a case of sitting down and desperately doing something on the computer that needs to be done

Phil: That is you

Rachel: Or bills or whatever, well yeah, so there isn't much time for comfort. So when you finally collapse into bed there is finally that sigh of relief so you can just breathe for a little and sleep. Sleep is a big comfort (46, 64, H14)

It is unfair to suggest that women always did more of the house work or experienced the home as less relaxing. Men however also discussed housework and the comfort of having a tidy home:

I'm not comfortable in a room that isn't clean, or when things get messy I get really agitated and that sort of stuff (Rob, 44, H16)

Expectations of cleanliness and responsibility for maintaining the home were arguably more about individuals than gender. In many of the households there were some explicit divisions in home management. For example, in one household, Nancy was responsible for cooking, cleaning, shopping for food, growing vegetables and managing the accounts; while her husband Jack chopped wood, tended the fire, was the 'handy man' and did yard work. Yet Jack reflected that when Nancy was away it was difficult for him to manage the house on his own:

Jack: *What I've discovered is when Nancy is away for a month each year visiting her mum, I try to do the things completely, and the bottom line is that the traditional European or Russian system of having a babushka, a granny, a Cinderella, poking the fire, keeping the water hot, cooking, is the only answer.*

Nancy: *They call it a wife. But then you do other things, so I'm not complaining* (62 and 63, H21)

Nancy teased that being 'a wife' is as demanding as Jack's description of the 'need' for a babushka, but she also acknowledged that the responsibility of maintaining the home is still shared, yet divided. Thus, even though women are (traditionally) charged with the responsibility of making and maintaining the home and the wellbeing of the family (section 2.5.4), the discussion of participants in this thesis indicated that household management was (more) mutual, except responsibilities may be differentiated by gender (to an extent).

For instance, female participants were generally more interested in speaking about comfort and homemaking. One of the biggest indications of women being more involved in homemaking were related to their role in decorating and creating an 'atmosphere'. Referring back to quotes in the section on visual comfort (4.2.6) it was predominantly women that spoke about the importance of aesthetics and lighting:

I mean lighting is really important to your comfort, and I think that a soft yellow-y orange glow is much more comfortable and relaxing than a hard blue kind of tone (Sue, 55, H13)

I think a main light in a room is quite depressing really. I mean people put it on because they have to see, but there is no atmosphere I think with the main light. It is nicer with lamps (Lucy, 70, H20)

I like the softer lamp lighting in a room like this that you are just sitting in the evening because I think it creates a better atmosphere than very bright overhead lights (Sarah, 54, H5)

Steve: You like the atmosphere
Katie: I'm really into atmosphere. I like candles and things, Steve would just want one light bulb hanging (61 & 61, H1)

My wife would relish this and would draw an enormously detailed picture, with all sorts of detail to do with how she likes a room to be. She is the interior décor person in the house. And I just go with it (Sean, 50, H10)

Furthermore, the last two quotes presented husbands emphasising that their wives were responsible for decorating. Male interviewees could speak to an extent about home-making, but there was some indication of a gendered difference in interest or responsibility. On the other hand, men (more often) dominated discussion related to energy-efficiency, technologies and physical home improvements. That is not to say that no female interviewees were interested in energy or involved in Do-It-Yourself. Simon joked that he "sent her [his wife] under the floor for three months, while she was insulating underneath" (55, H2). A prime example of men being less willing to speak about comfort came from one interview in which Keith refused to do the drawing of an ideal room or talk about comfort, not seeing its relevance to energy demand and assuming that his wife would be more willing:

Keith: I'm not going to do that, I'm prepared to answer questions, I'm not prepared to engage in anything else other than answering direct questions. Rhona might want to, I'll come back when you finish with that if you want
Rhona: You are a bit stressed aren't you?
Keith: Yes, I haven't got time for that
Interviewer: Is this not a good time?
Keith: I'm willing to give you the time; I'm prepared to answer questions but not anything else

Interviewer: Ok well if you don't want to draw, my first question is just what does comfort mean to you?

Keith: I don't think that I can handle that. I don't know what you are talking about (72, H15)

By the end of the interview, Keith did speak about comfort and apologised for being inflexible and negative, but other participants, especially men, shared his reservations (albeit less vocally) and were often sceptical about speaking about comfort rather than energy-efficiency improvements and technologies.

Thinking about gender is important to understanding energy demand because saving energy is not simply about technology and changing the house (which more men were interested in discussing). Considering that energy demand depends on everyday household management and expectations of home comfort (which more women were interested in speaking about), understanding energy demand may be enhanced by making a point of speaking to women about their everyday practices or relating energy-saving advice to homemaking (e.g. generalised as feminine) rather than cost, maintenance, or gadgets (e.g. generalised as masculine). Yet emphasising gender offered little insight into a way to reorganise the meanings of home comfort identified by participants in this thesis (Figure 4.11).

4.3.5 Summary

Overall, this section began to connect meanings of home and comfort. The relationship between these themes of homemaking and meanings of home comfort are the focus of this summary (RO1) and links between home comfort and energy as well as implications for future research and policy will be discussed further in the next chapter. The section was organised around evidence related to the key homemaking themes identified in section 2.5 in order to inform the development of home comfort. Analysing the whole-household interviews demonstrated that the themes in homemaking scholarship were relevant to understanding home life.

Two out of the five themes had strong parallels with two of the most prominent meanings of home comfort that emerged in section 4.2: the themes of family and privacy related to the home comforts of companionship and control. Indicating that a conceptualisation of home comfort may be usefully oriented around expectations of companionship and control. Furthermore, householder's discussion related to the importance of sharing the home with family (i.e. companionship) and the desire for privacy (i.e. control) illustrated that these two home comforts have to be balanced or can at times exist in opposition, which is useful for organising meanings of home comfort in relation to one another. The themes home-as-ideal, hearth and gender may still inform understandings and expectations of home comfort but do not link as closely with

meanings of home comfort identified by participants of this thesis. The homemaking themes therefore offered some insight into developing a new concept of home comfort in order to understand expectations of home, which in turn have implications for domestic energy demand.

The next section begins to explore how investigating home comfort may be linked to energy saving (RO2). This is done by analysing householder's explanation of their activities to save energy, which appeared to be tied to much broader household management and homemaking as the next section will reveal.

4.4 Domestic energy and home improvements

The majority of domestic energy research is preoccupied with technical and physical investigation and intervention. Narrowing focus onto these strategies ignores wider considerations that influence the physical form of houses. Few studies have endeavoured to inform understanding of domestic energy demand by collecting data on these other home and homemaking considerations which may impede or support retrofits that are explicitly related to energy saving. Section 4.4.1 identifies what activities were undertaken by householders to reduce their energy demand (contributing to RQ2a). These findings reinforced that 'fabric first' was the priority in practice. Building on this, Section 4.4.2 analyses householder's discussion of energy retrofit in more depth (contributing to RQ2b).

4.4.1 The priority: fabric first

This section summarises householder's discussion of what they did to save energy. In response to "what do you do to save energy?" there were three main strategies: tightening the building fabric (e.g. upgrading insulation, windows, and draught-proofing) (section 4.4.1.1), installing microgeneration technologies (section 4.4.1.2) and buying efficient appliances and lighting (section 4.4.1.3)(Table 4.5).

Table 4.5 Householder's activities to save energy

	Number of participating household																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Building fabric	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■
Micro-generation	■	■		■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■
Efficient appliances	■	■		■	■		■	■			■	■		■				■			■
Daily activities		■	■	■		■		■		■	■			■		■				■	

Shaded boxes indicate homes that had undertaken a particular activity to save energy: investing in the building fabric (e.g. insulation, glazing, new heating system), micro-generation technologies (PV panels, wood-burning stove, solar thermal panels, wind turbine, biomass boiler), efficient appliances and low-energy lighting, or altering daily activities (e.g. regulating warmth with clothing, and turning off lights).

In comparison routine activities to conserve energy were much less common even though this could include a much wider range of topics than upgrading applications and lighting for instance (e.g. turning off lights, putting on extra layers) (the shaded boxes indicate households that have these features or made these changes) (Table 4.5). This section provides evidence of the importance householders placed on making physical and technical changes, but does not go into considerable depth describing what activities constitute each of these strategies. This is so discussion can move onto social considerations affecting these energy saving activities which is the more novel contribution (section 4.4.2).

4.4.1.1 Tightening the building fabric

The most common strategy for householders to reduce their energy demand was by tightening the building fabric (through insulating, upgrading windows, and draught-proofing) and upgrading central heating systems. In general, tightening the building fabric reduces energy demand for space heating by decreasing air infiltration and slowing down air exchange rates. Nearly every household commented on installing insulation, approximately three-quarters mentioned upgrading windows, and a third had bought a new boiler. This 'fabric first' approach is a policy priority (section 2.3) and there was evidence that householders in this thesis adopted this thinking by focusing on technical and physical changes to reduce their energy demand. Evidence and analysis of householder's discussion of energy retrofitting to improve the building fabric is explored in more depth in Section 4.2.2.1 because this investment was predominately triggered and tied to moving home.

4.4.1.2 Microgeneration technologies

Due to the sampling strategy nearly every household had at least one microgeneration technology (e.g. PV panels, solar thermal panels, wood-burning stove, heat pump, wind turbine, biomass boiler)(Table 3.4) and these householders often mentioned microgeneration as an aspect of energy saving (even though this is less about reducing demand than decarbonising energy production). Microgeneration technologies are installed in a tiny fraction of households nationally. In 2013, in the UK only 2.8 percent of heat was generated from renewables and only about 4 per cent of renewable electricity comes from PV panels (which occurred mainly at domestic scale, 98 per cent)(DECC, 2014).

4.4.1.3 A-rated appliances and low-energy lighting

Approximately half of the households had invested in low-energy light bulbs and A-rated appliances to reduce their electricity usage (Table 4.5). Several participants spoke about considering efficiency ratings when replacing appliances and installing low-energy light bulbs

when replacing older bulbs. In some cases householders justified choosing more efficient lighting and appliances as a way to use these more without using more energy. For instance, Harold explained that when he designed the flat extension for his mother-in-law they decided that it was more effective to use energy-efficient lighting than to try to conserve energy by using less lighting:

> *We installed all the lights, 40 total, are all LED spotlights. So she uses less energy than the security light outside. So it is just those kinds of things, it was just easier to accept, she is going to put a lot of lights on. So let's just install very energy efficient lights. That was a very conscious decision* (Harold, 53, H5)

This is not to suggest that improvements in energy efficiency are (always) offset by changing expectations (e.g. as lighting has become more efficient, more lighting has become expected in some contexts (Bille, 2015)) but that these sorts of improvements in efficiency play a role in legitimising current lifestyles.

It is important to note that the majority of participant's discussion of energy saving indicated a reliance on technical and physical changes, tightening the building fabric (section 4.4.1.1), microgeneration (section 4.4.1.2) and investing in A-rated appliances and low-energy lighting (section 4.4.1.3) were much more common than activities to conserve energy through altering everyday routines or expectations of thermal comfort. Overall, participant's explanation of their energy-saving activities reflected mainstream policy and rhetoric: prioritising the physical house or 'fabric first' in order to reduce demand. While a few householders were making what some might consider to be relatively radical lifestyle changes (e.g. heating solely through wood they harvested on their land, wearing winter coats inside instead of turning on central heating, or downsizing), for the most part participants in this thesis were turning to technical improvements to save energy.

The next section explores the wider context in which householders spoke about making improvements to the building fabric (because this was the main strategy to reduce domestic energy demand (section 4.4.1.1)).

4.4.2 Energy retrofit and homemaking

The whole-household interviews were not intentionally designed to collect data on home improvements, nonetheless through discussion of energy saving, drawing of ideal rooms, asking about desired future improvements, and the house tour a considerable body of data was elicited on other homemaking activities that affected the physical form of the house. Householder's

discussion of energy saving and wider homemaking practices highlighted that the timing of energy efficiency improvements was often closely tied to key moments in the making of home: first moving in, designing a new home, and putting in an extension. Overall, this data is useful in demonstrating the utility of putting energy saving in the context of the home and understanding what householders expect a home to be for. Table 4.6 summarises the most popular physical improvements and whether households also remodelled, added an extension or designed and built their own home (the shaded boxes indicate households that have these features or made these changes).

Table 4.6 Household's home improvements

	Number of participating household																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
insulation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■
glazing	■	■	■	■	■	■	■	■	■		■	■	■	■	■		■	■	■		■
stove		■		■			■			■		■			■	■		■	■	■	■
remodel		■			■				■		■	■							■	■	
extension	■			■	■		■			■		■		■					■		
new build			■					■				■					■	■			■

Shaded boxes indicate homes that had made a particular home improvement; and indicates which households lived in new builds (H3, H8, H12, H17, H18, H21) because this explains why they have not remodelled or added an extension.

Considering insulation and glazing in retrofitting and existing home or designing of a new build was a common priority for nearly all the households. Of the three households that had not made these improvements, all were in old stone homes, two knew that the previous owners had recently made these improvements (H16 and H20) and one did not like the stuffiness of, or understand the desire for, a tighter building fabric (H11):

> *Aaron: I mean double-glazing has a perfectly good function in the wintertime, it keeps the house warmer.*
> *Sharon: It is true, but even in the winter I like the sense of real air going through* (57 &55, H11)

> *We gutted it, it was just like a bothy, the floor boards had to be stripped, and it's been rewired and re-plumbed. Unfortunately they had already put the windows in, totally inappropriate windows, wrong size really* (Lucy, 70, H20)

Interestingly, all but one of the households had made physical home improvements, either taking part in designing the physical form of a new house, remodelling or adding an extension in an existing house. This is important because physical energy improvements may occur in relation to other home improvements. For instance, it is often more affordable to improve insulation at the same time as other building work because tradesmen and/or equipment will already be present

(Susanka, 2001). However, these other moments (e.g. move house, new build, extension) generally have very little to do with saving energy (at least initially) and are more related to broader life events in householder's lives (e.g. relocating for work, expecting children and wanting a family home, downsizing as unable to manage a bigger home) and householder's expectations of what a home should be or have (e.g. style of kitchen, number of bathrooms and bedrooms 'needed'). It is out of the scope of this thesis to explain householder's motivations for moving home, building a new home or adding an extension (as again this was not the explicit intention of data collection), drawing attention to this is still important and novel in domestic energy research. Consideration of these moments emphasised that broader social expectations of the home impact and structure attempts to improve energy efficiency. Therefore, section 4.4.2 presents evidence on the relationship between saving energy and these key moments in homemaking (e.g. moving in, adding on, and building new).

4.4.2.1 Moving homes

Moving into a new home was a key moment identified in householder's discussion of energy saving. Improving insulation and windows was generally stressed as the priority and was commonly the 'first thing' and done 'straight away' after moving in:

The first thing that we did was we secondary glazed the windows looking out over onto the street. The second thing we did was we double-glazed our upstairs bedrooms. Then we put in new replacement windows in all the other windows on that south-facing part of the house and then we put in two new doors (Keith, 72, H15)

We put in loft insulation as soon as we could after our first winter (Sean, 55, H10)

Cavity wall was the year after we moved in, yes straight away, that was the first thing we did (Steve, 61, H1)

The roof first of all, we had to put in another 20cm of insulation up there […] Secondary glazing, we did that quite quick when we moved in (Andrew, 41, H4)

Moving in [the house] had very little insulation, vertically or even more importantly below the floors because it's a suspended floor here, so I insulated under the floors (Harold, 53, H5)

We put double-glazing in all the windows; that was the first move towards energy-efficiency because the metal frame single-glazed ones were a real heat sinker (Kelly, 64, H7)

We had double-glazing done before our first winter in here (Sue, 55, H13)

That is not to say that energy-related improvements did not or do not occur at other times, but moving in was the most discussed period for making changes and the above quotes illustrated some urgency by householders. The importance of moving homes being a key time in which energy improvements are undertaken is likely unsurprising, but it is useful for understanding domestic energy demand in two main ways. Firstly, it highlights that energy efficiency is not necessarily the priority when choosing a new home- if it was these renovations would not be such a priority. This is a reminder of the significance of understanding what householders expect from their homes and home comfort, which is not simply affordable heating or thermal comfort. Secondly, it evidences that this may be a key period for energy advisers and energy efficiency marketing to target.

The quotes in this section indicated that moving home was an important trigger for investing in energy saving improvements. The next two sections highlight two other similar periods. Adding an extension on to the home was the next most discussed period that prompted activity on energy saving and is thus explored in the next section. Then Section 4.2.2.3 explores how energy saving was part of designing or choosing to live in a new home. Six of the participating householders did not move into an existing home and were the first residents of newly built homes, thus this initial phase of improving insulation and windows was unnecessary.

4.4.2.2 Adding onto the home

Seven of the fifteen households that moved into existing houses added extensions, in order to create additional bedrooms and living space (Table 4.7).

Table 4.7 Households with extensions

	Number of participating household						
	1	4	5	7	11	14	19
Changed & Added	Kitchen, living room	Kitchen, guest bedroom	Attic into 2 bedrooms, Granny flat	B&B = 2 bedrooms	B&B = 1 bedroom	Conservatory & study	En-suite bedroom, study
Energy saving consideration	New boiler	Building fabric/ windows	Building fabric, biomass boiler	Building fabric, stove, new boiler	Building fabric, stove	Building fabric	Building fabric, MHRV, PV panels
Householders/ Bedrooms	2 3	4 4	4 5	1 4	2 3	4 2	2 3

In relation to energy saving, extensions were a prime opportunity to upgrade boilers, especially if a household's heating system did not have the capacity to heat the additional space. Three of the households had upgraded their boiler in relation to their extensions:

The extension was going to be done, so the boiler was put in first and we knew it had to take account of the extension (Steve, 61, H1)

I knew that I was going to build this extension eventually and I needed a much bigger system to power it so I was either going to replace- and also we were remodelling bathrooms so where the gas boiler was had to be moved- so I was either going to put in a huge gas boiler or go for this biomass boiler (Harold, 53, H5)

We replaced the roof and built the extension [...] we had an oil fired-boiler that was 40 years old and it seemed very efficient, but they couldn't get parts for it so we had to look at a new form of central heating and I would have preferred something like an air-source or ground-source heat pump but we couldn't afford it. So I had to go for a new oil-boiler (Kelly, 64, H7)

However, while new boilers were mentioned by householders as part of what they had done to save energy, these excerpts suggest that the impetus for upgrading boilers was not on saving energy *per se* but as a necessary part of coping with additional space. Therefore, understanding the meanings and timings of extensions (i.e. as part of homemaking) may be useful in explaining and intervening in domestic energy demand. For instance, targeting advice and linking energy efficiency marketing at householders making extensions or by tightening building regulations on extensions.

In fact, tightening the building fabric was stressed more in relation to extensions when there was a 'mistake':

I did the attic conversion; I did insulate it, [but] not particularly good enough. So I didn't cut out the draughts and the draughts have come back to haunt me (Harold, 53, H5)

We made a mistake with that conservatory though because it is not well insulated. So it is really difficult to use it at all in the winter. I think if we had put it in two years later, we would have gone for something that was massively well insulated and was triple glazed. So it's supposed to be all year- and certainly the roof is argon filled double-glazing and it's all double-glazing- but it's not what we expected (Rachel, 46, H14)

Both Harold and Rachel spoke about wanting to improve the insulation in their extensions in the future, though their concern was less to do with energy saving than their comfort in being able to use this additional space (i.e. visual comfort from sunlight, comfort of control and having more space). Moreover, conservatories were not initially designed to be used (or heated) all year round and the expectation that they should be has already been identified as increasing domestic energy

demands for space heating (DECC, 2013). Rachel's comment highlighted a lack of reflection on their household's desire to reduce energy consumption and their more fundamental decisions related to making a home for their family. For example, the conservatory in Rachel's home has a dining table, making it an important space for the family to spend time together (e.g. for meals and crafts) and this large table is multifunctional, fulfilling her need for an office space. The significance of the conservatory in this home (H14), tied to expectations of family life as well as personal space, trumps the idea of only using this space for part of the year (e.g. warmer months and sunny days). However, during planning of an extension, there is an opportunity to reflect on the household's 'needs' and expectations for their added space. In this instance a sunroom may have been better placed to meet their expectations. Therefore, energy advisers and advice could potentially go further, encouraging householders to reflect further on their expectations of home (e.g. conservatory ≠ year-round dining room) rather than focusing on how to meet these expectations most efficiently.

Expectations of house size and space per person are inherent in discussion of home extensions, which clearly have implications for domestic energy demand by creating more demand for space heating. Yet focusing simply on the size of a house overlooks the topic of quality and other important considerations householders may have for their homes (e.g. functionality, aesthetics, acoustics, cosiness). For example, Andrew and Emma explained that their extension was meant to be very energy efficient but the architect maintained that they could not afford it, even though she was able to build an extension that was bigger than they had requested:

> *Emma: It will be a big kitchen diner, just to maximise the view. We have a lovely view out the*
> *back but you can't really see it because we have this utility room stuck out the back. Yeah, it*
> *just doesn't make the most of it does it?*
> *Andrew: We were trying to specify it as a very eco-build, very warm, you know, minimal*
> *heating for that space, but I don't think the architect really...*
> *Emma: Yes I don't know, I mean I think she maintained that we couldn't afford it. She did give*
> *us in the end something bigger than we imaged having*
> *Interviewer: Do you want it that big?*
> *Emma: Well we do like it, but it's not what we imagined. She gave us a two story, which is*
> *great, our families live away and when they come to visit we don't have a spare room. And you*
> *know our parents are retired and they will come and stay for a couple of weeks and it is quite*
> *disruptive and the kids get moved. So the two story will be great because we will have an*
> *extra bedroom space which will be nice* (41 & 40, H4)

The desire for an extension already hints at householder's perception of a 'need' for more space. Andrew and Emma's experience emphasised that even households trying to be energy aware can

be distracted by other expectations of home. In this case, energy saving is outweighed by the desire to connect with family (e.g. spare bedroom and large open-plan kitchen). While this demand for more space per person affects wider trends in domestic energy demand (DECC, 2013) it is relatively unchallenged in domestic energy discourses.

This section highlighted that adding onto the home can be an important trigger for energy efficiency improvements (e.g. new boiler, insulation, or windows); nonetheless extensions are not generally motivated by a desire to save energy and will likely increase demand for space heating (e.g. bigger kitchen, adding on a spare room or conservatory). Adding onto the home thus may be an overlooked opportunity for energy advisers and energy policy to intervene in. The other key period that energy saving was mentioned was in designing and building a new home, another moment that has more to do with expectations of what a home is for, and this is explored in the next section.

4.4.2.3 Building a new home

There were six households in newly built homes. Four households designed and were involved in building their own homes and Table 4.8 presents the different household's main motivation for moving into a newly built home.

Table 4.8 Households in newly-built homes

	Number of participating household					
	3	8	12	17	18	21
Intentionally an eco-build	Yes, tiny house	No	No	No	Yes, Passivhaus	Yes, low-carbon
Designed by householder	Yes	No	Yes	No	Yes	Yes
Reason for buying/ building	Downsize, save energy	Allocated by Housing Association	Family home to fit 'needs'	Downsize, be less remote	Family home, low energy costs	Retiring, reduce fossil fuels/carbon
Year built	2012	1993	1967	2004	2011	2010
Householders/ Bedrooms	1 1	2 3	2 4	1 3	4 4	2 3

Only three of the newly built homes were intentionally eco-builds (Table 4.8), the other three met building regulations at the time they were built, which means they are generally to a higher standard than the majority of the UK housing stock, but were not intended to go beyond normal standards to save energy or reduce carbon emissions. What is interesting about the four households that designed their new homes was the importance placed on the size, even if energy demand and environmental impact were significant for three of them:

We worked out actually what we wanted for the next half of our lives- a fifth of our lives probably- and that is when we came up with no oil, no gas, regular power-cuts, warm and wetter climate and two people who want to live together and separately [...] The other thing is that it is 450 m², which is a big family house, with four bathrooms (Jack, 62, H21)

Well I think our architect was amazing [...] He said to us, 'you tell me how much money that you've got and I will tell you how many square feet'. And all the things that we wanted, three bedrooms, one each for the children, one for my mother and a double bedroom for us and I said 'he [my husband] needs a study to retreat to and with all these people in the house we need another shower downstairs' (Stacy, 81, H12)

We wanted to build a really cheap house to live in because we don't have very much, like we are obviously massively wealthy, but our income is quite small. So we did a lot of research about the cheapest way to run a large house and it turned out that it was the Passivhaus system [...] So that was the main thing that we did to save energy was to make the house as efficient as possible (Bill, 34, H18)

I told him [the architect] that 'I want the minimum area [...] I do not want any more than I have drawn unless you can produce a good reason'. And his reason was that I could have it, and I said 'I don't want it, it is extra heat'. Architects are used to thinking people want as much room as they can possibly get (Michael, 85, H3)

The first three excerpts stressed the desire for large family homes. At the time of building (Table 4.8), Stacy and Darren were designing a home that could accommodate a family of six and ensuring everyone had their own personal space 'to retreat to' was a primary aim (H12). Similarly, Shona and Bill have two young children and their home is meant to adapt to the 'needs' of a growing family (H18). Jack and Nancy were at a different stage in their life when designing and building their home; even though they built a big family house it is only for the two of them and the occasional guest (H21). Jack stressed this space was 'needed' for them 'to live together and separately' and they each have a study and en-suite bedroom (Figures 4.5 and 4.6, section 4.2.4). Thus saving energy may be connected to a key moment in homemaking (e.g. designing a home) but is not necessarily the reason for moving or building a new home. The desire for more space was arguably realised, with all but Michael living in relatively large houses (Figures 4.12-4.15) with more bedrooms than occupants (Table 4.8).

Figure 4.12. Michael's house *(H3)*   **Figure 4.13. Bill, Shona, Gabriel and Isolde** *(H18)*

Figure 4.14. Maggie's house *(H17)*   **Figure 4.15. Jack and Nancy's house** *(H21)*

When Michael was asked "what do you do to save energy?" his primary change was to reduce the size of his house and hence why he designed his own: "what I have done is move out of that place into this place, which is smaller" (85, H3). Michael even complained that multiple architects had not been able to comprehend his desire for a 'minimum area' and in the design phase they had encouraged him to make his tiny house bigger. Jack (H21) and Bill (H18) framed their understanding of energy saving in a different way. Jack and Nancy were most concerned with reducing their reliance on fossil fuels, 'no oil, no gas' and thus their installation of five sources of renewable energy (e.g. PV, solar thermal, wind, heat pump, wood) addressed this aim (H21). Bill and Shona were both artists and they included two studios in their home in order for them to be able to work; this is why Bill emphasised their small income and desire for a really cheap house to live in (H18). The Passivhaus standard and being as efficient as possible to save energy was their solution. Again, even households most concerned with saving energy (e.g. H18, H21) are not simply investing in a cause and had other considerations for what they expect from their home.

4.4.3 Summary

Overall, this section explored energy saving activities and their relationship to key moments in homemaking. In so doing, this has demonstrated the utility of putting energy saving in the context of the home and understanding what householders expect a home to be for.

Section 4.4 contributed to the objective of this thesis to link energy saving to home comfort (RO2). Householder's discussion of saving energy evidenced the mainstream policy approach to reduce domestic energy, which prioritised the house (e.g. fabric first, efficiency) and relied on technology and physical improvements (section 4.4.1)(answering RQ2a). According to householder's descriptions of their energy-saving activities, incorporating energy efficiency into the physical home was often linked to first moving into a new home, when designing and building a new home, or when adding an extension (section 4.4.2). However, this finding also indicated that energy saving may often occur as a benefit, rather than a cause, of other home improvements (contributing to RQ2b).

Considering that energy retrofitting is tied to other home improvements suggests that domestic energy research would benefit from exploring what householders want and expect from their homes. The next section presents the results from interviews with home energy advisers in Scotland, presenting their current understanding of comfort in their role and their reception to this broader concept of home comfort.

4.5 Home energy advice and home comfort

This section explores the extent to which home comfort was considered by home energy advisers in Scotland. These home energy advice centres are government funded and subsequently to an extent reflect wider government agendas. Thus interviewing home energy advisers is a way of understanding how domestic energy is approached in a practical and policy context. These expert interviews therefore contributed to exploring the implications of home comfort to future research and policy (contributing to RQ2d). Section 4.5.1 first outlines that home energy advisers perceived their role to be about addressing *both* climate change and fuel poverty; and explores adviser's explanation of how they approached meeting these goals. Section 4.5.2 then presents discussion related to the importance and understanding of comfort in their role. In doing so, this section sets out a foundation in which to gauge the novelty that a broader framing of home comfort may offer to future domestic energy research and policy. All interviewees have been identified by a number (their location/organisation are not included to ensure anonymity although some of the analysis refers to distinctions between different locations).

4.5.1 How home energy advisers contribute to reducing carbon emissions and fuel poverty

The interviews with home energy advisers began with interviewees describing the goal of their organisation and how they and/or their organisation approached meeting these goals. Interviews were intentionally structured to allow home energy advisers to first explain their understanding of their role in intervening in domestic energy demand, which afforded them an opportunity to

mention comfort spontaneously. Note however that comfort was not mentioned until prompted, and therefore it is not discussed in this section (these results are presented in section 4.5.2).

Home energy advisers were not simply interested in reducing domestic energy demand. Rather advisers framed the goals of their organisation to be about both fuel poverty and climate change:

> *Our main goal, what we were set up to do, was to reduce the carbon footprint of the community [...] and we also do a lot of work with fuel poverty* (i1)

> *We have multiple goals: as an organisation we are seeking to reduce carbon use [...] and the people who fund most of our services are looking at fuel poverty* (i5)

These quotes highlighted that these home energy advice centres reflect wider energy policies as they mentioned their goals being influenced by their source of government funding. The focus on *both* climate change and fuel poverty is important because strategies to reduce fuel poverty are in many ways different from what is needed to reduce carbon emissions. For instance, the intention is not to make fuel poor households consume less energy, but to support them to afford the energy costs of a basic standard of living. Affordability and equality are more important to a fuel poverty agenda than reducing energy demand *per se*. Whereas the goal to reduce carbon emissions is more targeted at affluent households who generally consume more energy. Nonetheless, as will be evidenced below, both these goals were predominately addressed through supporting householders to make material and technical improvements to the house in order to improve efficiency and reduce the cost of householder's energy bills.

While the home energy advisers described multifaceted ways in which they offered support to householders, the approach to tackling fuel poverty and reducing carbon emissions largely revolved around technical interventions. Centres offered a wide range of energy advice: on the use of heating systems and controls, helping householders to find funding and support to undertake efficiency improvements, explaining energy bills, as well as providing information about (small) lifestyle adjustments that could save householders energy and/or money:

> *Trying to support people to have a good understanding of how to control their heating system. An understanding of the market in terms of tariffs; how to check and find out what is going to be the cheapest tariff for them and support to actually make that switch. Fundamental energy behaviour advice; how they are using their appliances. And then looking at the fabric of the building, in terms of insulation or draught-proofing, and other measures that they can take, and linking them in with funding for those sort of measures* (i5)

The other interviewees similarly mentioned the wide range of advice reflected in the above quote. Nevertheless, providing advice on funding was arguably still often about making physical changes to the house (e.g. to invest in insulation or microgeneration technologies) and explaining the use of heating controls side-steps discussion of what energy is being used for or challenging energy-intensive expectations of home life. The major focus was on physical and technical improvements and energy efficiency:

> *Normally we go through "how can we make your home more energy efficient?" We work through an audit form; promote insulation, draught-proofing, then the fuel they are using, their heating system and we see if we can make it more energy efficient (i3)*

> *Concentrate on the fabric first (i4)*

> *Looking at the fabric of the building, in terms of insulation or draught-proofing and other measures that they can take […] whether it is renewables or maybe it is more controls for their heating system (i1)*

In general, the focus of home energy advisers and advice therefore was on the materiality of the house and technical intervention. For example, one interviewee described part of their thought process during a home visit, which highlighted the focus placed on the physical fabric of the house:

> *You are looking at the heating, the windows, draughts, under the doors, front door, back door, the key holes, the letter boxes, there is a lot going on in your mind"* (i2)

Moreover, several of the home energy advisers explained that part of their advice was about helping householder's interested in investing in energy saving to think more holistically. For example, "trying to get people to realise that sometimes they could actually save more by tackling the basics [such as] draughty windows and un-insulated lofts" before going for "nice fancy systems" and micro-generation technologies (i1). In particular, advisers mentioned that households often wanted to invest in microgeneration technologies before doing more basic energy retrofitting.

The home energy advisers commonly saw themselves to be helping to address the building performance gap (i.e. predicted energy savings are not met by technical improvements because householders are not informed of the best way to use these technologies), which they indicated was an issue of information and education. Interviewees applauded councils and housing

associations for increasing the installation of new heating systems and micro-generation technologies, but cautioned that education on how to live and use these technologies was missing:

> *People are getting up-to-date and newer systems and newer controls, but if nobody is teaching them how to use those controls then they are not getting the best out of their system. I think that is where councils and organisations are failing* (i1)

> *There are lots of housing associations at the moment fitting renewables- heat pumps, solar PV, a bit of solar thermal, lots of biomass and district heating systems- but often it has been stuck in their system then deal with the issues afterwards, and actually there are lots of fundamental changes with how householders have to behave and interact with these renewable heating systems* (i5)

As such home energy advisers explained that they helped householders understand how to 'get the best out of their system', information that they implied was not being provided elsewhere. Interviewees suggested that this gap in information provision might be lacking in part because physical features of homes, and householder's needs, are somewhat unique making it difficult to provide generic energy advice. Consequently, interviewees stressed that they were always "trying to target the advice to the particular person" (i1) and "tailor it to what they [the individual household] need[ed]" (i3). Yet, this sort of advice still emphasised a technical intervention in domestic energy demand because it is about using systems as intended and does not engage with lifestyles or everyday practices that shape demand.

The leaning towards technical intervention was acknowledged and to an extent justified by some of the home energy advisers because of the difficulty of changing householder's behaviours. All the energy advisers mentioned trying to "encourage some behavioural change" (i4):

> *From boiling a full kettle when you only need a cup, putting the washing machine on for two or three coloured items, washing at too high a temperature, heating a massive tank of water and not using it [or] leaving things on standby* (i1)

> *We can explain, for example, what it* costs *them to be in the shower for five minutes, or be in the shower for ten minutes. We can explain to them the savings they can make from washing their clothes at 30°C instead of 40°C. So there is a range of behavioural things that we do cover* (i4)

As these quotes suggest, home energy advisers understood their role in changing behaviours to generally be about information provision and making householder's aware of the energy demand

from certain activities (i.e. standby, boiling more water than needed, clothes washing machine settings). Householder's motivation for changing behaviours to reduce their energy demand was primarily framed around either householder's environmental values or financial rationalisation. For example, some advisers explained that if householders could afford their energy bills then it was difficult to encourage behaviour changes:

> *Unless the person is being driven by cost* [...] *A lot of people are comfortable in what they do, it is not causing them a financial strain [...] 'I'm OK, I can have five TVs in the house because I can afford it'* (i1)

> *People's bills can sometimes be pretty big but [they] haven't given it a thought as long as they are warm* (i2)

To an extent energy advisers indicated that environmental values were significant to householders altering their energy demand. Visits with householders that cared about their carbon footprint were described as 'good fun' and one of the biggest challenges to reduce domestic energy was perceived to be about a lack of concern about sustainability issues:

> *Where we have got clients who are trying to reduce, and want to reduce, their carbon footprint, it is great. Those kind of visits are good fun because they understand what you are trying to do and they go with it [...] Otherwise, it is quite difficult because you are talking about behavioural changes [and householders] putting into practice things that we are advising* (i3)

> *The biggest challenge is society, which has moved towards a demand-driven, gadget-driven society, a throw-away world* (i1)

However, there was a difference in the discussion of the importance of environmental values depending on the location of the energy advisers interviewed. For instance, in St Andrews, a more affluent area, the importance of environmental values was mentioned (this may also be because their funding is more tied to reducing carbon emissions). Rather the energy advisers representing much wider areas of Scotland (i.e. south-east, highlands and islands) were more focused on fuel poverty and motivating householder's to reduce their energy consumption was not the main concern.

This section has presented home energy adviser's responses to questions about how they approached home energy demand and the goal(s) of their organisation. For the most part, the energy advisers represented different organisations and locations in Scotland were similar in

understanding the goal of home energy advice to be about reducing *both* fuel poverty and carbon emissions. Although the focus varied to an extent, with fuel poverty being much more extreme in the context of the highlands and islands compared to St Andrews, for instance. Moreover, energy advice predominately focused on technical improvements and energy efficiency to reduce cost or energy demand. Mention of the 'fabric first' approach was common and much of the information about saving energy related to using systems as intended (i.e. setting heating controls, understanding how to capitalise on the energy produced from microgeneration technologies).

The next section explores home energy adviser's responses to being asked if comfort was a topic considered in their role.

4.5.2 Consideration of home comfort in relation to role as home energy adviser
Interestingly, when home energy advisers were asked whether comfort was considered in their work, or informed how they approached home energy advice, their responses indicated that comfort was a major concern:

> *That is the other side of our equation, when we go into people's houses, is to make sure that, one, they are adequately heating their house [and, two,] adequately heating with the least energy as possible. So comfort is a big, big issue with us* (i1)

> *Health and wellbeing supersede everything, you have to have people well and warm. Yes, comfort is important on a level, not hot, but survivable. […] People have to be warmish you don't want to advocate being cold. Health, and the effects of cold on health, we think about that naturally in our work* (i2)

> *In the work that I do, particularly in the way that I engage with clients, [being comfortable] is often what I'm there to try to enable; more so than carbon savings, probably with equal weight to financial savings* (i5)

> *Yeah, that is one of the core things that we ask people in our calls, you know are they warm. And the very reason that they phoned us is probably because they are not, they want advice on how best to make their homes energy efficient or save money* (i4)

While comfort did not arise spontaneously in home energy adviser's description of their organisation's goals or their role in engaging householders, comfort was clearly significant, being described as 'core,' 'a big thing' that 'supersedes everything'. Indeed, comfort was suggested to be of greater importance than carbon savings. These quotes indicate that perhaps comfort was not mentioned, until prompted, because it is implicit in home energy advice (i.e. 'we think about that

naturally in our work'), especially in relation to addressing fuel poverty. For instance, the home energy advisers discussed that householders need to have 'adequate heating' or enough so that it is 'not hot, but survivable'. Interviewee's responses demonstrated the assumption that comfort is invariably thermal comfort, it is about making sure that householders are warm. One interviewee did mention 'health and wellbeing' but this quickly was clarified in terms of warmth and the health implications of homes being too cold. The understanding of comfort being thermal was confirmed when interviewees were asked to consider if there were other types of comfort considered in their role as energy advisers. Energy advisers responded with confusion, mentioned other factors related to thermal comfort (i.e. ventilation, damp) or argued for thermal comfort to be the prime concern:

> *So broader than heating comfort? Umm, can you give me some examples? Would that be leading?* (i5)

> *Are you talking about no draughts?* (i3)

> *Thermal comfort is the big one, it is the obvious starting point when you are talking about energy because heat is very much about temperature. I think dampness can be a result of inadequate heating or patchy heating and of course [there is] ventilation* (i1)

> *There is some very well established research to a sliding scale of comfort [and] a whole series of associated problems that occur when you don't heat your house properly* (i4)

The emphasis on thermal comfort was unsurprising, as Chapter 2 evidenced, comfort is widely defined narrowly as thermal comfort (section 2.4). It would be more unexpected if home energy advisers focused their discourse around comfort and normal, everyday practice rather than efficiency, carbon saving, and affordability which is generally considered to be the mainstream policy approach in domestic energy research (sections 2.2 and 2.3). While there was some discussion around meeting basic levels of thermal comfort, only one interviewee spoke about engaging with householders on changing perceptions of thermal comfort.

> *I work with a lot of older people, and just the way that heating systems are developing, they are changing the way that heat is delivered. A lot of the people that I work with are used to gas fires, where they feel a radiant heat, or even a solid fuel fire. So you could rip that out and put in a super-efficient gas system, and the ambient temperature in the property can actually go up, but because they are not feeling it on their skin the way that they used to, people can actually feel cold. Even when you have thermometers and you can say look it is 21°C or 23°C in here, the perception isn't there* (i5)

This quote is an example that changes in physical features of our homes are linked to social expectations and experiences of comfort. Interestingly, this energy adviser's observation highlighted that it is not simply about knowing how to use a technology as 'intended'. A householder can be living with an efficient, low-carbon heating system and yet feel uncomfortable because the perception and understanding of comfort is also important.

4.5.3 Summary

This section presented the results from interviews with home energy advisers in Scotland. The section was organised around exploring home energy advisers understanding of the role of home energy advice and the extent to which comfort was considered in their work.

Home energy advisers did not simply frame the goal of their organisation to be about reducing domestic energy demand. Rather interviewees explained their goals in terms of fuel poverty and climate change. For the most part, meeting these goals was pursued through supporting householders to make material and technical improvements to the house in order to improve efficiency and reduce the cost of householder's energy bills. Behaviour change was mentioned, but mainly because of its difficulty. Moreover, home energy advisers framed the limitations of behaviour change as an issue of awareness that can be addressed through information provision.

Comfort was emphasised as being 'a big thing' and more important than carbon or money saving, but had not been mentioned when home energy advisers were asked to describe their work. Comfort was only discussed when prompted, and home energy advisers in many ways reframed the goal of their organisations in terms of ensuring a basic standard of comfort, alongside concerns about affordability and carbon emissions. Comfort was assumed to be thermal and was perceived to be especially relevant to home energy adviser's role in helping fuel poor households and ensuring that householders had a basic level of warmth. Interviewees were generally confused when pushed to consider other meanings of comfort beyond warmth and defended understanding comfort as only thermal comfort (i.e. referencing well-established health implications of living in cold conditions).

To sum up, home energy advisers understood their role as an intervention to help make a basic standard of comfort affordable. This was delivered primarily through technical improvements and questions of lifestyles or what energy is being used for were out of scope. These discussions with home energy advisers points to the novelty of expanding the meaning of comfort and linking it to understanding domestic energy demand.

4.6 Conclusion

This chapter has presented the empirical results of this thesis, examining the relationship between energy retrofits and other home improvements as well as meanings of home comfort and expectations of what a home is for. The evidence has demonstrated the potency of exploring the meanings of home comfort because physical house improvements and everyday activities were not simply driven by pursuit of thermal comfort or environmental concern but more fundamental expectations by householders of what a home should be. Householder's decisions to improve the energy efficiency of their homes was not done in isolation and often energy improvements were connected to other changes made to the home for non-energy saving purposes. Speaking about only energy saving or pro-environmental values removes these decisions from the wider context of the home and householder's changing expectations.

The first part of this chapter was concerned with meanings of comfort and twelve co-existing meanings emerged from participant's discussion: thermal comfort, relaxation, companionship, control, tactile comfort, visual comfort, mental wellbeing, auditory comfort, familiarity, contributory comfort, physiological comfort, and odour and fresh air (organised most to least discussed)(section 4.2). Comfort was not simply understood to be warmth, although thermal comfort was important and most commonly discussed. The data illustrated that comfort had many interrelated, co-existing meanings: both physical and psychological. Indeed, the significance of relaxation, control, and companionship emerged as these were the next most discussed and interconnecting meanings of home comfort, after thermal comfort. Exploring these other meanings of comfort and how they may inform understanding domestic energy demand forms a central part of discussion in the next chapter.

The second part of this chapter also provided some evaluation of the relationship between common themes in homemaking, meanings of home comfort identified by participants in this thesis (section 4.3) and domestic energy demand. In particular, the importance of family and privacy to the meanings and making of home were evident, raising the profile of companionship and control further in developing a new concept of home comfort. The data suggested that there was a tension between a desire to share space (family/companionship) and to have personal space (privacy/control) within the home. This presents an important finding, and the utility of investigating meanings of home comfort, because understanding this tension between companionship and control may be potentially useful in explaining a trend towards increasing space per person.

This chapter also identified how householders approached saving energy at home and the data demonstrated that technical or fabric first improvements were the priority. However, these physical house improvements occurred largely as the result of other key moments in

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homemaking. Moving house, designing a new home or adding an extension were prime opportunities in which householders improved the fabric of the building or upgraded heating systems. Yet, these decisions have much less to do with energy saving initially. Moreover, home improvements also generally resulted in bigger homes, running counter to householder's intentions to save energy. These particular results raise important points for discussion in the next chapter, for instance, the relationship between home improvements and energy retrofitting or the reasons for desiring bigger homes.

Lastly, this chapter presented data from interviews with home energy advisers in Scotland as a way of understanding how domestic energy is approached in a practical and policy context. This section explored the extent to which home comfort was considered to be of importance in addressing the important energy policy issues of fuel poverty and climate change. While the topic of comfort did not arise spontaneously, when prompted home energy advisers were adamant of the importance of comfort as a main goal of their organisation. Comfort was understood, and defended, (perhaps unsurprisingly) as warmth and 'adequate heating'. Clearly, the development of the concept of home comfort then is a novel contribution in domestic energy discourses.

In all, this chapter has demonstrated that investigating home comfort is useful in understanding domestic energy demand and has begun to identify some areas for further discussion. For example, exploring how energy improvements may be connected to other changes made to the home for non-energy saving purposes (i.e. homemaking). Another opportunity emerges from acknowledging that home comfort is about more than warmth which opens up the exploration of how other important expectations of the home may influence domestic energy demand (i.e. relaxation, control, and companionship). Finally, investigating the way in which the home is associated with being a space for both family (i.e. companionship) and privacy (i.e. control) affects house designs and expectations of space per person may be another fruitful avenue in future domestic energy research.

5: Discussion: Understanding and conceptualising home comfort

5.1 Introduction

This chapter discusses the conceptual contribution of this thesis to knowledge on sustainable consumption and domestic energy demand. Section 5.2 explores householder's understandings of home comfort and linked this to existing scholarship (in response to RO1). Sections 5.3 and 5.4 develop a conceptual framework to explore the implications that understandings of home comfort have for domestic energy demand (contributing to RO2). Section 5.5 offers some reflections on the methods informing these findings, and the chapter is brought to a conclusion in section 5.6.

5.2 Home comforts

As previously discussed, there is much more to home life and home management than being sufficiently warm. In order to develop a concept of home comfort that moves beyond thermal comfort (RQ1d), each sub-section compares the meanings of home comfort that emerged from this thesis to the existing literature on home comfort (chapter 2). Subsequently, this section is structured in the same way as section 4.2 from most to least discussed meanings of home comfort. The literature in this section is relatively limited (and somewhat out-dated) because there is little written on home comfort specifically (Table 2.2) and broader scholarship on the home is incorporated in section 5.3.

5.2.1 Thermal comfort

Thermal comfort was the most discussed meaning of home comfort in this thesis (Table 4.1, section 4.2.1). The prominence of thermal comfort in this thesis was also apparent in other literature on home comfort (Burris, 2014; Burris *et al.,* 2012; Crowley, 2001; Hardyment, 1992; Heijs and Stringer, 1987; Pineau, 1982; Rybcznski, 1986) and by the focus in sustainable consumption research on a global convergence of expectations of indoor temperatures (Rudge, 2012; Shove, 2003).

Generally, thermal comfort was spoken about in terms of 'the right temperature' by participants in this thesis. Yet prompting householders to speak about what they did to make themselves warm resulted in a much richer explanation than descriptions of thermal comfort in terms of thermostat settings and preferred indoor temperatures. For instance, there was general acknowledgement that desirable temperatures varied around the home (e.g. bedrooms could be cooler than living rooms), between householders (e.g. partners often had different temperature preferences, older householders need warmer temperatures), and temporally (e.g. seasonal and daily rhythms). Similarly, researchers writing on thermal comfort in sustainable consumption discourses have stressed that there are a variety of comfortable temperatures (Nicol and

Humphreys, 1973; Nicol *et al.,* 1995; Oseland and Humphreys, 1994). Thus, the goal of being sufficiently warm or cool should be centred on building homes that enable people to negotiate comfort through adjustment and adaptation (Chappells and Shove, 2004; Hitchings and Day, 2011; Hitchings and Lee, 2008; Pickerill, 2015; Nicol and Humphreys, 1973; Shove, 2003).

It is also important to note that participant's discussion in this thesis repeatedly demonstrated that thermal comfort was only one aspect of overall home comfort (section 4.2.1). Similarly, Humphrey's (2005) analysis of environmental surveys on thermal, lighting and acoustic conditions suggested that satisfaction of one or more aspects did not necessarily lead to overall satisfaction. Further, Burris (2014) proposed that householders who are experiencing thermal discomfort may still be comfortable because other aspects of home comfort are being met, such as a pleasing ambience, aesthetics, control, or social interactions. The isolation of one meaning may give a limited understanding of home comfort, yet this is the way the majority of research on comfort is typically approached (section 2.4). Arguably, the mainstream understanding of comfort-as-thermal-comfort does not adequately reflect the complexity and multiple co-existing meanings of home comfort highlighted in this thesis. Therefore, whilst the subsequent sub-sections review each meaning of comfort individually, the purpose of this chapter is to offer a new and holistic framework of home comfort which is presented in section 5.4.

5.2.2 Relaxation

Relaxation was an important meaning of home comfort to householders in this thesis (section 4.2.2). When householders were asked what they wanted to do in their ideal rooms the most common response was to relax: "just somewhere that I could relax" (Helen, 24, H8), "a nice place to sit and relax" (Maggie, 80, H17), "it would be primarily for pleasure, you know just relaxing" (Oliver, 66, H9). Indeed, 'relax' was a common term used by householders in this thesis, whereas the other meanings of home comfort were labels developed to categorise common themes that emerged in the analysis (section 4.2). In a similar study, Burris (2014) asked householders in the Midlands, UK "what does comfort mean to you?" and indicated that 'relaxation' was a frequent term used by householders explaining the meanings and activities related to home comfort. Householder's discussion of home comfort in this thesis indicated that relaxation was related to being 'at ease' both physically and psychologically. Often relaxation was explained in relation to having comfortable seating and when 'you don't do things' as well as being able to do whatever you want and identifying favourite leisure activities, such as watching television, using the computer, sleeping or reading. Sometimes relaxing depended on having time on one's own and at other times came from socialising with family and friends.

Furthermore, relaxation was the meaning of home comfort that was most interrelated to other meanings of comfort in this thesis (Figure 4.11). Householders connected relaxation explicitly with all the other meanings of comfort, except odour and fresh air: tactile (e.g. comfortable seating), visual (e.g. mood lighting as opposed to bright 'task' lighting), familiarity (e.g. having your stuff and usual routines), thermal (e.g. cosy and warm), control (e.g. 'doing what you want'), companionship (e.g. socialising), mental wellbeing (e.g. at ease), physiological (e.g. relaxing with cup of tea or alcoholic beverage), auditory (e.g. listening to music), and contributory comfort (e.g. ensuring guests feel welcomed). Relaxation therefore was predicated on meeting (some of) these other aspects of comfort. Being cosy in bed watching Netflix or having the radio channel you like on may be more about relaxing, than thermal or auditory comfort, for instance. The point being that relaxation gives meaning to meeting these other aspects of home comfort. The other studies on home comfort do not refer to relaxation *per se*, although many of the related attributes described above were nonetheless key: a sense of control (Heijs and Stringer, 1987; Pineau, 1982), ease (Rybczynski, 1986) or enjoyment from socialising and sharing the home (Heijs and Stringer, 1987; Rybczynski, 1986). Relaxation may be more of an umbrella meaning that is underpinned by meeting or negotiating other home comforts.

The next two (most discussed) meanings of home comfort relate to this tension between the comfort of having personal space/control or sharing/companionship, and are significant themes in the other home comfort literature.

5.2.3 Companionship

Having "the right company" (Stacy, 81, H12) was an important meaning of home comfort (section 4.3.3). 'People' and 'family' were even mentioned before thermal comfort by many participants in this thesis. Friends and family were mentioned in nearly every interview and there was a consensus that the home was expected to be a shared space.

Mothers were especially vocal about the significance of family and their children to their home comfort: "when all four of us are in the house it just feels totally right, it doesn't matter what is going on" (Sue, 55, H13). The importance of companionship was also reflected in the comfort of having 'reminders of the family' and photos of children even if they were no longer permanent members of the household. Friends and visitors were also discussed extensively in terms of companionship and sharing the home. For example, roughly half of the drawings of ideal rooms were clearly drawn to be communal, emphasised by the inclusion of large sofas and tables to accommodate multiple occupants (Figures 4.1-4.4).

Companionship was a much less interconnected meaning than relaxation (Figure 4.11); it was mentioned as being important to mental wellbeing, aesthetics of decorating, and the satisfaction of contributing to someone else's comfort or wellbeing. However, 'people' and 'family' were key topics in this thesis, indicating that companionship is deserving of much greater attention in understandings and investigations of home comfort. The importance of companionship in this thesis is similarly documented in literature on home (Blunt and Dowling, 2004; Dowling and Power, 2012; Flanders, 2015; Ozaki, 2002) but is only included in a couple of the writings on home comfort (Burris, 2014; Heijs and Stringer, 1987; Rybczynski, 1986). For many participants in this thesis sharing the home with family members was a key part of what 'makes a house a home'. This was a statement made by a participant in this thesis but has also been argued in literature on the home (Gilman, 1980). Numerous studies reviewed by Heijs and Stringer (1987) on social and psychological dwelling needs similarly stressed the home as a place of 'social contact'. The finding that family was a significant part of home comfort (section 4.3.2) is unsurprising as already presented in Section 2.5.3 the family is such an important aspect of home (Beeton, 1861; Blunt and Dowling, 2004; Flanders, 2015; Moore, 2000; Perkins *et al.*, 2002; Smith, 1994; Soaita, 2014; Sommerville, 1992; Valentine, 2001) that the two are often conflated in housing literature (Gorman-Murray, 2007; Mallett, 2004). Yet, it is interesting that family was not a focus in the other home comfort literature (Burris *et al.*, 2012; Crowley, 2001; Hardyment, 1992; Pineau, 1982). Instead there is acknowledgement of the home being a shared space, but the focus is on comfort gained from a feeling of control over one's own activities and interaction with others.

From analysis of householder's discussion in this thesis, companionship emerged as a key expectation of the home and home comfort and becomes central in the conceptualisation of home comfort presented in section 5.4. While companionship was underexplored in the other literature on home comfort, it is arguably an important consideration and one that affects domestic energy demand. For example, putting on heating in order to be a 'good host' (Hitchings and Day, 2011; Hards, 2013). The next section explores control because this was the next most discussed meaning by householders in this thesis.

5.2.4 Control

Being able to 'do what you want' and having a sense of control was an important aspect of home comfort (section 4.2.4). In domestic energy research, the topic of control is already considered to be important to reducing demand in terms of householders being able to adequately manage heating systems (Leaman and Bordass, 2001; Li and Lim, 2013; Caird *et al.*, 2008; Sexton and Lees, 2012). Householders in this thesis similarly used the term control to refer to setting their thermostat, radiator valves or storage heaters. However, the label of control is used in a much

broader sense here to emphasise the significance of the home offering householders personal space that enables them to 'do what they want'.

After thermal comfort, control appeared most in academic literature on home comfort (Crowley, 2001; Dowling and Power, 2012; Hardyment, 1992; Heijs and Stringer, 1987; Pineau, 1982; Rybcznski, 1986) and home (Aune, 2007; Blunt and Dowling, 2006; Brickell, 2012; Mallett, 2004; Ozaki, 2002; Perkins *et al.*, 2002; Saunders and Williams, 1998; Sixsmith, 1986; Soaita, 2014; Sommerville, 1992; Valentine, 2001). For instance, in Pineau's (1982) study three out of the four key meanings of home comfort related to this theme of control: personalisation, freedom of choice, and space (the fourth was warmth). Similarly, Heijs and Stringer's (1987) review of the literature identified several aspects of psychological comfort, with all but one related to control: privacy, freedom of choice, extent of control, opportunities for establishing a recognisable place, quietness and social contacts. Furthermore, other 'home comfort' studies (Burris *et al.,* 2012; Heijs and Stringer, 1987; Pineau, 1982) emphasised 'peace and quiet' more than the householders in this thesis did. For example, Pineau's (1982) reference to 'freedom of choice' as a key aspect of comfort mainly related to the 'need' for calm, silence and/or a space to recuperate in the home. Instead, householders in this thesis focused more on the comfort of being able to do what they wanted, but acknowledged that these comfort preferences may vary.

Householders recognised that their ability to 'do what they want' in the home is dependent on social and physical constraints both inside and outside of the home (e.g. building regulations, builders and installers, funding schemes, other household members, physical house, layout, size of rooms, energy infrastructure). In home literature, control is often an important theme because the home is idealised as a place of freedom from outside rules and regulations (Brickell, 2012; Flanders, 2015; Mallett, 2004). However, in this thesis, householders spoke much less about control in terms of a public/private divide. In comparison, householders focused more on internal features that influenced their activities, such as other householders and the material properties or design of the home. Householders in this thesis spoke mostly about control in relation to sharing the home with other household members. For instance, disputes over the management and decoration of shared spaces arose, with children especially commenting on their lack of power to influence decisions within the home. Certainly, all the children focused on their bedrooms as places of comfort, with some including locks and security systems in their ideal drawings in order to protect their personal space.

Having personal space was important to adults as well as children and it was common to suggest that individuals needed space within the home to retreat from family life (section 4.4.3) or "have some peace from everyone else" (Ben, 11, H16). There was also often an assumption that control was afforded by the size of the house and having enough space so that householders did not

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disturb one another. Having "[r]oom for different activities to go on within the [home] so there can be somebody being very noisy and it's not bothering anyone else" (Shona, 36, H18) or designing a home so that "people [can] carry on doing their own thing, but living together as well" (Jack, 62, H21). One householder may prefer quiet, while the other prefers music for example; or householders may not want 'peace and quiet' at the same time (i.e. auditory comfort). Thus, the significance of control underpinned other meanings of home comfort. Another example related to thermal comfort as householders may prefer different temperatures and subsequently have to negotiate or compromise on these, or they may have different opinions on how to decorate and personalise a communal space (i.e. visual comfort). In this sense, control was also connected to mental wellbeing and familiarity: "Not just being physically comfortable but being mentally comfortable and happy, being able to do what you enjoy" (Helen, 24, H8).

The importance of a sense of control to home comfort is reflected in the prominence of this aspect in the conceptualisation of home comfort presented in section 5.4. The next most discussed meaning was tactile comfort.

5.2.5 Tactile comfort

Tactile comfort, or features of the home being pleasant to touch, was another important part of home comfort (section 4.3.5). Having a comfortable place to sit was often a prerequisite for being able to relax and householders in this thesis spoke extensively about the desire for large couches and armchairs. Tactile considerations were often mentioned in relation to thermal comfort; especially the discomfort of wearing too many layers or the 'feel' of socks or 'scratchy jumpers' even though these improved thermal comfort. This connection between tactile considerations influencing thermal comfort was also raised in Heijs and Stringer's (1987) review, in which they highlighted a trade-off between soft materials which are more pleasant to feel and often warmer and hard materials that require less maintenance. Hence, it is useful to investigate home comfort broadly because other meanings can impact thermal comfort but may be overlooked when the focus is on space heating and temperature alone. For example, this may influence deciding between the feel and warmth of a carpet and the convenience of cleaning a wooden or tiled floor. Again this is a reminder of the utility of investigating and developing the concept of home comfort holistically, rather than isolating types. Even while there was agreement over the significance of tactile comfort, householders had different preferences. For instance, one preferred hard seats and the other wanted softer cushions. This related back to the tension between companionship (section 5.2.3) and control (section 5.2.4) or the need to negotiate comfort preferences because the home is a shared space.

The next section explores visual aspects of comforts which were discussed to a similar extent as tactile comfort by householders in this thesis.

5.2.6 Visual comfort

Visual comfort combines lighting and aesthetics because householder's descriptions suggested a blurring boundary between these two aspects (section 4.3.6). For instance, windows were widely discussed as being integral to comfort for both letting in natural light *and* because of the view or connection with the outdoors these afforded. Having a view of green space goes far beyond mainstream investigation of visual comfort and lighting.

Most of the research on lighting or visual comfort is related to physiological or physical investigation (e.g. colour and brightness) ignoring the more social or psychological influences lighting may have on home comfort. For instance, research has investigated how the colour of artificial lighting affects thermal comfort (e.g. bluer lights make people feel colder than more red hues) (Fanger *et al.,* 1977) or the impact to workplace productivity (Abbaszadeh *et al.,* 2006; Galasiu and Veitch*,* 2006). For some householders, having the appropriate level of brightness from artificial lighting for a particular task was the focus (e.g. reading), but for others setting a mood was more important. This is different from exploring why dimmer artificial lighting can alter the ambience of a room, or why the abundance of natural light can make a room the most comfortable place in the home during the day or summer (Susanka, 2001). Therefore, visual comfort is a consideration in occupant satisfaction and broader comfort research but is understood in a much narrower way than by the householders in this thesis.

Natural light was also commonly highlighted for its impact on mental health: "I would obviously choose the one that faced south because it has a much better psychological effect with the sun coming in" (Maggie, 80, H17). Householders discussed the comfort of aesthetics in terms of having personal items (e.g. pictures of family or items that were from trips) and some control in decorating, including the style of furniture. These different preferences for lighting or décor were another point of debate and contention within some households in this thesis, as household member's different comfort tastes sometimes led to clashes (relating back to companionship and control). As previously mentioned in section 5.2.4 on control, personalisation is a key aspect of home comfort (Burris *et al.,* 2012; Heijs and Stringer, 1987; Pineau, 1982; Rybcznski, 1986), which complemented participant's emphasis on aesthetics and visual comfort. By combining lighting and aesthetics this thesis expands on the mainstream framing of visual comfort (e.g. physiological and objective lighting preferences), without dismissing the importance lighting has on home comfort.

The subsequent sub-sections review other meanings of comfort that were less commonly mentioned in the interviews (Table 4.1).

5.2.7 Mental wellbeing

Mental wellbeing was another aspect of home comfort identified by householders in this thesis (section 4.2.7). Householders referred to mental health in terms of being happy, not having worries or being rushed, and a feeling of inner peace.

Some participants in this thesis explained that mental wellbeing was more fundamental than physiological concerns, such as a soft bed or warm room. For instance, after describing other aspects of home comfort one participant clarified a difference between "comfort on the basic level or comfort on the luxury level" (Sharon, 55, H11). Similarly, another participant suggested that mental wellbeing was a key part of what made a house feel like home: "It's more mental comfort, than physical I think. So physical yeah, but not just warmth, it's also about somewhere to curl up that feels good in terms of… feels balanced and feels safe… and feels like home" (Rachel, 45, H14). Certainly, the importance of mental wellbeing related back to historical meanings of comfort which were much more emotionally centred, relating more to consolation, mental satisfaction, inner peace, support and encouragement (Crowley, 2001). Returning focus to these psychological meanings of comfort may be a useful avenue for future domestic energy research, considering that the shift to a physical framing of comfort alongside commodification and standardisation of these 'needs' (e.g. minimum temperatures) has been connected to increasingly resource intensive lifestyles (Shove, 2003). Burris *et al.* (2012) also emphasised that an individual's state of mind can affect how they perceive a product or environment. The inclusion of mental wellbeing is not meant to deny the importance of physical comforts but to acknowledge that these are interconnected and may be underpinned by psychological security found in the home.

However, mental wellbeing was rarely explicitly mentioned in home comfort literature. Heijs and Stringer (1987) explained that this may be because research on the (social) psychological needs of home lack a common vocabulary. Investigation of psychological home comforts has resulted in an abundance of concepts and labels that explain similar and overlapping phenomena (Heijs and Stringer, 1987). Even though Heijs and Stringer's (1987) assessment was made nearly 30 years ago, this area of research is arguably still fragmented today. Therefore, even though mental wellbeing was not extensively identified as an aspect of home comfort, it may still be an area of interest.

The next section explores auditory comfort, which was discussed to a similar extent to mental wellbeing by householders in this thesis.

5.2.8 Auditory

Auditory comfort, having music or 'peace and quiet' when it was desired, was commonly mentioned by householders (section 4.2.8). In several households, members divided their control of music or background noise in particular areas of the home. The home comfort literature similarly emphasised the significance of auditory comfort. These authors focused primarily on 'peace and quiet' with little mention of the positive effects of music (Burris, 2014; Burris *et al.,* 2012; Heijs and Stringer, 1987; Pineau, 1982; Rybcznski, 1986). For instance, several householders in this thesis commented that music was part of making a room comfortable or found a sense of companionship from having the radio on.

Auditory considerations or acoustic quality are a common consideration in terms of occupant satisfaction (Abbaszadeh *et al.,* 2006). As previously noted the research on occupant satisfaction draws heavily from the workplace context which is distinct from expectations of the home. Yet interestingly, both home comfort and occupant satisfaction literatures highlighted the importance of auditory comfort because of its impact on privacy. For instance, people overhearing private conversations. This relationship between auditory comfort and privacy is significant for domestic energy research as it may influence householder's perception of necessary house size in order to find a quiet or private place of one's own. A design that takes auditory comfort into consideration, for example thicker walls, may address some of these concerns without 'needing' a larger house (Dowling and Power, 2012).

The next section explores the importance of familiarity, which was discussed to a similar extent as auditory comfort and mental health by householders in this thesis.

5.2.9 Familiarity

Familiarity was a commonly mentioned aspect of home comfort as householders stressed the importance of having their own things and routines (section 4.2.9). One participant explained the significance of familiarity in terms of the difference between a hotel and a home. A hotel might have all the amenities that one would want to be comfortable: for example, being warm, quiet, aesthetically pleasing, affording a sense of privacy and containing a cosy bed or comfy chairs. Yet a hotel room rarely has the same sense of homely comfort, in part, because it is impersonal and lacks familiar objects.

This is a similar finding to the home comfort literature. Pineau's (1982) participants similarly associated familiar surroundings and belongings with comfort at home. Indeed, a participant in Burris' (2014: 97) study commented that "if things are changing all the time it gets to the point of

being anonymous and sterile, so familiar things can give you comfort". Familiarity is a key part of why personalisation is integral to home comfort (Heijs and Stringer, 1987); without these familiar objects and routines, places are described as 'sterile', 'impersonal', and 'anonymous'. Furthermore, as the quote from Burris' (2014) study of home comfort indicated, familiarity is important because it also related to a sense of continuity and stability. Stability in the home is stressed in housing literature because it is understood as an integral psychological necessity in life and a base around which identities are constructed (Giddens, 1991; Dupuis and Thorns, 1998; Saunders, 1989; Smith, 1994) (section 2.5.4).

Considering that personalisation is closely tied to householders having some 'say' in the management of the home, the comfort from familiarity appeared related to the home comfort of control (this relationship is reflected in Figure 5.1). Familiarity is distinct from control because it is not simply about 'being able to do what you want' but the comfort that comes from a sense of continuity, repetition and reliability.

5.2.10 Contributory comfort

Contributing to something or someone else was another important source of home comfort (section 4.2.10). This included being part of a cause, community, or faith group as well as contributing to the comfort or wellbeing of guests or other household members. Contributory comfort was mentioned much less than other meanings of comfort and interestingly emphasised that all the other meanings of comfort were focused on the individual. This may in part be due to the framing of the interview guide, asking "what does comfort mean to you?" which sets home comfort in terms of the individual's context, as opposed to the household's experience.

There is no mention of contributory comfort, or similar concepts, in the other home comfort literature (Crowley, 2001; Heijs and Stringer, 1987; Rybcznski, 1986) and this may also reflect an individualistic framing of data collection in the empirical studies (e.g. not taking household as basic unit of analysis)(Burris, 2014; Burris *et al.,* 2012; Pineau, 1982). However, this may also be explained to an extent by a cultural bias as Ozaki (2002) demonstrated that individualism, independence and self-reliance are emphasised in studies of British homes. Whereas other cultures are more group-oriented and thus collective notions of home comfort would perhaps emerge if home and home comfort literature was less Anglo-Saxon centric (Ozaki, 2002; Soaita, 2014). Householder's discussion in this thesis demonstrated that it was important to include a sense of comfort that comes from contributing to others, instead of only thinking about one's own preferred temperature, lighting, or aesthetics.

Concerns about environmental impact and climate change fall into contributory comfort. For example, some householders mentioned that turning off the lights or investing in insulation was a source of comfort because they were 'doing their bit' to save the planet. While there is certainly a considerable body of literature on environmental concern influencing household management and resource consumption, it is notable that this was mentioned in only four of the twenty one interviews. This highlighted the utility of a practice-informed approach because it identifies other everyday considerations (e.g. meeting thermal, visual, relaxation, companionship, control, auditory comforts) that can outweigh or compete with householder's intentions to reduce demand. Even so, contributory comfort is significant because it captures how the home is not simply about individual or personal comfort and can be used for a cause (e.g. gathering place for a church group), to declare a householder's values and identity (e.g. PV panels), or to offer shelter to others (e.g. friends, family, neighbours). These uses of the home have little to do with an individual's immediate comfort, but are integral to a broader understanding of home comfort because the home is generally expected to be a shared social space (sections 2.5.3 and 5.3.1 on family and companionship, respectively). The comfort gained from contributing to others thus was related, but distinct, from companionship. For instance, several householders stressed that furnishings, décor, and the temperature in terms of wanting to be a good host, but this did not necessarily imply that these were the same conditions sought for 'normal' everyday comfort (Hards, 2013).

5.2.11 Physiological comfort

Householders also mentioned meeting 'basic' physiological needs as an aspect of home comfort, discussed mainly in terms of being physically healthy and not hungry or injured (section 4.2.11). This is similar to a dictionary definition of comfort as "a state of physical and material well-being, <u>with freedom from pain and trouble, and the satisfaction of bodily needs</u>" (OED, 2016b, emphasis added). Both acknowledge that home comfort was based on a foundation of 'basic' physiological needs and a lack of pain. Food was primarily spoken about in terms of nourishment rather than 'comfort eating'. Furthermore, comfortable seating and bathing were both discussed in relation to easing aches and pains. In several interviews, older participants mentioned that seats were comfortable if they allowed householders to 'get their feet up' or were easy to get in and out of. Physiological comfort then is a reminder that thermal, tactile or visual comforts are not the only considerations in creating a comfortable home. Being hungry or in pain will also influence a householder's mental wellbeing, ability to relax, and interactions with other householders.

Physiological comfort appeared in, but is not the focus of, the other home comfort literature (Burris, 2014; Heijs and Stringer, 1987), and these authors briefly draw on theories of need (Maslow, 1968). However, there is debate over the evidence for these theories of need (Wahba

and Bridwell, 1976) and therefore the inclusion of physiological comfort in this thesis is not based on an argument of 'basic' human needs. Comfort is a socially constructed concept and where it sits between basic 'need' and luxury is contested (Crowley, 2001). For example, Nancy and Jack stressed that relieving sore muscles was central to their home comfort, they had a very active lifestyle and having a bath was important to 'ease off the pain of the day'. Thus, when they designed their home they included three bathtubs. While being free from pain may not be disputed as a component of comfort, how discomfort is avoided or relieved is much more debatable and complicated. Three bathtubs for a two-person household may not be seen as necessary to home comfort.

5.2.12 Odour and fresh air

The least discussed aspect of home comfort was related to olfactory comfort or odour and fresh air (section 4.2.12). The households with mechanical ventilation, a common component in the design of highly insulated buildings, were the most vocal about odour and fresh air being important to home comfort. The introduction of mechanical ventilation may therefore be an example of how a change in the materiality of the home can alter expectations of comfort (e.g. make householders more sensitive to odours or a lack of fresh air). Participants stressed that odour and fresh air must be included because even if a room was sufficiently warm it could still be uncomfortable if it is stuffy. Similarly, olfactory comfort is a common consideration in the development of building standards because these impact thermal comfort and health conditions (for example from damp). It was first recognised in 1905 that several environmental criteria combine to achieve thermal comfort, including radiant and air temperature, air flow and humidity (Rudge, 2012). Thus, in relation to ventilation, odour and fresh air are widely researched in occupant satisfaction scholarship and domestic energy research. However, olfactory comfort has received little attention in home comfort literature (Heijs and Stringer, 1987; Rybczynski, 1986).

Odour and fresh air importantly influence domestic energy demand. Like much of the scholarship on thermal comfort, determining ideal air flow and humidity conditions is generally based on averaged results from laboratory experiments. Yet some studies draw attention to cultural variations of olfactory preferences. For example, the writings of German architect Muthesius (1904) evidenced that other cultures may attach less value to fresh air and find British homes uncomfortably draughty. Yet Rudge (2012) demonstrated a connection between fresh air and an attachment to open coal fires. Thus, British homes were intentionally designed and built to be 'leaky' because fresh air was associated with hygiene and cleanliness (Ibid, 2012), with the Ministry of Health Housing Manual in 1927 emphasising the value of flues for ventilation and reducing condensation problems (Ibid, 2012). While stoves demand nearly air tight rooms for full efficiency.

To sum up, this section has undoubtedly revealed some of the ways in which home comfort is more complex and multi-faceted than mainstream framings of comfort-as-thermal-comfort would suggest.

5.2.13 Summary

Certain meanings of home comfort were already apparent to building scientists and engineers' understandings of occupant satisfaction, including thermal, tactile (e.g. ergonomics), visual (e.g. lighting), auditory (e.g. acoustic), and odour and fresh air (e.g. ventilation). These were generally defined in more objective, physiological ways than participants of this thesis described, which was a similar finding to the home comfort literature.

After thermal comfort, control was the most important and common meaning of home comfort discussed by participants of this thesis as well as being a common topic in the home comfort literature. A sense of control was essential to householders creating a personal space and establishing a sense of stability, which is fundamental to ontological security, home and identity (Giddens, 1991; Dupuis and Thorns, 1998; Saunders, 1989; Smith, 1994). Householders in this thesis were not particularly focused on having freedom from outside forces (e.g. government rules and regulations), but were instead concerned with how other householders impacted their home comfort.

Participants in this thesis emphasised that sharing the home and companionship could be a source of home comfort, even though it could also take away from their freedom of choice and personalisation. The importance of control may in part be the result of this recognition that the home is often a shared space, yet the majority of home comfort literature did not mention companionship (Burris *et al.,* 2012; Crowley, 2001; Hardyment, 1992; Pineau, 1982). Therefore, companionship may be more of an implicit aspect of home comfort in these other studies. Certainly, family features prominently in literature on home and homemaking (Blunt and Dowling, 2004; Dowling and Power, 2012; Flanders, 2015; Ozaki, 2002) and drawing greater attention to companionship could move understandings of home comfort forward in a novel way. Home comfort is not all about meeting personal expectations; it may also be about the collective household's comfort preferences.

Relaxation and mental wellbeing were also meanings of home comfort that received little explicit attention in home comfort studies, but were similar to concepts of significance in this scholarship. In many ways, relaxation and mental wellbeing were implicitly overarching aspects of home comfort. The review of other home comfort and home literatures also raised the importance of

familiarity because stability and continuity are considered a psychological necessity in life (Giddens, 1991; Dupuis and Thorns, 1998; Saunders, 1989). Contributory and physiological comfort received nearly no mention in the home comfort literature, they are included in understandings of home comfort because participants in this thesis demonstrated their interrelationship with other meanings. For example, contributing to a cause or another's wellbeing can undoubtedly be a source of comfort and being in pain can make a cosy, relaxing evening with friends less enjoyable.

Comparing the meanings of home comfort that emerged from participant's discussions with wider literature thus has moved understanding forward by raising the profile of control, companionship, relaxation, mental health and familiarity. The next section turns to advancing understandings of home comfort further by considering the interrelationships between these twelve co-existing meanings (thermal comfort, relaxation, companionship, control, tactile comfort, visual comfort, mental wellbeing, auditory comfort, familiarity, contributory comfort, physiological comfort, and odour and fresh air).

5.3 Linking homemaking and home comfort

This section contributes to connecting meanings of home and comfort (RQ1c) into a new concept to understand householder's expectations of home (RQ1d). Connecting these themes of homemaking with the meanings of home comfort contributes to the development of the concept of home comfort because it is a way to reassess and reorganize the relationships between the empirical meanings identified by householders in this thesis with wider discourses on expectations of the home. Specific recommendations for understanding or intervening in domestic energy demand are offered within each theme but (when possible) the focus is to use these themes to advance understandings of home comfort more generally. The section is organised around the key themes identified in section 2.5: family and privacy (section 5.3.1), the home-as-ideal (section 5.3.2), hearth (section 5.3.3), and gender (section 5.3.4).

5.3.1 Family and Privacy

The themes of family and privacy are presented together in this section as the empirical findings indicated that issues of privacy were largely the result of sharing the home with other family members (section 4.3.1). The majority of households in this thesis were living with family, thus the family theme was more relevant than it may have been with a different sample of occupants (e.g. students living in shared accommodation). The themes of family and privacy advance understandings of home comfort because they are closely tied to companionship and control, respectively, which were key meanings of home comfort (section 4.3). Family and privacy related to companionship and control because 'family time' and being 'together' was an important aspect

of home comfort; yet sharing the home could (at times) lead to the desire for privacy (section 4.3.1). Thus, this section offers some direction for developing the framework of home comfort and navigating the interconnections between meanings of home comfort (which will be presented in section 5.4). Moreover, discussion of family and privacy clearly had implications for understanding, and intervening in, domestic energy demand and these are organised into three main recommendations: designing for togetherness and privacy (section 5.3.1.1), challenging demands of the peak household (section 5.3.1.2) and questioning whether bigger houses are more comfortable (section 5.3.1.3).

5.3.1.1 Design for togetherness and privacy

In a majority of the multiple-occupancy households the desire to share space (i.e. companionship, sections 4.3.3 and 5.3.3) as well as have personal space (i.e. control, sections 4.3.2 and 5.3.2) arose as important aspects of home life without a set question to direct discussion to this topic. In some cases talking about sharing the home sparked debates and drew attention to tension between some householder's different preferences for how the home ought to be managed. The importance of companionship and control was therefore evident from the considerable amount of discussion that arose in relation to sharing the home.

Family time and spaces where householders were together were commonly mentioned in the course of interviews. Open-plan kitchens in particular were emphasised as a preferred design that enabled everyone to stay together and sixteen of the twenty-one households had open-plan kitchens. Other studies commented on this preference for open-plan kitchens which is linked to the decline of a formal dining room (Hand *et al.,* 2007; Judson and Maller, 2014) and this may be a positive trend for domestic energy demand because it reduces the demand for heating a room that is rarely used. Further, the trend towards open-plan kitchens may compliment strategies to reduce energy demand. Susanka (2001) argued that the home should be designed around activities (e.g. eating, sleeping, playing) and should be composed of multi-functional spaces that are used daily. Rooms should not be duplicated for the same activity or the space will not get used. Formal dining rooms and living rooms are generally redundant spaces for eating and socialising that are only used occasionally for parties or visitors. A few householders in this thesis commented on parts of the home not being used regularly, especially after their children had grown up and moved out. Nonetheless, householders often assumed that these were still necessary spaces in the home. Susanka (2001) suggested that householders should focus on the quality and detail of the home, rather than having more space that is not regularly used. The open-plan kitchen fits this recommendation for a multifunctional, everyday space in the home.

On the other hand, while householders stressed the importance of being together, their discussion also evidenced some points of tension which arose from sharing the home. For example, the noise

of the TV in the living room was a source of stress for one couple because Amy wanted to be in the living room with the cosy fire in the evenings, but did not want to watch TV (section 4.3.1). Another example of tension over sharing the home was a couple that was unable to hang any artwork, except a mirror, when they first moved in together because of their different decorating tastes. One of the most important ways householders dealt with balancing the desire to have companionship and control was for individuals to have their own space. Thus, even if someone did not have much control in communal areas of the home they still had somewhere that they could make their own (i.e. bedroom, study). The perception of a 'need' for personal space arguably influenced householder's preference for larger homes (sections 4.2.2 and 4.3.1). This is a common topic in housing mobility literature, which reflects on the relationship between 'space needs' of a changing family and at different points in an individual's life (Winstanley *et al.,* 2010). For the domestic energy context, Dowling and Power (2012), studying sustainability and consumption of 'McMansions' in Australia, have also found that more space was justified by parents as a way to create privacy and contain children's mess from overwhelming the entire home. Their explanation usefully reflected that this tension between companionship (e.g. common desire to have a family) and control (e.g. segregating children's spaces, toys, and mess within the home) can explain the justification for larger homes (Dowling and Power, 2012).

Further exploration of designs and ways of meeting home comforts of companionship and control would be extremely useful and is an area generally missing in domestic energy discourses. The next sub-section continues to explore how the desire for companionship and privacy influence house size, and subsequently domestic energy demand, focusing on the impact of accommodating the 'peak household'.

5.3.1.2 Shared spaces and challenging demands of the peak household

Ensuring that all household members have some privacy impacts house layout and size. These privacy expectations created a demand in space related to the peak household because extra bedrooms and bathrooms are 'needed' for (future) children and guests. For example, multiple participants in this thesis mentioned having spare bedrooms either in anticipation of children needing their own room or as a result of adult children moving out. The majority of participants had older children and thus were explaining how they managed living in a house that at one point accommodated a bigger family, and amongst this sample it was also common to have one or two spare bedrooms. Some justified staying in a larger family home by explaining how they repurposed these spaces for individual activities, filled the extra space by letting out rooms, or stressed that it was important to keep in order for grandchildren to visit (sections 4.2.3 and 4.3.1). A few participants acknowledged that these larger homes took more effort to clean and maintain; yet only two participants had downsized, and these were retired single women. This attachment to the home is a similar finding to a number of housing studies which suggested that

for older people the home becomes a place where they have put down roots and invested emotionally as well as financially (Satsangi *et al.*, 2015; Saunders, 1989; Winstanley *et al.,* 2010). This is again a reminder that home management is not simply dependent on financial, thermal, or environmental concerns, despite the majority of domestic energy research focusing on these factors.

Expanding the size of the home to accommodate this 'peak household' clearly has implications for domestic energy demand (Clune *et al.,* 2012; Wilson and Boehland, 2005). Therefore, separating ways to accommodate the peak household from the expectation of more space per person is a potentially significant recommendation that has been overlooked. For instance, one participant commented on wanting an extension so that they could have a separate guest room from office, but then reflected that her children would be grown up and moved out in less than 10 years (section 4.4.3). Thinking about the long term space 'needs' is important because a house that 'needs' four bedrooms to accommodate children and the occasional guest may become virtually empty when kids move out (Susanka, 2001: 121). Extensions are the most commonly carried out alteration in UK homes (29 per cent of the UK housing stock) (DCLG, 2013) and there is an opportunity then to emphasise home improvements that improve home comfort but are not necessarily predicated on adding more space. Judson and Maller's (2014) study on energy efficiency improvements had a complimentary finding related to householders adding bathrooms to meet the demands of the peak household. Specifically, bathrooms were added in households with teenagers to reduce the potential for conflict when getting ready in the morning (e.g. contributing to comforts of control and privacy). However, these bathrooms likely become underused when children move out. Considering that bathrooms are the most expensive room to build per square meter in the home (Susanka, 2001), this may be an area to engage householders on reconsidering how else they may invest in their everyday, long-term home comforts. This is not to overlook that householders likely considering the added economic value resulting from home improvements and extensions, but that this is for the most part seen as a benefit rather than the dominant justification (Judson and Maller, 2014; Winstanley *et al.,* 2010).

Instead of discouraging extensions or encouraging householders to question the long-term benefits of moving into large family homes, the other opportunity to reduce domestic energy demand is to highlight the benefits of downsizing. Downsizing is one of the most effective recommendations energy advisers can offer (Palm, 2010), especially to older people who require higher indoor temperatures and are less likely to invest in thermal retrofitting (Wilk and Wilhite, 1985). Householders in this thesis were reluctant to consider the idea of downsizing and could extensively justify their 'need' for a large family home (sections 4.2.3, 4.3.1, and 4.4.2). This attachment to a particular home is not unusual (e.g. comfort of familiarity, sections 4.2.9 and 5.2.9). People's willingness to move house declines drastically after the age of 45 and when

reaching retirement age householders generally feel attached to their home and do not want to leave (Satsangi *et al.,* 2015; Saunder, 1989; Winstanley *et al.,* 2010). In the Scottish context, Satsangi *et al*. (2015) similarly found that older householders often only move when they are forced to through injury, illness or the death of a partner. This attachment to the home is important in domestic energy research because it is part of why householders remain in homes that have (multiple) rooms that are no longer in daily use. Indeed, there is a considerable body of scholarship on residential mobility that may offer insights on how to engage with householder's housing decisions (for an overview see Winstanley *et al.,* 2010 for example). A reminder again that household management is much more complex than domestic energy research generally acknowledges (i.e. framing householders activities in terms of financial rationalisation or improving thermal comfort)(Head *et al.,* 2013).

Planning for children and being left with a large family home are factors influencing the peak household, but the peak is also related to guests: both for parties and short visits and in order to accommodate visitors overnight and for longer periods. In this thesis, participants commonly highlighted the expectation that accommodating guests required more space, with sixteen out of the twenty-one households stressing the importance of having a guest bedroom (section 4.3.1). Challenging the 'need' for a guest bedroom is a relatively novel recommendation in domestic energy research. Judson and Maller's (2014) study similarly questioned householders justifying extensions because of the 'need' to ensure that guests have a certain degree of privacy (e.g. 'need' for en-suite guest bedroom). A home that is made bigger for non-regular activities (e.g. dinner parties, guest bedroom), as opposed to daily use has implications for energy demand. Yet there is potential to meet these same functions without expanding the home. For instance, having dining areas and guest bedrooms do 'double-duty' (Susanka, 2001) where the everyday table can be extended or a guest bed can transform into a desk or couch. The point then is to design for a home that will be used every day, not one that accommodates the infrequent larger parties and visitors staying over, and the next sub-section explores why the quality rather than the quantity of space may be more important to home comfort.

5.3.1.3 Is bigger better? Comfort in quality over quantity?

As the two previous sections (5.4.1.1 and 5.4.1.2) indicated, participants in this thesis suggested that more space or a bigger home was the key to having together time and privacy (section 4.4.1). Yet exploring ways to create privacy in the home may be an area that has potential to reduce domestic energy demand.

Having some time or some space in the home to be alone does not necessarily require adding more space to the home. From the framework of home comfort, it is evident that there is much more opportunity to engage with creating a sense of control than what is afforded by more space.

Being able to decorate an area, choose the lighting and music, and choosing what to do all relate to personalisation and creating a space for oneself in the home. In this sense, having things 'your way' is much more about managing comfort and expectations as a household, which depends on communication as much as design.

High density living solutions (Richmond, 2012), such as the tiny house movement in the United States (Kahn, 2012) or the Japanese 'jatuka' micro homes (Pollock, 2015), are an underexplored phenomena in academic scholarship and potentially provide insight into space efficient designs. Thus, meeting expectations of privacy and personal space without 'needing' more space per person. In the United States, householders are choosing to downsize to 30 to 100m² size homes as a way to reduce resource consumption and improve affordability (Kahn, 2012). In Japan, the 'jatuka' micro homes are rarely larger than 50m² and have emerged as a way to increase urban density as opposed to adding further suburban sprawl (Richmond, 2012). Investigating how occupants of smaller houses design and manage their home comfort, as well as other cultures that live in less space per capita (Gao and Asami, 2011; Hashim *et al.,* 2006; Ozaki, 2002; Ozaki and Lewis, 2006), is likely to uncover creative solutions to create privacy and novel ways of accommodating the 'peak household'. Temporary bedrooms and socialising outside of the home are important in managing smaller homes in Japanese culture (Richmond, 2012). Furthermore, the focus on detail is a major feature of the tiny house movement because homes are typically designed to meet the particular 'needs' and preferences of the household (Anson, 2014). For instance, there is often a trade off between having a larger bathroom or more kitchen space. A person that takes pleasure in cooking is likely more willing to 'sacrifice' some luxuries in the bathroom (e.g. bathtub, storage) in order to enhance the kitchen (e.g. more counter space, storage or appliances). The home therefore reflects the interests and personality of the household, which relates to the attention to detail and has less to do with the size of a home. In relation to domestic energy research this draws attention to a new avenue for intervention and exploration: how to meet needs of privacy that do not play into the expectations of increasing space per person.

The themes of family and privacy offered several recommendations for future domestic energy research and advanced understanding of home comfort, being closely tied to companionship and control. The significance of family and privacy in the meanings and making of home then informed development of the meanings of home comfort (Figure 4.11), elevating companionship and control in the new conceptualisation of home comfort presented in section 5.4.

5.3.2 Home-as-ideal

Evidence of the home-as-ideal theme primarily related to householders in this thesis idealising historical features of their homes (section 4.4.2). Preserving traditions and past symbols of homeliness can have an impact on recommended changes to the house (e.g. prevent householders

investing in stoves because of a preference for open fires) or can be marketed on these grounds (e.g. heavy curtains for aesthetics, with energy saving as a secondary benefit). Greater attention to preservation of these idealised historical features may be useful in the UK context because upgrading an old housing stock is a major challenge for energy policy. The finding from this thesis that householders may at times hold onto these symbols of past homeliness (e.g. fireplaces and cornicing) is complimented by Sunikka-Blank and Galvin's (2016) study on thermal retrofitting. Every household in their study at some point made a decision on thermal retrofitting that prioritised heritage symbols (e.g. facades, bay windows, lead light windows, cornicing, slate and lead roofing) over saving money, making their homes warmer, or reducing their environmental impact (Ibid, 2016). Even though cornices and slate roofs may not immediately appear to be symbols of homeliness, these features are preserved for their beauty, tradition or nostalgia (Sunikka-Blank and Galvin, 2016), connecting to the earlier contention that part of homemaking is to (re)create aspects of past homes (section 2.5.1). Discussion by householders in this thesis therefore supported Sunikka-Blank and Galvin's (2016) recommendation for the development of 'warm heritage' energy advisers who would offer householders an assessment that prioritises architectural characteristics, even if the energy savings are sub-optimal. This sort of advice is an example of a way to navigate the complexity of homemaking in practice, by recognising that aesthetic considerations influence thermal retrofitting. Furthermore, the existence of heritage conservation areas is evidence of this home-as-ideal theme at a broader cultural sale than the household presents an opportunity to better align heritage conservation with energy policy more generally as being in a conservation area was an issue householders referred to in terms of affordability of making changes (i.e. windows needing to maintain the character of the time period). A recommendation that relates back to considering how non-energy policies shape demand as Shove and Walker (2014) emphasised in their discussion of 'steering' practices.

The next section explores another key theme in homemaking and its connection to home comfort: the hearth.

5.3.3 Hearth

The hearth theme is useful for making sense of the dominance of thermal comfort because the home is expected to be a place of warmth and shelter (section 2.5.2). Nonetheless, the obduracy of the hearth supports the idea that thermal comfort is interwoven in other comforts, with the hearth also contributing to other aspects of home comfort such as aesthetics, smell or crackle of a fire (i.e. visual comfort, section 5.3.6; olfactory, section 5.2.12; auditory, section 5.3.8), a cosy atmosphere (i.e. relaxation, section 5.3.2 and mental health, section 5.2.7), and the feel of a radiant heat source (i.e. tactile comfort, section 5.3.5). Furthermore, the hearth is symbolic of the home being welcoming (i.e. contributory, section 5.2.10; companionship, section 5.2.3) and if it is what householders grew up with may be comforting for its familiarity (section 5.2.9). Thus, the

hearth theme contributes to advancing a critique of the focus on improving the efficiency of heating systems, financial rationalisation, and thermal comfort.

There was evidence of the obduracy of the hearth, while all the households in this thesis had some form of central heating, seventeen out of the twenty one also had a fire of some sort. This attachment to the hearth is not simply a legacy of an old housing stock, as the four new builds in the thesis interestingly all had radiant sources of heating as well. This matters to energy demand in relation to upgrading heating systems because households invest in stoves for the ambience, cosiness, and glow with thermal comfort or cost being secondary considerations (Devine-Wright *et al.*, 2014; Peterson, 2008; Pineau, 1982). Subsequently, householders balance aesthetics and functionality in their decisions to thermally retrofit (Sunikka-Blank and Galvin, 2016). Therefore, the development and marketing of new heating systems may benefit from greater consideration of the centrality of the fire in the home. For instance, some householders still prefer the feel of radiant heat (Devine-Wright *et al.,* 2014). Considering that more energy is required to heat the volume of a room than the surfaces of the same room (de Decker, 2015), it is arguably useful to draw attention to attachment to the hearth and the desirability of the 'feel' of radiant heat sources. Infrared heaters can be operated at lower air temperatures than convection heaters (e.g. radiators) whilst still providing the same levels of thermal satisfaction and require roughly a third less energy (Roth *et al.,* 2007; Sarbu and Sebarchievici, 2015). While infrared heating (i.e. a highly efficient electric heater that works by directly heating objects such as walls, couches, floors and a human body, rather than the air) is relatively uncommon, the two households in this thesis living with these heaters were complimentary of the benefits of being able to heat 'objects' and the 'feel' of this radiant heat source, instead of relying on convective heating.

The importance of the hearth should not be overlooked as it is strongly linked to ideals of home comfort and thus can hinder (e.g. prefer feel of radiant heat even if central heating more efficient) or help (e.g. wood can be renewable fuel source) strategies to save energy. The next section explores the final homemaking theme: gender.

5.3.4 Gender
In housing and home scholarship the expectation and experience of the home is accepted as being highly gendered (Flanders, 2015; Mallett, 2004; Perkins *et al.,* 2002; Valentine, 2001). Following this reasoning, gender impacts householder's experience and expectations of the home. If women are more responsible for managing domestic activities (Brickell, 2012; Flanders, 2015; Valentine, 2001) then their choices and activities are particularly important for understanding everyday practices in the home. For the most part discussion by participants of this thesis indicated that house work was generally shared: "you do other things, so I'm not complaining" (Nancy, 62, H21). Women were not necessarily tidier or cleaner than men:

Rob: I hate clutter

Mandy: And then he married me (Rob laughs) (44 & 47, H16)

But women were more likely to manage the decorating aspects of homemaking and were generally more interested in speaking about home comfort than the male participants in this thesis. This is somewhat similar to other studies which suggested that the cooking, cleaning, and childrearing aspects of domestic labour are still less common for men than women (Isaksson and Ellegard, 2015), but that the work of maintaining and fixing the home most often falls on men (Blunt and Dowling, 2006; Organo *et al.,* 2013). Certainly, male participants in this thesis dominated the part of the interviews related to energy saving and were more sceptical about the purpose of talking about comfort. The dominance of techno-economic thinking in domestic energy research and policy reinforces this focus on energy efficiency, technologies and making physical improvements to the house. However, the fact that women were more open to this sort of discussion may be a useful finding for future research because a practice-informed approach to investigating domestic energy demand emphasises the importance of understanding everyday routines and activities. Again this highlights the importance of a whole-household methodology because men and women may experience the home differently.

In particular, gender differences may be important in domestic energy research because women are the instigators of changes in household practices in their roles as homemakers and household managers (Organo *et al.,* 2013; Pink, 2004). In emphasising gendered differences the intention is not to reproduce stereotypes, but to emphasise that gender deserves greater attention in domestic energy scholarship.

5.3.5 Summary
To summarise, this section focused on clarifying the connections between the key themes in homemaking and developing the concept of home comfort (RO1). Recommendations for future domestic energy research and policy implications that arose in section 5.3 will be returned to in chapter 6, the conclusion.

As previously introduced (in section 2.5), family, privacy, the home-as-ideal, hearth, and gender are key themes in home-making literature and can help to organise and orient the twelve meanings of home comfort in relation to one another (Figure 5.1). The themes of family and privacy are given precedence in bringing together the twelve meanings of home comfort because 'family time' and being 'together' is an important aspect of home comfort (i.e. companionship) and the home is also expected to afford individual's some privacy or having 'a say' (i.e. a sense of control). Whereas, the other meanings of home comfort (e.g. thermal, tactile, visual, auditory,

physiological, odour and fresh air) and themes of homemaking (e.g. home-as-ideal, hearth, gender) did not match with one another.

With some direction from the home themes explored in this section, the next section presents a new further refined framework of home comfort (RO1) and explores the implications of home comfort to understanding domestic energy demand (RO2).

5.4 Why home comfort matters in domestic energy research

Supporting the research approach to investigate expectations of home comfort, this section returns to developing a concept of home comfort (RO1) by bringing together the meanings of home comfort (section 5.2) and themes important to homemaking (section 5.3). The section begins by returning to defining home comfort and presents Figure 5.1 to visually represent the findings of this thesis (section 5.4.1). Section 5.4.2 then offers an overview of the implications that this framing of home comfort has for the research of domestic energy demand and developing strategies to 'steer' practices in more sustainable directions. Section 5.4.3 provides an example of the importance of investigating home comfort as opposed to thermal comfort by exploring how energy efficiency improvements were tied to other moments in homemaking (i.e. extensions, moving home or building new). This section therefore addresses the objective of this thesis to demonstrate how the concept of home comfort informs understanding of domestic energy demand (RO2).

5.4.1 A new conceptual framework of home comfort

This section presents a new framework of home comfort, reorganising the visual representation of the meanings of home comfort from the results chapter (Figure 4.11) into a new Figure 5.1. As will be explained below, the home comforts of relaxation, mental wellbeing, companionship, contributory comfort, control and familiarity emerged as the most important meanings. Figure 5.1 visually presents the meanings and relationships of comfort from householder's descriptions. The thickness of the arrows represents the number of references participants made about the interconnections between these meanings of comfort and the arrow direction suggests direction of influence. The different shapes in Figure 5.1 distinguish the categorisation of these meanings of comfort, with a diamond for physical, star for physical-psychological, and circle for psychological.

The Oxford English Dictionary defined home comfort as "any of the comforts which make being in one's own home pleasant; a domestic amenity which contributes to physical ease and wellbeing" (OED, 2016b). This definition was a useful starting place (introduced in section 2.4) to make sense of the meanings of home comfort that emerged in this thesis (sections 4.2 and 5.2). For

example, indicating that home comfort was not just physical (i.e. thermal comfort). This definition is useful because 'physical ease and wellbeing' relates to householder's description of relaxation

Figure 5.1 Reorganising meanings of home comfort

Types of comfort- Physical ◇ Physical-psychological ⬡ Psychological ○
The size of arrows relates to how often participants referred to meanings influencing each other.
The arrow direction suggests direction of influence.
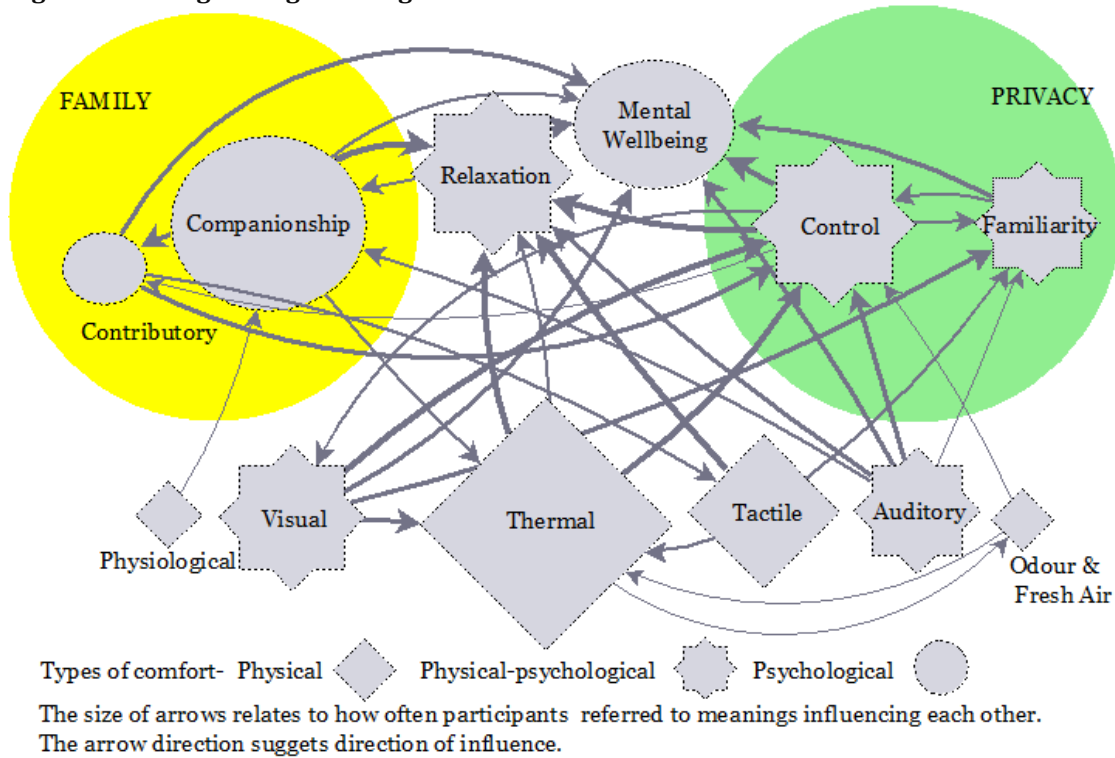
(sections 4.2.2 and 5.2.2), which then becomes the centre of the conceptualisation of home comfort presented in this section. Indeed, while the other meanings of home comfort were generally labels developed to categorise common themes that emerged in the analysis, 'relax' was a common term used by householders in this thesis. This decision is further supported by relaxation being the second most discussed meaning of home comfort after thermal comfort, represented in Figure 4.11 by being placed above all the other home comforts, besides thermal comfort. As explained previously (sections 5.3.1 and 5.3.5), companionship and control were raised above other meanings of home comfort and this reorganisation fits with relaxation as the centre of home comfort because relaxation comes from sharing the home with others and having personal space. Other meanings of comfort then are negotiated as part of this tension. For example, the benefit of socialising may be more important to comfort than a preferred temperature or being able to sit in your favourite spot and a householder may turn up the thermostat to make sure that their guests are warm (i.e. contributory comfort and companionship), even if they prefer a lower temperature normally (i.e. familiarity) or to use blankets (i.e. tactile). Furthermore, a householder not getting to listen to their preferred radio station or have the type of lighting they prefer may be a source of discomfort not simply because

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of its impact on their auditory comfort but because it undermines their sense of control. A key finding of this thesis then is that home comfort is relaxation and wellbeing, which results from companionship and sharing the home as well as having some control and being able to manage the home as desired (Figure 5.1).

Mental wellbeing, familiarity and contributory comforts were also raised in importance in the framework of home comfort because of their relationship with relaxation, control and companionship, respectively. Firstly, there is a clear connection between mental wellbeing and relaxation. The Oxford English Dictionary (2016b) definition mentioned 'physical ease and wellbeing' clearly indicating the centrality of mental wellbeing to relaxation. Moreover, participants in this thesis suggested mental wellbeing was more fundamental than physiological concerns (sections 4.2.7 and 5.2.7) and certainly an individual's state of mind can affect how they experience the home (Burris *et al.,* 2012). For example, if you are sad, being warm may not be your most pressing concern. Therefore mental wellbeing is presented alongside relaxation in the framework of home comfort (Figure 5.1).

Secondly, familiarity was also linked to the importance of privacy and control. Familiarity was explained by householders in this thesis in terms of the comfort of having their own things and routines, and this relates to the Oxford English Dictionary (2016b) definition of home comfort being about 'one's own home'. Just as a hotel or someone else's home might have all the amenities that one would want to be comfortable, neither has the same sense of homely comfort because personalisation is integral (Aune, 2007; Blunt and Dowling, 2006; Heijs and Stringer, 1987; Perkins *et al.,* 2002; Pineau, 1982; Susanka, 2001). Familiarity was an important part of home comfort related to, but distinct from, control because it is not simply about 'being able to do what you want' but also the comfort that comes from a sense of continuity, repetition and reliability. This sense of stability, or ontological security, is a fundamental feature of the home in housing literature (Giddens, 1991; Dupuis and Thorns, 1998; Saunders, 1989) and therefore it is fitting that familiarity takes a more central place in the framework of home comfort (Figure 5.1).

Finally, contributory comfort related to the theme of family and the home comfort of companionship. Contributory comfort was significant because it captures how the home is not simply about individual or personal comfort and can be used for a cause or to offer shelter to others. These uses of the home are integral to a broader understanding of home comfort because the home is generally expected to be a shared social space (Mallett, 2004). Contributing to something or someone else is important to distinguish from the comfort of companionship because part of this satisfaction comes from contributing to other's wellbeing. The importance of contributory comfort, and its connection to companionship, was thus also reflected in the framework of home comfort (Figure 5.1).

This reorganisation of Figure 4.11 presents some new insights, particularly on the relationship between meanings of home comfort. Relaxation and mental health have the most and largest arrows directed at them, reflecting their location at the centre of Figure 5.1. The meanings of home comfort related to family and privacy also appeared more clearly as hubs because relatively more arrows are directed towards these meanings (especially control). For example, having a room at the temperature you prefer is also satisfying because it means you are able to do things 'your way' in the home. Whereas, the six remaining meanings of home comfort (e.g. tactile visual, auditory, physiological comforts, and odour and fresh air) rarely have arrows directed at them. It is also notable that none of the six central meanings of home comfort are physical (e.g. relaxation, mental wellbeing, companionship, contributory, control, familiarity). While many of the physical meanings of home comfort were already identified in occupant satisfaction literature, these considerations nonetheless have the least number of arrows directed at them. Understanding comfort as physical *and* mental relaxation thus usefully identifies some new areas for investigation, such as considering social and material ways in which to ensure individual's privacy.

Reorienting the understanding of home comfort around relaxation, dependent on negotiating a desire for companionship and control, is a novel contribution to studies of the home and sustainability and to summarise, Figure 5.1 is useful for two main reasons. Firstly, even though thermal comfort was the most discussed meaning in this thesis and the focus of academic literature, in Figure 5.1 thermal comfort is important because of how it contributes to relaxation (e.g. being cosy in front of a fire), companionship (e.g. the home being welcoming for guests) and control (e.g. managing heating in your preferred way). Secondly, Figure 5.1 presents a broader conceptualisation of home comfort than previously considered in sustainable consumption or domestic energy scholarship, identifying eleven (i.e. not including thermal comfort) expectations of the home environment that may affect everyday activities and household management. In fact, very recently researchers writing in the context of fuel poverty and energy justice have also called for understanding of essential energy practices and quality of life to move beyond meeting basic needs related to thermal comfort (Simcock *et al.,* 2016; Walker *et al.,* 2016). Certainly, this understanding of home comfort as more than thermal comfort then highlights numerous avenues for future domestic energy research (returned to in sections 5.4.2 and 5.5).

The subsequent sections explore how defining home comfort as relaxation relates to understanding home energy. First by considering whether this understanding of home comfort is novel in practical energy interventions by analysing how home energy advisers understood comfort (5.4.2). Building on this, section 5.4.3 proposes that the understanding of comfort impacts strategies to steer energy demand. Therefore these sections address the objective of this

thesis to develop a concept of home comfort in order to inform future research and policy related to domestic energy demand (RO2).

5.4.2 Home energy advice and home comfort

This section contributes to exploring the implications of home comfort for future research and policy (RQ2d). Home energy advisers were interviewed to help understanding how domestic energy was approached in a practical and policy context.

The main aims of UK energy policy are to address the challenges of climate change, energy security, and affordability (DECC, 2016). Similarly, home energy advisers suggested their role to be not simply to reduce domestic energy demand, but to help tackle fuel poverty and climate change (section 4.5.1). This is an important distinction because strategies to engage with fuel poverty and climate change may differ. The former is an issue of equality and is often about ensuring a basic standard of living which likely requires an increase in domestic energy demand for fuel poor households (Walker *et al.,* 2016). Whereas efforts to intervene in the latter and reduce carbon emissions are more often targeted at households that consume the most energy (Gibson *et al.,* 2011b). Nonetheless, home energy advisers explained the strategy to meet both these goals as an intervention in design, technologies, and other physical aspects of the house. Issues of affordability and carbon emissions can both be met by technical improvements. For instance, it should cost a household less to heat their home with a newer, more efficient boiler and reducing carbon emissions can be achieved through decarbonising the energy supply as opposed to reducing demand. However, focusing on only physical elements has been critiqued for being reliant on unsophisticated understandings of the role of occupants and the way in which energy demand is created (section 2.3.1).

The home energy advisers saw themselves as filling an important role in providing education and information on how to live and use new technologies in the home, which was perceived to contribute to addressing the building performance gap (i.e. predicted energy savings are not met by technical improvements because householders are not using systems as 'intended'). This was a similar finding to a study with home energy advisers in Sweden (Palm, 2010), whose participants also emphasised the significance of their role in tailoring information and advice to the needs and circumstances of householders. Nevertheless, these sorts of recommendations remain focused on efficiency and technologies even though energy advisers frame their role in terms of education such as support on funding options (e.g. grants or loans for insulation and boilers, explaining schemes for microgeneration technologies), information about wasteful energy practices (e.g. overfilling the kettle or taking long showers), or to start with the 'fabric first' as opposed to microgeneration technologies.

Admittedly, some of the home energy advisers commented on a desire to make more radical recommendations or discuss particularly energy-demanding activities with householders (e.g. householder's expectation to be able to use a conservatory all year round or advising that older adults downsize), but this was felt to overstep their role. The Swedish home energy advisers also indicated that the focus on technology was a 'safe' topic (Palm, 2010) and they chose not to mention this sort of advice. Behaviour change was therefore framed as an issue of awareness that could be addressed through information provision. For the most part then the interviews with home energy advisers corroborated the characterisation of domestic energy policy in the academic scholarship as being underpinned by a psychological or economic framing of activity (Hargreaves *et al.,* 2010; Shove, 2010)(section 2.2).

Interestingly, comfort was emphasised as being 'a big thing' and by some as more significant than carbon or money saving, but had not been mentioned when home energy advisers were asked to describe their work. Comfort was invariably assumed to be thermal and was perceived to be especially relevant to home energy adviser's role in helping fuel poor households and ensuring that householders had a basic level of warmth. Interviewees were generally confused when pushed to consider other meanings of comfort beyond warmth and for the most part defended a narrow definition of comfort as only thermal comfort, for example, by referencing well-established health implications of living in cold conditions. There was some critique that certain householders heated their homes to unnecessarily high temperatures. Yet only one interviewee reflected on the way in which the introduction of new (more efficient) heating systems could be mismatched with expectations of thermal comfort and this is an observation that has also recently appeared in academic literature on upgrading heating systems in the UK (Devine-Wright *et al.,* 2014). Nevertheless, this may be an indication of comfort being an important way of engaging with energy policy and home advisers because comfort is already part of this discourse.

The framing of occupant satisfaction or comfort as thermal comfort has implications for how domestic energy demand is approached (Table 5.1) and indeed these align to a large extent with the home energy advisers descriptions of their role. The focus on thermal comfort results in three main approaches: (1) tighten the building fabric (e.g. upgrade insulation and glazing), (2) invest in efficiency and low-carbon heating systems (e.g. new boiler, heat pump), and (3) question the standardisation of the 'comfort zone' (e.g. adapting with temperature or the siesta). Home energy advisers in this thesis described all three of these strategies. This has led to a relatively limited set of recommendations that assume space heating and thermal comfort were householder's biggest consideration in household management (Table 5.1). Yet this thesis has demonstrated that home comfort and homemaking are much more complex and multifaceted than the desire to be sufficiently warm or cool. Home comfort is about a sense of relaxation and wellbeing, which results from the companionship of sharing the home and having some control to manage the

home as desired (section 5.4.1). Broadening out understandings of occupant satisfaction and home comfort to account for some of this complexity highlights new avenues for domestic energy research and strategies to reduce demand (Table 5.1).

Table 5.1 Understandings of home comfort influences strategies to reduce domestic energy demand

Home comfort as	Defined by	Affects energy demand by impacting	Resulting strategies to reduce domestic energy demand
Thermal comfort	Temperature (C)	Space heating	• Tighten building fabric (e.g. draught-proofing, upgrading glazing and insulation, Passivhaus standard) • Invest in efficiency and low-carbon heating systems • Question expectations of narrow temperature bands & highlight cultural and non-mechanical ways of coping (e.g. clothing, Siesta)
Relaxation	Companionship & Control	House size Household size (which impact space per person and thus indirectly space heating)	• Design for privacy & focus on multifunctional spaces and furniture (e.g. no formal dining room, murphy beds) • Question expectations of hospitality and meeting peak household as opposed to longer term needs (e.g. 'need' for guest room or extra bathroom) • Challenge expenditure on quantity over quality found in bigger homes

This is because defining home comfort in terms of companionship and control draws attention to house size and household size. These are partly dependent on householder's perception of the space per person 'needed' to facilitate comfortably sharing the home with others, or having 'enough' public space (i.e. for the comfort of companionship) and private space (i.e. to ensure some privacy and sense of control). Investigating and intervening in the trend towards increasing space per person has the potential to reduce energy demand for space heating without falling back into emphasising technical intervention or questioning the standardisation of thermal comfort. There is limited literature linking companionship and the family (Head *et al.,* 2013; Dowling and Power, 2012; Klocker *et al.,* 2012; Walker *et al.,* 2015) or a desire for privacy and personal space (Judson and Maller, 2014; Maller and Horne, 2011) to domestic energy demand. Nonetheless these writings combined with scholarship on the benefits of smaller homes (Richmond, 2012; Susanka, 2001) reveal some potential strategies: (1) making rooms for everyday use through multifunctional designs and furniture (e.g. no formal dining room, murphy beds), (2), questioning how demands for the 'peak household' are met (e.g. 'need' for an extra bathroom when children will be moving out in a few years or guests stay infrequently) and (3)

challenging that home comfort is improved by more space per person (e.g. personalisation) (Table 5.1). Further recommendations are likely to emerge from future investigation of the relationship between home comfort and domestic energy research, but importantly, these new lines of enquiry evidence the utility of studying meanings of home comfort and justify the methodological choice to investigate everyday aspects of home life.

With the implications of refocusing attention on to home comfort rather than comfort-as-thermal-comfort, the next section further analyses an empirical example from this thesis that links home comfort with understanding householder's explanation of their activities to reduce domestic energy.

5.4.3 Domestic energy and home improvement

Much energy policy is predicated on improving the energy efficiency of buildings and technologies, which is underpinned by the dominance of techno-economic research focused on design, technologies, and other physical aspects of domestic buildings (Sunikka-Blank and Galvin, 2016; Wilson *et al.,* 2015). The evidence from this thesis suggested that householders have adopted this mainstream policy framing by favouring energy-efficiency improvements rather than reflecting on lifestyle and everyday routines. Nearly every household in this thesis had made efforts to 'tighten' the building fabric through investing in insulation, new windows and draught-proofing or an upgraded heating system (section 4.2.1). This finding addresses RQ2a: householder's activities to reduce domestic energy demand are focused on material improvements. These householders represent an important group to study in domestic energy research because retrofitting existing homes is often identified to have the greatest potential to reduce carbon emissions from the housing stock (Sunikka-Blank and Galvin, 2016). Understanding the circumstances enabling householders to invest in energy retrofitting is an area deserving more attention and therefore is explored further in this section.

There needs to be some caution against narrowing investigation and intervention solely onto technical improvements. For example, half of the sample fell below, and half above, the national average for annual energy costs (section 3.4.2)[2]. This is a reminder that technical improvements do not necessarily result in an overall reduction of a household's energy demand. While technical improvements are undoubtedly important, social scientists have been critical that this mainstream approach overlooks social conventions that influence domestic energy demand (Ellsworth-Krebs *et al.,* 2015). This is because improvements in energy efficiency are intended to

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[2] While it was out of the scope of this thesis to measure participating household's actual energy consumption (e.g. complex with multi-fuel households: mains gas compared to electricity, oil, gas canisters, wood), energy costs can be used as a rough proxy. It may be expected (or hoped) that a sample of households that have all invested in energy efficiency improvements, microgeneration technologies, and/or live in newly built 'low-carbon' homes would consume less energy (e.g. be below the national average).

reduce energy demand by allowing householders to do 'more with less' which does not engage with what energy is used for (e.g. cleaning, cooking, relaxing)(Shove and Walker, 2014).

Investigating domestic energy from a relatively technical perspective overlooks the influence of more routine activities that reduce demand and ignores a more holistic picture of householder's decisions that influence investment in energy efficiency improvements. Fewer than half of the households in this thesis mentioned activities to conserve energy (e.g. use less) such as wearing more layers to reduce demand on space heating, turning off lights, or air-drying clothes instead of using a tumble dryer (section 4.2.1). The lack of discussion about these energy saving activities may indicate that households who have invested in technical energy improvements assume they are 'doing their bit' and have *carte blanche*. Harold (53, H5) gave a prime example of this explaining that they had made a "very conscious decision [to] install very energy efficient lights" because "it was just easier to accept [that his mother-in-law was] going to put a lot of lights on" (section 4.2.1). How to encourage these 'pro-environmental behaviours' and avoid 'rebound' has been the topic of a considerable body of social psychology informed research (Caird *et al.,* 2008; Druckman *et al.,* 2011; Jackson, 2005); however, contributing to this line of investigation is not the intention of the thesis. Instead this section explores another 'social' avenue of inquiry that affects domestic energy demand: making a house feel homely and improving home comfort.

The rest of this section answers RQ2b, exploring the extent to which actions to reduce domestic energy demand were linked to meanings of home comfort. This section is structured around the findings from section 4.4.2, which suggested that energy efficiency improvements were not isolated decisions but were in fact closely tied to key moments in the making of home. Moving house (section 4.4.2.1), adding an extension (section 4.4.2.2) and designing a new home (section 4.4.2.3) prompted investment in energy efficiency improvements, but are more related to homemaking and home comfort. Although the data collection was designed to illicit information on energy-saving activities, as opposed to home improvement more broadly, the importance of the connection with these other homemaking activities was a common theme in the results (section 4.4). As this section will discuss, a focus on energy saving technologies has generally overlooked how social expectations of the home affect uptake and investment in the physical house. The attention here to social considerations of home life is not to conclude that energy retrofit or improvements in efficiency are unimportant or ineffective to reducing overall demand, but rather that understanding investment in, and use of, energy saving technologies may be enhanced by incorporating these activities within a socio-material framing of home life.

The majority of research de-contextualises efficiency improvements from other on going processes of homemaking, and a few studies showed that householder's rationalisation for making home improvements depended on *when* during the process interviews and investigation

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occurs (e.g. before, during or after home improvement)(Wilson *et al.,* 2015). For instance, Wilson *et al.* (2015) found that financial incentives tended to be attractive to householders only once they had already committed to making a home improvement. Thus, understanding what leads to energy efficiency improvements may not simply be explained by financial rationalisation because the impetus for making a change is sparked by other considerations about home life.

The section explores how these key moments in the making of home may inform domestic energy research, thus contributing to RQ2d (implications for future research and policy).

5.4.3.1 Moving home

From analysis of householder's discussions of saving energy, moving into a new home was a key period for activity. There was a sense of urgency or priority to invest in insulation and upgrading windows 'first thing', and 'straight away' after moving in (section 4.4.2.1). The importance of moving homes being a key time in which energy improvements were undertaken is likely unsurprising, and yet it is challenging to find domestic energy research emphasising the potential of targeting advice and financial support at new homeowners. In fact, only two (relatively out dated) studies make a link between moving home and energy efficiency improvements (EST, 2010; Wilk and Wilhite, 1985). While the period after moving into a new home was a significant trigger for energy efficiency improvements, but it is important to acknowledge that saving energy was not the motivation to move home.

Similarly, Wilk and Wilhite (1985: 628) found that moving into a new home was an important trigger for many energy efficiency improvements because "at this time anything that can possibly be repaired is taken care of in an intense effort". In their study on why Californians weather-proofed their homes (e.g. draught-proofing, insulation, upgrading windows, upgrading heating system) the majority of changes occurred within the first few years of moving in. After this point, householders responded with a sense of embarrassment at the recommendation of further energy efficiency improvements because "the household must admit that what they had thought of as a complete, functioning, house had actually been in need of repair all along" (Wilk and Wilhite, 1985: 628). Wilk and Wilhite (1985) proposed that something either has to actually break or be classified as an improvement to initiate a repair activity after this initial phase.

Consequently, there may be opportunity to better align funding schemes for energy efficiency improvements in relation to buying a new house. Focusing on homeowners in this thesis and in designing energy efficiency schemes is justified because 65 per cent of UK homes are owner-occupied (DCLG, 2013) and other mechanisms exist for improving the energy performance of public and private landlords as well as new builds (e.g. minimum energy performance standards, building regulations). Targeting energy efficiency improvements at homeowners who have

recently moved homes is a relatively novel recommendation in studies of energy efficiency renovation. Moreover, as Wilk and Wilhite (1985) recommend, there may be greater potential to market weather-proofing after this period as a home improvement (e.g. something that will make the home better) rather than a repair (e.g. fixing something that is wrong or broken). Indeed, in this thesis even though moving in was the most discussed period for making changes (e.g. first two years), other energy-related improvements that occurred after this point were often triggered by other home improvements, such as an extension or remodelling (section 4.4.2.2). In many ways, this is unsurprising as home improvements are much more positive, interesting and constructive than many energy efficiency improvements (e.g. draught-proofing, upgrading windows, insulation)(Judson and Maller, 2014; Maller and Horne, 2011; Maller *et al.,* 2012).

This section highlighted that the timing of energy efficiency improvements may be linked to other aspects of home life. In particular, moving home was a key trigger for activity; and this may indicate that new homeowners are potentially good targets for energy saving schemes. The next two sub-sections focus on uncovering other moments that emerged from this thesis as triggers for energy-saving improvements: adding on (5.4.3.2) or building a new home (5.4.3.3).

5.4.3.2 Adding onto the home

The results indicated that building an extension was also a key moment that was linked with activity to invest in saving energy (section 4.4.2.2). For instance, while householders mentioned new boilers as part of what they had done to save energy, the impetus for upgrading boilers was not always on saving energy *per se* but as a necessary part of coping with additional space. Although extensions were connected with some energy saving improvements (e.g. new boiler or heating system, upgrading insulation or installing low-carbon technologies), these were initiated by everyday routines and home aspirations. Remodelling kitchens and living spaces or adding bedrooms, bathrooms and studies featured frequently in householder's rationale for making an extension and these reflect common understandings about socialising with friends and family (e.g. open-plan kitchen), ways of avoiding congestion and conflict in everyday routines, and to ensure privacy within the home (e.g. ensuring personal space through addition of guest bedrooms or studies). These are all considerations that relate to expectations of home and home comfort, but generally receive little attention in domestic energy research. Thus, understanding the meanings and timings of extensions may be useful in targeting advice and energy efficiency marketing at householders making extensions.

In fact, targeting advice at householders making extensions or tightening building regulations on extensions appears to be an untapped opportunity highlighted by householder's discussion in this thesis. Energy efficiency was mentioned more explicitly in relation to extensions only when there was a mistake and not as a main part of their planning process (section 4.4.2.2). For instance,

Harold (H5) and Rachel (H14) were the most outspoken about improving the building fabric of their extensions. This was not because energy saving or insulation had been a significant consideration in their initial decisions but because they were disappointed by the effect of their attic conversion and conservatory being poorly insulated, respectively. For example, Rachel wanted to be able to use her conservatory throughout the winter. In the UK, the expectation that conservatories can be used year round has already been identified by DECC (2013) as a key factor increasing demands for space heating. Conservatories were not initially designed to be used or heated year round, and there is an opportunity to engage with these changing expectations during the planning of an extension. In Rachel's home the conservatory had their dining table, making it an important space for the family to spend time together and the table was multifunctional, fulfilling her need for an office space. In this case, a sunroom would likely have been more appropriate to meet the 'needs' of adding space onto the home. The finding that extensions may be an important period to target in energy advice or building regulations (section 4.4.2.2) points to the potential to encourage householders to reflect further on their expectations of home and home comfort rather than focusing on how to meet these expectations most efficiently.

Expectations of house size and space per person are inherent considerations in decisions to add onto the home. Yet focusing simply on the size of a house overlooks the topic of quality and other expectations householders may have for their homes (e.g. functionality, aesthetics, acoustics, cosiness). Indeed, Andrew and Emma's (H4) kitchen and guest bedroom extension is an example of more homely considerations outweighing intentions to save energy (section 4.4.2.2). Their extension was meant to be very energy efficient but the architect maintained that they could not afford it, even though she was able to build an extension that was bigger than they had requested. In fact home improvements are predominantly intended to improve 'amenity' features (e.g. kitchens, bathrooms, living areas) in response to daily routines and those expected in the future (Judson and Maller, 2014). Householders invest billions of pounds in home improvements annually (EST, 2010) and the DCLG (2012) reports that 43 per cent of the UK's housing stock has had at least one major alteration since being built. Nonetheless, the majority of research on domestic energy investigates the process of, and householder's motivation for, energy efficiency improvements in isolation from these other home improvements (Wilson *et al.,* 2015).

The finding that a trigger for energy efficiency is adding an extension (section 4.4.2.2) compliments the limited number of studies that have adopted a sociological or practice framework to analyse energy efficiency improvements (Aune, 2007; Judson *et al.,* 2014; Maller and Horne, 2011; Maller *et al.,* 2012; Wilk and Wilhite, 1985; Wilson *et al.,* 2015). These authors also argued that energy demand is bound up in the process of making a home. In this thesis half the households that moved into existing homes added extensions and other authors who interviewed householders on their experience of making energy efficiency improvements found

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that for the most part these activities also increased floor size and the number of rooms (Judson and Maller, 2014; Maller and Horne, 2011; Maller *et al.,* 2012). This common finding that householders are increasing the size of their homes is not unusual considering that extensions are the most commonly carried out alteration in UK homes (29 per cent of the UK housing stock) (DCLG, 2012); however, these material changes are (often) contrary to the intention to improve the energy performance of the home.

Highlighting that energy efficiency improvements are linked to or prompted by other home improvements (section 4.2.2) importantly critiques mainstream techno-economic thinking. As previously discussed, the majority of research on energy efficiency improvements focused on householder's financial rationalisation for saving energy (e.g. upfront costs, savings over time, payback periods, interest rates, repayment mechanisms, value for money). The limited uptake of cost-effective, but less visible, energy efficiency improvements (e.g. draught-proofing, insulation, upgrading windows)(Caird *et al.,* 2008) has been partly attributed to the idea of conspicuous consumption, which proposes that householders are more likely to invest in wood-burning stoves or PV panels, even if these are more costly or have a longer payback period, because their visibility enables them to be symbols of status (Hards, 2013; Wilk and Wilhite, 1985). This is less often extended to argue that investing in home improvements, such as a new kitchen or more space, may be even more attractive as a form of conspicuous consumption than draught-proofing or a wood-burning stove for instance. Moreover, for some these 'amenity' home improvements are integral to the process of homemaking and a sense of homeliness and home comfort (Aune, 2007).

Besides moving and adding on to the home, some householders in this thesis identified designing and building a new home as a key moment to consider and incorporate energy saving features into the house. The next section therefore explores how energy saving was part of designing or choosing to live in a new home.

5.4.3.3 Building a new home

Building a new home was another key moment identified by householder's discussion of saving energy (section 4.4.2.3). Half of the newly built homes in this thesis were eco-builds and these householders explained that designing an eco-build was their major activity to save energy. These householder's understanding of eco-builds varied and each approached energy saving in different ways: downsizing to a 'tiny' house, increasing efficiency by building to a Passivhaus standard or installing numerous microgeneration technologies.

Placing energy saving as a central part of choosing and designing a home is arguably uncommon. For instance, generally low-carbon housing developments downplay the outward distinctiveness of energy efficiency features (Lovell, 2004; Walker *et al.,* 2015). Interviews of architects, local authorities, builders, developers, and consultants as well as analysis of publications from the Zero Carbon Hub (i.e. non-profit organisation set up to deliver zero-carbon housing target) by Walker *et al.* (2015) found that there was commonly an active rejection of the distinctiveness of new housing developments being low carbon and instead the intention was to highlight how these were 'normal'. For instance, there was a general notion that "a zero carbon home doesn't have to scream zero carbon. It's in there, [but] it looks like just any other house" because "they buy a home not a cause – a life for my family versus an ecological statement" (Walker *et al.,* 2015: 498).

Reducing the visibility of these technical energy saving improvements is a point of critique made by some researchers on the effectiveness of zero or low carbon homes because this reproduces 'normal' expectations of everyday life that may need to be challenged in order to achieve more ambitious carbon targets and visions of sustainability (Lovell, 2004, 2007; Walker *et al.,* 2015). Specifically, Lovell (2004) cautioned that there is a lack of evidence that mainstreaming technical improvements from bottom up radical social movements (e.g. eco-villages) would reduce energy demand without the shared values or social conventions of these communities. This concern connects generally to the argument for a socio-material approach to understanding domestic energy demand (Shove, 2003, 2010) and serves as a further reminder that choosing and making a home is about more than saving energy or environmental concern (Blunt and Dowling, 2006; Winstanley *et al.,* 2010). Thus, even if householders intentionally choose a home for being low-carbon or based on its Energy Performance Certificate, other desirable features of their ideal home may counteract the goal of saving energy, for example the desire for a large family house or picturesque stone cottage.

This is why understanding the making of home and expectations of home comfort are significant in domestic energy research because these considerations affect everyday life and ultimately shape demand much more than householder's intentions to save energy. For instance, in this thesis there was an overall emphasis on house size in choosing a newly built home, without reflecting extensively on how this impacted energy demand. In the quotes about building new homes (section 4.4.2.3), Stacy (H12) and Michael (H3) commented that architects generally attempted to give householders as much space as they could possibly afford: 'you tell me how much money that you've got and I will tell you how many square feet'. House size was an integral consideration in the making of home and home comfort in order to ensure that everyone had personal space 'to retreat to' (section 4.4.2.3). Furthermore, all but one of the households in new builds lived in relatively large houses with more bedrooms than occupants. Yet there was no

acknowledgement of the contradiction this expectation for a large family home may have with the intention to save energy.

While some householders in this thesis identified saving energy as a priority in choosing or designing a newly built home, there was clearly much more that goes into this decision. Thus, designing a new home was another example of a key moment in the making of home that may be connected with thoughts about energy efficiency but are not simply initiated by an intention to save energy. Indeed, householders in the new builds generally emphasised the importance of having large, family homes (section 4.4.2.3), which is (somewhat of) a contradiction if the main intention is to save energy.

5.4.4 Summary

Understanding householder's expectations of and aspirations for their homes or home comfort is essential to explaining and intervening in domestic energy demand. Moving house was a key trigger for energy efficiency improvements, this may point to an opportunity to target funding schemes and support at new homeowners. Considering that 65 per cent of the UK are owner-occupiers and that this is a difficult group to influence, this may be a useful finding. Adding onto the home was also an activity that was linked to investment in energy efficiency improvements. This may be another period or group that can be targeted because these home renovations actually increase the size of homes which generally increases energy demand for space heating. Furthermore, this may be an important time in which to discuss with householders their long-term goals and home comfort 'needs'. For example, exploring how to engage with norms and expectations around guest bedrooms may be an interesting area for future research. For some of the householders taking part in this thesis, building a new home was also a key period identified as the main activity to save energy. Similar to investment in energy efficiency being tied to adding onto the home, many of these newly built homes were bigger than average and this was not seen as a contradiction with the intention to save energy. Interestingly, even though these householders emphasised the energy-saving features of their homes (e.g. microgeneration technologies, Passivhaus), in more mainstream and larger scale 'low-carbon' housing developments generally downplay these features (Walker *et al.,* 2015). Yet there are many assumptions in housing developments about the features of a 'normal' home, even though there is very little discussion of home comfort and these 'normal' expectations.

The next section reflects on the utility of the methodology of this thesis, stressing the significance of adopting a practice and 'home' approach to domestic energy research.

5.5 Reflecting on methods to study domestic energy

The preceding sections indicated that being too focused on energy saving activities without placing them in the context of the home can result in other important factors being overlooked (e.g. moving home, ensuring household members have personal or 'enough' space). Specifically, more general choices about home management and what people want from their homes (i.e. motivation for home improvements or expectations of home comfort) offer insight into the timing of energy efficiency improvements (e.g. when moving homes, designing new or adding an extension).

As explained in chapters two and three, the methodological approach of this thesis aimed to contribute to the 'practice turn' in sustainable consumption scholarship (Shove, 2010). Exploring how everyday activities and social conventions evolve in the home was intended to offer new insights and avenues for intervention that have been overlooked in conventional economic and social-psychological investigation focused on what motivates householders to save energy. Yet despite an increasing body of scholarship informed by social practice theory, there has arguably been little written on appropriate methods (Greene and Westerhoff, 2014; Gram-Hanssen, 2015). This section therefore reflects on the impact of moving away from speaking to householders about energy saving to talking about more everyday concerns. Thereby giving attention to how social norms affect, and are affected by, the materiality of the home. This thesis therefore developed and suggested ways to improve the use of whole-household interviews, drawing activities and house tours to study domestic energy demand. Subsequently, reflection on the expert interviews is not included because the interest is to contribute to debates on how to study everyday practices.

The section takes each method of this thesis in turn, reflecting on how the data collection affected the findings and offering some recommendations for future use of these methods. The section concludes by also reflecting on the strengths and limitations of the recruitment strategy and resulting sample of households.

5.5.1 Implications of doing whole-household interviews

The use of whole-household interviews was significant to the findings of this thesis because this method emphasised the (dis)comforts of the shared reality of domestic life. Having a joint interview often resulted in householders within the same household expressing different preferences which drew attention to debates and conflicts over household management. Therefore, if the data collection for this thesis had involved only one household member discussing meanings of comfort and energy saving, the significance of companionship and control may have been less prominent. Certainly, the findings revealed how householders interacted with one another and together enabled joint discussion of their concerns, rather than interviewing

members of the household alone, the researcher therefore heard 'their story' (Bjornholt and Farstad, 2014; Eggenberger *et al.,* 2007; Taylor and Vocht, 2011; Winstanley *et al.,* 2010).

Considering that the conceptualisation of home comfort (Figures 5.1 and 5.2) is in many ways based on the importance of companionship and control, choosing to do whole-household interviews over one-to-one interviews was certainly significant. Conducting whole-household interviews provided an opportunity to understand the collective perspective of the household, including insight into the dynamics between householders that would be harder to identify in one-to-one interviews. While some other domestic energy studies have used whole-household interviews (e.g. Chetty *et al.,* 2008; Head *et al.,* 2013; Hitchings *et al.,* 2015b; Wilhite *et al.,* 1996) with interesting results, methods on how to study the complexity of home life are rarely written about in academic scholarship and this method deserves more attention as a tool for investigating the shared reality of home life and understanding factors that shape domestic energy demand.

5.5.2 Contribution to the findings from the ideal drawing activity

A drawing activity may be another useful method to study practices and the researcher is not aware of any other practice-informed studies using drawings to speak about the materiality of the home. Drawings were introduced in this thesis as a way to bring together social and material aspects of home life because householders had to consider the objects and design of a room as well as explain the significance of these features. Like the whole-household interviews, the ideal drawings corroborated the importance of companionship and control. For example, the majority of adult participants drew shared living spaces, highlighting the importance of shared space within the home. Whereas all the children that took part in this thesis drew their bedrooms, emphasising the desire to have personal space, control and a place of one's own in the home. It was also helpful to observe the similarities between participant's ideal drawings and features of their actual home as these often aligned with or confirmed aspects of importance to home comfort. Furthermore, the drawings allowed individual members of the household to distinguish what was important to them in a room. For instance, in one interview the wife and husband both drew their living room (H1); but the wife included decorations such as paintings, rugs and lamps and the husband had not considered these features. Arguably then this drawing activity made a useful contribution to understandings of home comfort.

Admittedly, there has been some critique of analysing drawings (Backett-Milburn and McKie, 1999), yet this is part of a much broader concern in that there needs to be greater methodological reflection and development of visual analysis in qualitative research (Dowling *et al.,* 2016). Subsequently, analysis is an area that should be considered further in future use of this method.

5.5.3 Exploring the utility of house tours and photography in domestic energy research

The house tour was an important part of the data collection because it allowed the researcher to observe the materiality of the home. Having the interviews take place in the home influenced householder's responses in several ways. Firstly, many of the ideal drawings were of the room that the interview took place in, or were similar to a room observed during the house tour. Thus, the inclusion of certain features of a room may have been different if interviews had taken place in a coffee shop, for example. Secondly, householder's explanation of the use of each room were enhanced by walking through the home; whereas, a description of everyday activities without objects and features of the home to prompt memories and stories would likely result in different answers. Finally, the house tour meant that there was a common frame of reference between the interviewer and participants, which arguably helped participants explain their everyday life and aspects of the home that were important to them. The interviews taking place in the house meant that a participant could literally show the researcher what they were talking about. These observations are in line with other studies on walking tours, which emphasised that walking prompts participants to connect with the surroundings (Carpiano, 2007; Evans and Jones, 2011; Klocker *et al.,* 2012; DeLeon and Cohen, 2005; Pink, 2007).

Furthermore, house tours and having the interview in the home was a useful way to observe the materiality of the home without being as intrusive or time-demanding as a full ethnography (Ho, 2015). However, the whole household was not consistently involved in the house tour. In some cases, one member elected themselves to be the guide or a couple did the whole tour together or a child showed the researcher around their bedroom. On reflection, the house tours were much richer if the whole-household (or at least all the adults) was involved because walking around the home often sparked debates and continued examples of how household management was a process of negotiation and compromise. Furthermore, certain rooms were used more by particular members of the home (e.g. bedrooms, offices, even the kitchen) and these individuals therefore had more to say. Hence, if only one household member gave the tour, some of these details were lost. Thus, it would be recommended in the future that researchers make the house tour explicitly a whole-household activity. Although, this may not always be easy to do in practice, as in the case of this thesis, asking participants to choose whether to participate in the house tour was to avoid participant' fatigue.

The house tours were audio-recorded and (to an extent) photographed. This followed other practice-informed domestic energy studies, which have effectively used photographs to demonstrate material elements of everyday practices (Dowling and Power, 2012; Klocker *et al.,* 2012). Whilst some of the photographs taken are included in the results (chapter four), the use of photography in the home is a point deserving much more methodological reflection (Dowling *et al.,* 2016). Consent had been received to take photos, yet the home is such a private and personal

space there was nonetheless some discomfort by the researcher to take an extensive number of photographs. In fact because participants were recruited on the grounds of their energy saving activities, there was almost an unspoken assumption that the points of interest for photography would be boilers or meters, not kitchens or living rooms. Therefore, even when some participants were insistent that anything could be photographed, photos were confined to the outside of the house and more public living spaces (e.g. kitchens, living rooms, and offices but not bedrooms or bathrooms). Indeed, a few participants chose not to show off bedrooms at all, with one or two commenting on embarrassment related to clutter or mess.

Critical reflection on the use of photography in the home as a method for data collection is limited (see Pink's (2004) for one of the only detailed methodological discussions of visual ethnographic research in the home). For instance, it can be difficult to capture the size or character of an entire room in a photograph and this is an area deserving of reflection and recommendations for best practice. Practicing different techniques (e.g. taking photographs in corners and from different heights, or using a panorama) and coming up with a procedure for taking photos before going to participant's homes would be highly recommended. However, there is still likely to be a trade-off during the house tour between taking the time to set up and take the 'best' photos or focusing on the content of discussion and moving dialogue along. On reflection, more photos should have been taken because these can represent places and materialities to the reader in a different way than quotes and written descriptions do (Pink, 2007).

House tours are therefore an important method for investigating domestic energy demand because they prompt reflection on home life by participants and allow the researcher to observe without being overly intrusive.

Whole-households, drawing activities and house tours thus offer insight into studying practices and home life and deserve more attention in domestic energy research. This section concludes with a reflection on the recruitment strategy and sample.

5.5.4 Recruitment strategy and sample

To address the research aim of this thesis, to develop a concept of home comfort to inform understanding of debates and policy related to domestic energy demand, the data collection targeted households that had made efforts to save energy. The decision to target this group was made for a number of reasons. Firstly, owner-occupiers were identified as an important group to investigate in domestic energy research. Owner-occupiers account for over half of the housing stock in the UK (ONS, 2013), are more difficult to regulate than housing associations or the private rented sector, and generally consume more energy (Williams, 2007). Secondly, there was interest in being able to consider how living in homes with energy efficiency improvements

and/or microgeneration technologies would affect everyday routines and householder's expectations of comfort. For instance, the households living with mechanical heat recovery ventilation remarked on having a higher expectation of air quality and freshness in the home. Finally, there were practical considerations, such as being aided in recruitment by local organisations that offered home energy advice and an assumption that these 'energy conscious' households would be more willing to take part in interviews.

Recruiting households that had made efforts to save energy ensured that these activities could be discussed (RQ2a), yet it also meant that some participants wanted to talk only about energy and did not want to discuss topics that they thought were unrelated. For instance, as noted in the section on gender, women were generally less engaged with the parts of the interview related to energy and were keener to discuss home comfort, do ideal drawings and think about future home improvements. On reflection, since this thesis was most interested in understandings of home comfort, it may have been better to develop a recruitment strategy that is not related to householder's intentions to save energy. Nonetheless, working with local organisations and householders knowledgeable about domestic energy was invaluable for understanding the challenges of reducing domestic energy demand specific to Scotland and developing a broader picture of the energy system.

5.6 Summary

This chapter discussed the contribution of this study to knowledge in two key areas: developing a new conceptual framework of home comfort (RO1); and, exploring how home comfort informs understanding of domestic energy demand (RO2).

The first section developing the concept of home comfort began by comparing the twelve meanings identified by householders in this thesis with literature on comfort and occupant satisfaction. From this comparison, control, companionship, relaxation, mental health and familiarity emerged as meanings of home comfort deserving more attention because these were areas of importance and overlap in the wider literature. To explore the interrelationships between these co-existing meanings, section 5.3 then related themes of homemaking to participant's discussions of home comfort. In doing so, attention was again drawn to the significance of companionship and control because these are similar to the themes of family and privacy, respectively. Section 5.4 defined home comfort as mental and physical relaxation and presented a conceptualisation of home comfort that brought together all twelve meanings that emerged from householder's discussion (Figures 5.1 and 5.2). A key finding of this thesis being that home comfort is a sense of relaxation and wellbeing, which results from the companionship of sharing the home and having some control to manage the home as desired.

This thesis therefore demonstrated that expectations of home comfort are much broader than thermal comfort and offered a framework to advance investigation of occupant satisfaction and what a home is for. Twelve co-existing meanings of home comfort emerged from analysis of participants' discussion: thermal comfort, relaxation, companionship, control, tactile comfort, visual comfort, mental wellbeing, auditory comfort, familiarity, contributory comfort, physiological comfort, and odour and fresh air (organised most to least discussed). Although thermal comfort was important and the most commonly discussed meaning, the data evidenced that home comfort had many inter-related, co-existing meanings: both physical and psychological. Indeed, the significance of relaxation, control, and companionship emerged as these were the next most discussed by participants in this thesis and are areas of importance in home scholarship. Subsequently, this thesis questions the narrow understanding of comfort-as-thermal-comfort that has been a rallying concept in practice-informed studies of energy demand. Following this line of reasoning leads to the recommendation to challenge domestic energy researchers to look beyond explaining energy demand from space heating being due to changing conventions around managing thermal comfort and expectations of indoor temperatures.

Recommendations for how studying home comfort informs understanding of domestic energy research were presented throughout the chapter but were consolidated in section 5.4. Understanding home comfort as being about relaxation, companionship and control moves away from the mainstream approach of tightening the building fabric and investing in efficiency and microgeneration technologies. Social scientists critiquing the standardisation of thermal comfort appears limited next to the potential of engaging with trends that affect space per person and thus have an even greater impact on space heating than increasing indoor temperatures, for example. Rather this opens up much broader investigation into understanding domestic energy demand as the result of changing house and household sizes. Refocusing on the expectation that homes afford occupants space for companionship as well as privacy opens up opportunities to engage with social conventions around how these are met.

Section 5.4 also connected what householder's did to save energy with the importance of home comfort. According to householder's description of their energy-saving activities, energy-efficiency improvements were often linked to first moving into a new home, when designing and building a new home, or when adding an extension. This finding indicated that investing in energy efficiency may often occur as a benefit, rather than a cause, of other home improvements. Not only does this importantly point to a policy opportunity to bundle efficiency measures to other types of home improvements, it also points to the need for more investigation into the meanings of home comfort in domestic energy research.

This thesis therefore supported the utility of adopting a practice-informed approach to investigating sustainable consumption because these sorts of recommendations have been overlooked in behavioural and economic studies. Consequently, the chapter concluded (section 5.5) with a reflection on developing appropriate research methods.

6: Conclusion: Implications of home-ing in on domestic energy research

6.1 Introduction

Realising the ambitious commitments of the 2015 Paris Climate Conference will require new ways of meeting human needs and lifestyle expectations. Technological development will be critical, but so will broader engagement with 'normal' forms of living and working. Considering that many familiar ways of life and patterns of consumption associated with them, particularly for the world's richest citizens, are fundamentally unsustainable (Shove and Walker, 2014; Walker *et al.,* 2016), it is essential to put the relationship between energy use and expectations of everyday life under the spotlight. The development of a new framework of home comfort in this thesis provides some context in which to further engage with questions about what is essential and desirable for a basic quality of life.

Rather than relying on behaviour change strategies that are framed around individualistic and rationalistic understandings of human action, an appreciation that individual activities are inseparable from broader social processes has led to an explicit interest in the ordinary (Hargreaves *et al.,* 2010; Ho, 2015; Shove, 2010; Shove and Walker, 2014)(section 2.2). Subsequently, householders in Scotland, UK were interviewed about the meaning of home comfort (RO1) and this thesis offered some implications for understanding and 'steering' domestic energy demand that arose from speaking about home life (RO2). Home energy advisers were also interviewed to corroborate the meaning of comfort in current energy discourses, highlighting the novelty of this thesis' aim to broaden understanding of home comfort and connect it to domestic energy demand. This investigation makes a useful contribution to debates on theory, methodologies and policy interventions in the fields of domestic energy and sustainable consumption and this chapter is structured around illustrating these contributions.

6.2 Key findings: addressing the research aim and objectives

The aim of this thesis was to develop a concept of home comfort to inform understanding, debates and policy related to domestic energy demand. The following sub-sections consider each research objective.

6.2.1 RO1: connect meanings of home and comfort into a new concept of home comfort

The first step was to connect meanings of home and comfort into a new concept of home comfort (Figures 4.11 and 5.1). This involved reviewing literature on the meaning of comfort in sustainable consumption scholarship (RQ1a). This review, as well as interviews with home energy advisers, uncovered a narrow definition of comfort as only thermal comfort in home heating/cooling research, which is of relevance to energy and sustainable consumption

discourses more generally (sections 2.4 and 5.4). This is problematic because it assumes that thermal comfort is the only or one of the main concerns of householders and determinants of occupant satisfaction, which feeds into the techno-economic thinking that dominates energy policy. For example, it adds one more point to market energy efficiency: 'save money', 'save the environment', 'improve your warmth'. But this sort of intervention is still primarily designed and understood as an exercise in raising awareness and implicitly frames changes in the home to be the result of householders making rational and functional renovations (Sunikka-Blank and Galvin, 2016). Broader processes of homemaking are overlooked. Considering that UK householders invest billions of pounds annually in home improvements (EST, 2010), predominantly on 'amenity' features such as kitchens, bathrooms, and living areas, it is important to remember that changes to the home are made in response to daily routines and expectations of what a home is for. Following this line of reasoning, a broader conceptualisation of home comfort, beyond being sufficiently warm, has the potential to highlight alternative strategies to 'steer' domestic energy demand (Table 5.1).

The interviews with householders demonstrated that expectations of home comfort are indeed much broader than thermal comfort and their discussion contributed to developing a framework to advance investigation of occupant satisfaction. Twelve co-existing meanings of home comfort emerged from analysis: thermal comfort, relaxation, companionship, control, tactile comfort, visual comfort, mental wellbeing, auditory comfort, familiarity, contributory comfort, physiological comfort, and odour and fresh air (organised most to least discussed)(section 4.2). Thus, even though thermal comfort was significant and the most commonly discussed meaning, the data suggested that home comfort had many interrelated and co-existing components. Thermal comfort was interwoven with other expectations; being a part of relaxation (e.g. being cosy and warm in bed to watch a show), control (e.g. being able to have heating the way that you want), companionship and contributory comfort (e.g. ensuring guests are sufficiently comfortable and warm), and odour and fresh air (e.g. if a room is too hot it can feel stuffy). Furthermore, thermal comfort was affected by other home comforts. For example, itchy socks or wooden floors impacted householder's way of keeping their feet warm (i.e. tactile comforts). The aesthetic appeal of having an open fireplace or living in a stone cottage at times was also identified as being at odds with expectations of thermal comfort and living in a draught-free home (i.e. visual comfort).

Importantly, this thesis has demonstrated that thermal comfort is not the only expectation of the home, which is a significant finding because this is an assumption and starting point in the majority of domestic energy research. Engineers, building scientists, and social scientists alike are singularly focused on thermal comfort in studies of sustainable consumption and in developing strategies to reduce domestic energy demand (sections 2.3 and 2.4). Subsequently, this thesis

questions the narrow understanding of comfort that has also been a rallying concept in practice-informed studies of energy demand. Therefore, this finding challenges domestic energy researchers to look beyond explaining energy demand from space heating to be mainly the result of changing conventions around managing thermal comfort.

The objective to connect meanings of home and comfort into a new concept of home comfort then turned to exploring key themes in home and home-making literature (RQ1b). The subject of home constitutes a considerable body of interdisciplinary academic work with contributions from researchers in architecture, geography, sociology, social-psychology, anthropology, history, philosophy, law, and housing studies and this review revealed that this scholarship could be useful to contextualise everyday home life and explore the socio-material evolution of homes. Five key themes, the home-as-ideal, hearth, family, privacy, and gender, emerged as importantly impacting expectations and experiences of householders.

For the purpose of connecting home and comfort, the themes of family and privacy were particularly helpful because these related to the home comforts of companionship and control (RQ1c). The significance of family and privacy, alongside householder's discussion in this thesis, demonstrated that these two expectations could at times exist in opposition and had to be balanced. For example, whilst it was common to emphasise the importance of spending time as a family, it was also suggested that everyone needed a place 'to retreat' to and debates arose over sharing communal spaces. This was useful to inform the organisation of meanings of home comfort in relation to one another and other meanings of comfort then were negotiated as part of this tension. Following on from this, a key finding of this thesis was that home comfort is a sense of relaxation and wellbeing, which results from companionship and sharing the home as well as having some control to do what you want (RQ1d).

6.2.2 RO2: implications of home comfort to understanding domestic energy demand

With a new framework of home comfort developed, the second step was to explore the implications of home comfort to understanding domestic energy demand. This began with empirical investigation of what householders did to save energy in their homes, so that the extent to which these actions were connected with meanings of home comfort could be explored.

Householder's discussion of saving energy indicated a focus on technology and physical improvements to reduce demand (RQ2a)(section 4.4). It is however important that the sampling strategy of this thesis likely biased responses toward discussion of energy efficiency improvements and microgeneration technologies because households were recruited on the grounds they had done something to save energy. Nonetheless, interviews with home energy advisers similarly indicated strategies to intervene in domestic energy demand that targeted the

physical house, which may be because technology was perceived to be a 'safe' topic to consult on (Palm, 2010). Even so, it was interesting to discover that these energy improvements were triggered by and connected to key moments in homemaking: moving home, building a new home, and adding onto the home (section 4.4). Pointing to the need to be cautious of narrowing investigation and intervention solely onto technical improvements. While technical improvements are undoubtedly important, focusing only on 'barriers' to, and what motivates, investment in energy efficiency overlooks social conventions that influence domestic energy demand. Homemaking is important for domestic energy researchers because it emphasises that homes do not simply change as a result of householders making rational and functional renovations (Aune, 2007; Sunikka-Blank and Galvin, 2016). Therefore, actions to reduce domestic energy demand are tightly, if implicitly, linked to meanings of home comfort (RQ2b).

The notion of home comfort enhances understanding of domestic energy demand (RQ2c) because decisions to change the home are not solely motivated by the potential to save money, reduce one's environmental impact, or improve thermal comfort. Not only does this highlight a policy opportunity to bundle efficiency measures to other types of home improvements, it also points to the need for more investigation into expectations of home/home comfort to make sense of these homemaking practices. To set out more specific examples and the implications for future research and policy (RQ2d), the insights from homemaking themes (e.g. family and privacy, home-as-ideal, hearth, gender) are presented in turn.

The themes of family and privacy enhanced understanding of domestic energy demand in three ways. Firstly by highlighting concerns that have influenced the socio-material evolution of homes; for example, householders stressed the importance of spaces that enabled them to be together (i.e. appeal of open-plan kitchen) but also a 'need' for personal space (Flanders, 2015; Rybczynski, 1986). The importance of family and privacy is thus entangled in expectations of space per person, impacting house layout and size (Dowling and Power, 2012; Ozaki, 2002; Susanka, 2001). Space per person, house and household size are significant determinants of energy demand per person (Clune *et al.,* 2012; DECC, 2013; Williams, 2009; Wilson and Boehland, 2005).

Secondly, the importance of family and privacy are related to demand in space related to the 'peak household' because extra bedrooms and bathrooms are 'needed' for (future) children and guests (Judson and Maller, 2014; Susanka, 2001). Similar to strategies to level off peaks in transport through relaxing strict working hours, as opposed to focusing only on efficiency, there is potential to fruitfully engage with the 'peak household' in terms of social norms and conventions. For instance, some households in this thesis had taken on lodgers to use the extra bedrooms after their children moved out, which reduces the energy demand per person and is a reminder of past definitions of the family and household being much more fluid (Flanders, 2015). Speaking about

downsizing was considered out of the remit of home energy advice (Palm, 2010), but this may be an important discussion to start having (Susanka, 2001). Decisions about moving and where to live are about much more than energy costs, householders have put down roots and invested emotionally as well as financially (Satsangi *et al.,* 2015; Saunders, 1989), again emphasising that non-energy concerns and policies shape and reproduce how processes might be 'steered' to create less energy-intensive practices. The conceptualisation of energy policy covers a very small area of influence and 'steering' will have to be broader in order to intervene in the evolution of energy demand (Reardon *et al.,* 2016).

Finally, the themes of family and privacy offered a partial explanation for the assumption that bigger homes are more comfortable and this is another area deserving further investigation. For example, from the framework of home comfort, it is evident that there is much more opportunity to engage with creating a sense of control than what is afforded by more space. Personalisation and detail are arguably as significant to home comfort (Susanka, 2001) and having things 'your way' is also about managing comfort as a household, which depends on communication as much as design. Family and privacy therefore point to the utility of further research into how to meet privacy needs within the home without increasing space per person. This is again a potential for 'steering' that is not dependent on improving efficiency or encouraging environmental concern but engages with the socio-material evolution of homes and expectations of what a home is for.

The home-as-ideal theme was particularly useful for understanding domestic energy demand in relation to the broader trend and desire to preserve historical features of homes. Curtains and fireplaces may no longer be necessary with modern building designs and technologies (e.g. Passivhaus) but may still be preserved because of the extra sense of cosiness they provide (Flanders, 2015). This also impacts on energy retrofitting, which is a key policy objective because the majority of the housing stock has already been built (only 13 per cent of the UK housing stock was built after 1991 (DECC, 2013)). Yet householders have prioritised heritage symbols (bay windows, cornicing, slate and lead roofing, lead light windows, fireplaces) over saving money, making their homes warmer, or reducing their environmental impact (Sunikka-Blank and Galvin, 2016). This is again an illustration of the point that encouraging householders to invest in energy saving measures needs to stop ignoring processes of homemaking. For example, there may be potential to offer householders an assessment that prioritises architectural characteristics alongside energy advice, even if the proposed measures do not reduce energy use as much as possible (Ibid, 2016). Furthermore, the home-as-ideal theme is reflected in the establishment of conservation areas (Flanders, 2015) and householders located in these areas complain that these regulations make energy retrofitting much more costly. This may be another area in which strategies to reduce domestic energy demand could be better aligned with non-energy policies (Shove and Walker, 2014).

The significance and obduracy of the hearth was a further example that householders sometimes preserve symbols of homeliness and tradition even if they no longer are serving their original purpose (Flanders, 2015). Fires and stoves were included, even in newly built homes, just for the 'cheer' they brought to householders and there is clearly more to home comfort than temperature and heating if householders are willing to go to the extra effort of having fires in their home (e.g. chopping, stacking, drying wood, dealing with the disposal of ash). Part of this may be explained by a preference for the 'feel' of radiant heat (Devine-Wright *et al.,* 2014). Considering that more energy is required to heat the volume of a room as opposed to the surfaces of the same room (de Decker, 2015; Roth *et al.,* 2007; Sarbu and Sebarchievici, 2015), this may be a useful reminder that convective forms of space heating are not always necessary to meet expectations of thermal comfort.

Finally, gender was a major topic in home scholarship (Flanders, 2015; Mallett, 2004; Perkins *et al.,* 2002; Valentine, 2001) and one that was largely absent from domestic energy research (Head *et al.,* 2016; Organo *et al.,* 2013 Ryan, 2014). Women are generally still responsible for the majority of domestic labour (Blunt and Dowling, 2006; Isaksson and Ellegard, 2015; Organo *et al.,* 2013) and are often the instigators of change in household practices due to their roles as homemakers and household managers (Organo *et al.,* 2013; Pink, 2004). This may be deserving of more attention in designing interventions to reduce demand (e.g. women were less interested in maintaining and fixing the home than homemaking) as well as a methodological consideration in future research (e.g. women and men may have different experiences and knowledge about everyday energy-demanding practices).

In conclusion, the ultimate goal of practice-informed approaches is to understand the means by which demand for energy is reproduced and shaped and how these processes might be 'steered' so that societies are living in ways that require less energy (Hitchings *et al,* 2015a; Reardon *et al.,* 2016; Shove and Walker, 2014). As this discussion has suggested, this 'practice turn' has important practical implications and calls for the emergence of a new style of policy that is "both more modest than at present, harbouring no illusions of manageability, and at the same time more ambitious – recognising that policy interventions across the board have effect in shaping future ways of life" (Shove, 2010: 1283). The suggestions offered here are intended to contribute to this ongoing debate.

6.3 Methodological contributions and limitations

In addition to its theoretical and empirical contribution, this thesis has also employed an innovative methodology, and the lessons from this experience may be of value to debates around qualitative inquiry and the emerging field of social practice methodology (Hui and Schafer, 2016).

However despite having a thoroughly planned methodological process there were some elements that, in retrospect, could have been done differently (although it is unclear whether those elements would have changed the outcome of this study). The following paragraphs thus also offer a more critical reflection on the methodological process of this thesis.

Whole-household interviews have only been rarely used in housing and sustainability studies. In particular, this thesis evidenced that whole-household interviews can provide greater insight into management of the household and daily routines since these topics are influenced and interwoven with the activities of other householders. Furthermore, the use of whole-household interviews was significant to the findings of this thesis because this method emphasised the (dis)comforts of the shared reality of domestic life. In this way, whole-household interviews can contribute a vital complement to the broader interest of investigating collective conventions and practices. On reflection though, the benefits of interviewing householders also came with some challenges, especially around how to respond to arguments between participants. Talking about home comfort and energy saving are not particularly controversial topics, yet this still led to disagreements between couples (e.g. whether it used less energy to keep boiler on constantly at a low temperature or for short bursts to higher temperatures) as well as parents and children (e.g. the importance of having family meals), and some participants asked the interviewer to 'weigh in' on debates. In hindsight it seems unsurprising that these sorts of disputes are likely to arise in whole-household interviews as part of an insight into families shared experiences and varied roles within the household. This is a common topic in nursing and family studies (where the majority of relevant methodological writings on whole-household interviews sits)(Eggenberger and Nelms, 2007; Leshed and Hakansson, 2014; Watzlawish, 1966) and it should not be dismissed as part of the ethics of doing research on even the most mundane aspects of home life. Creating a safe space for discussion is a critical in doing any research and the whole-household interview is likely to require the interviewer to be sensitive and careful in facilitating these group discussions.

The use of a drawing activity of the built environment was also an innovation in practice-informed research. This method was useful for collecting data on the socio-materiality of everyday life because it required participants to consider physical features (i.e. materials), alongside explaining their activities (i.e. competencies) and the importance (i.e. meanings) of the two. . However, the thesis has also highlighted some challenges and issues to be considered when using drawings, including a concern about the limited development of visual analysis tools in qualitative research (Dowling *et al.,* 2016). Yet the ideal drawing activity complimented the whole-household method by acting as an icebreaker and allowing each individual an opportunity to present their own perspective. The drawings were particularly helpful as a way to involve children in discussion, previously mentioned as a benefit in other writings on whole-household interviews (Eggenberger and Nelms, 2007; Leshed and Hakansson, 2014), but it also highlighted

the difficulties of doing interviews with children because they were sent away or wanted to go after the drawing activity finished. This is an indication that discussion of comfort and energy saving were not being 'translated' into terms children understood or were interested in. For example, children did not understand the request to draw their 'ideal room' and parents rephrased this to 'best room' or 'imaginary room'. There is a whole body of writing on methodologies around involving children in research and this may be deserving of more attention in developing and deploying whole-household interviews and analysing drawing activities.

While house tours have been previously used in studies of domestic energy demand (e.g. post-occupancy evaluation) and practice-informed investigation of sustainable consumption, it is important to stress this further as a research method that brings together socio-material observations. A topic less often raised relates to the utility and analysis of photography within the home in order to understand everyday life, and this thesis has begun to highlight points topics useful to developing this method further (e.g. how to take photographs of rooms and navigate issues of privacy, having the house tour be a whole-household activity). But it is also significant to add some caution about undertaking research *in* the home. As already stressed in this thesis the home is much more than a physical house and is connected to emotions and cultural expectations as well as identity and researchers need to be respectful of this space, and its meanings for participants. For instance, in several interviews participants did not want to give a tour of bedrooms suggesting that these were private spaces within the home. This was not problematic for this study but bridging these private spaces within the home may require further effort in order to be observed (e.g. serial interviews to establish rapport). Furthermore, there was a tendency for householders to show off energy-saving technologies, whilst overlooking or downplaying other practices and features of the home that might be more energy demanding (e.g. new American style fridge-freezer, extensions requiring more space heating, house size). Interesting conversations may have arisen from drawing some attention to these other energy-saving opportunities during house tours, yet it was deemed insensitive and inappropriate in the context of respecting householder's generosity in welcoming and allowing observation of their homes. House tours, rather than interviews undertaken outside of the home, undoubtedly allow for different data collection that is likely important to an investigation into mundane, everyday practices, such as observing objects, layouts, and the infrastructure of homes that are often taken-for-granted and subsequently unlikely to be considered worth mention by householders.

Another point deserving some comment is the way in which these methods were used in combination. Data analysis was primarily focused on content analysis of transcripts, but the house tour and ideal drawing activity importantly acted as prompts for reflection on materiality, meanings and expectations of the home. Conversations that emerged around ideal rooms and the house tours feature as a major part of the results presented in this thesis and are recommended

as a suite of methods to investigate everyday home life. While only 21 homes were visited, the data collected from these sites was much richer and more diverse than would be gained from one method (for instance 21 interviews): 45 individuals commented on their understandings and experience of home comfort, photographs and drawings offered potential for visual analysis, and house tours allowed for the researcher to corroborate participant's descriptions of their homes in order to gain a sense of what was important to householders that may not have come out explicitly in interview questions.

While the 'practice turn' has led to a range of interesting and innovative theoretical and empirical contributions to sustainable consumption scholarship, discussion of methodology has been comparatively lacking (Browne, 2015; Foulds *et al.*, 2013; Greene and Westerhoff, 2015; Gram-Hanssen, 2015). Practice theorists argued that tacit knowledge and embodied experiences, which are not always dependent on conscious reflection, affect individual's performances of practices and understandings of situations (Hui and Schafer, 2016). This approach raises questions about *how* to study the socio-materiality of everyday practices or describe, explain and interpret social life for sustainable consumption research; and whole-household interviews, house tours and drawing activities can contribute to this growing interest in methodology.

6.4 Future research

This thesis suggests a number of directions for future research. The most important recommendation being the call for further exploration of expectations of home and a basic quality of life (Walker *et al.,* 2016). There is certainly a considerable body of scholarship on the home and housing that is currently an underused resource for domestic energy and home heating/cooling research. The focus on thermal comfort has arguably led to a narrow understanding of occupant satisfaction, ignoring everyday concerns of what a home is for. Even though there appears to be a hesitancy of intervening in 'normal' expectations of what a home should be (i.e. new 'low-carbon' housing downplaying energy saving features (Walker *et al.,* 2015) or energy advisers only advising on technology because it is a 'safe' topic (Palm, 2010)), interestingly there is little research on what these basic expectations of home comfort are. In particular, a practice-informed approach to understanding domestic energy demand would be to ask householders about their practices to relax, as opposed to their practices to manage warmth (Hards, 2013; Hitchings and Day, 2008; Hitchings *et al.,* 2015b). This also has the potential to provide insight into the use of ICTs, which has been a consistently increasing area of overall domestic energy demand (DECC, 2013). Another valuable area for further work concerns exploring privacy-making practices. Especially, how privacy and personal space is negotiated in smaller dwellings and different cultures, comparing the practices of householders living in tiny houses in the United States, 'jutaku' in Japan, and canal boats in the United Kingdom may be interesting cross-cultural case studies for instance.

Following on from this, a necessary limitation of this thesis is its focus on people engaged with saving energy; comparative work to assess the meaning of home comfort (and its links to domestic energy demand) amongst those who are less concerned about saving energy and in other countries and housing types would be a valuable endeavour. Whilst there is evidence of converging conventions and globalised standards of indoor environments, there is also still cultural and geographic variation of 'normal' home practices and what energy uses matter in everyday terms. Exploring and comparing expectations of home comfort may highlight less energy-intensive practices, beyond those related to thermal comfort, which could then become targets of 'steering' (space optimisation practices, for example). This sort of investigation could also inform understanding of, and householder's justification for, wanting more space per person or larger homes.

Another area warranting further research relates to exploring the potential to align (non-energy efficiency) home improvements and renovations with the aims of energy policy. Certainly, a practice-informed framing of 'steering' does not assume that householders are the only target of intervention (i.e. awareness raising, financial rationalisation). Instead, there may be considerable opportunity to engage with architects, designers, builders, and tradesmen on influencing the material arrangements and evolution of homes.

Finally, in the future, useful advances in methodological knowledge could be made through further testing of whole-household interviews, house tours, and drawing of the built environment in sustainability research. In particular this could address the question of whether data collected in joint interviews is different from that elicited by interviewing householders individually. Developing visual analysis methods is another important area that would be extremely helpful to the study of the socio-materiality of everyday life, and greater reflection on the use of photography is recommended.

6.5 Practice and policy implications

Whether practice informed research can and should result in policy recommendations is somewhat debated (Hards, 2011; Reardon *et al.,* 2016). The ability to intentionally direct practices is questioned in acknowledgment that social scientists and policy-makers are part of an evolving system. "End-user practices are not simply the result of exogenous policy prescriptions or individual agent acting on a system, but rather evolve endogenously over time along with changing social meanings, technologies, resources and competencies" (Reardon *et al.,* 2016: 1). While the relationship between research and policy is complex, practice theorists have critiqued the dominant theoretical models as limiting the effectiveness of interventions (Shove, 2010). Similarly, the findings of this thesis call into question the assumption that pro-environmental

values are a key determinant of lower impact lifestyles considering that the sample fell half below and half above the national average annual costs in the UK (£1130, Ofgem, 2013). This is despite recruiting households that had made efforts to save energy in their homes. Indeed, discussing home comfort with these same households drew attention to a tension between current visions of desirable home life and how saving energy is often thought about in particular terms. For example, the majority of participants did not consider the volume of domestic space in relation to saving energy even though this is a significant determinant of energy demand per person. For these reasons, this section aims to offer some reflections for policy and practice in the field of sustainability and domestic energy that (potentially) intervene in the elements of a practice as opposed to targeting the practitioner. Rather than trying to create a one-off attitude change, these recommendations aim to make 'normal' practices less energy-intensive (e.g. spread out peak through relaxing strict 9am to 5pm working hours)(Walker, 2014), without persuading individuals what they 'ought' to do. Furthermore, and in light of the main findings of this thesis, the recommendations relate to engaging with how space-heating demands are impacted by expectations of privacy and companionship.

This thesis can offer some recommendations as to how policy may 'steer' household energy practices, however, the small sample size means that these should be treated as cautious suggestions for further consideration. One key finding was that the timing of householder's investment in energy saving improvements was generally linked to moving house and making amenity improvements. This suggests that it might be beneficial to support (e.g. develop financial incentive schemes that target new homeowners), emphasise (e.g. introduce, certify or train 'heritage energy advisors' and/or remodelling specialists that are also knowledgeable about domestic energy demand) or regulate further (e.g. conservatories that are desired to be used all year round could pushed to be built as sunrooms) energy saving opportunities at these times. This sort of intervention is not focused on an individual's values or financial rationalisation, instead it is about recognising the other everyday concerns and expectations of home that saving energy is entangled with.

A further recommendation concerns government energy advice (e.g. EPC reports, Energy Saving Trust) not being practical enough to inform householder's renovations, nor engage with everyday expectations that may be leading practices to be more energy demanding. This presents an opportunity for policy to expand the role of energy advisors to discuss how energy efficiency improvements and microgeneration technologies fit with other desires householders will have when making material changes to their home – a recommendation made elsewhere in regard to energy-efficiency improvements (Gram-Hanssen, 2014) and preserving heritage features of homes (Judson *et al.,* 2014). Increasing expectations of space per person is an issue that has been largely neglected in home heating/cooling research and energy policy, yet is critical to energy

demand per person. Being able to discuss the benefits of downsizing or renting to lodgers are options to explore further. At a household scale, downsizing is likely a bigger way to reduce demand per person than upgrading a boiler or loft insulation, this sort of recommendation are unlikely to emerge from dominant lines of enquiry related to pro-environmental values or financial rationalisation of technical improvements. Indeed, home energy advisers (Palm, 2010) have reported a desire to give this sort of advice. Organisations already exist that "help boomers and seniors gain freedom [by] downsizing" (Upside of Downsizing, 2016) or publicise a room in their home to rent, such as SpareRoom and MondaytoFriday (Papworth, 2010). In fact, the UK Government already incentivises renting to lodgers through its 'Rent a Room' scheme that offers homeowners up to £7,500 per year tax-free income from letting rooms (UK Government, 2016). This is another example of how non-energy policies are important to consider.

In conclusion, the goal of practice-informed approaches is "to understand how the contours of what are taken to be "normal" ways of living evolve and then influencing this process so that future collectives simply find themselves adopting more sustainable practices" (Hitchings et al., 2015a). While this is a relatively recent area of scholarship, social practice theorists have already challenged policymakers to think differently about 'behaviour change' and the tentative recommendations offered in this thesis aim to contribute to this emerging discourse.

6.6 Concluding thoughts

Governments encourage us to save energy by turning off lights and taking shorter showers; better insulation and boiler upgrades; and installing renewable energy sources. However, this neglects the comforts we expect, which have implications for domestic energy demand. Considering that the 2015 Paris Climate Conference (COP21) marks a global agreement to address climate change, it is time that the changing expectations of home comfort came under the spotlight. It is insufficient to encourage citizens to assume greater personal responsibility for their lifestyles. Especially considering that individuals that identify as having pro-environmental values often still have a higher environmental impact (Gibson *et al.,* 2011a) and that the richest ten per cent of the population are responsible for half of the world's carbon emissions (OXFAM, 2015). Researching and encouraging environmental values is unlikely to address the escalation of increasingly energy demanding lifestyles. Despite several decades of behaviour change campaigns and improvements in efficiency these methods have failed to adequately reduce energy demand or carbon emissions; making the utility of studying the interaction between social and physical elements of the home increasingly apparent. Governments and academics need to pay much more attention to what people want from their homes, and this thesis offers a robust framework from which future research on domestic energy can build.

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Appendixes

A Interview Guide and Basic Questionnaire for Household Interviews

Interview Guide

Part 1 Introduction/Confidentiality forms and permissions

Part 2 Ice-breaker

- Start off by drawing of ideal room.

- Why are these things in your ideal room?

- What would you do in your ideal room?

Part 3 Meaning of Comfort

- What does comfort mean to you?

- What do you do to be comfortable?

Part 3 Comfort making and energy saving

- What have you done to save energy in your home? You can do this in chronological order or biggest changes first, or whatever way you think makes the most sense
    - Does it change the way you do other things?
    - If you did it again, would you do anything differently?
- What would you like to do with your home in the future? (To make it more comfortable?)

Part 4 Conclusion

- Any other comments?
- Thanks

Home Comforts Questionnaire

Participation in this study is voluntary and you can also leave out any questions that you do not wish to answer. Question 8 provides a space for additional comments should you wish to add to any answers given. All answers given will be kept confidential.

1. Name and age of each household member:

-   -

-   -

2. What is the employment status of the adults in your household?

Employed full time	Employed part time	Self-employed
Unemployed	Retired	Student
Homemaker	Sick/Disabled	Other _____

3. Roughly, how much did your household spend on energy?

Over the last month	*Over the last 12 months*
Less than £20	Less than £240
Between £20 and £60	Between £240 and £720 Between
£60 and £100	Between £720 and £1200
Between £100 and £140	Between £1200 and £1680
Between £140 and £180	Between £1680 and £2160
Between £180 and £220	Between £2160 and £2640
Between £220 and £260	Between £2640 and £3120
More than £260	More than £3120
Don't know	Don't know

Any money back from Feed-in Tariff? If so, how much monthly or annually?

4. What is your annual household income before tax?

Less than £20,000

Between £20,000 and £40,000

Between £40,000 and £60,000

Between £60,000 and £80,000

Between £80,000 and £100,000

More than £100,000

Prefer not to answer

5. How long have you lived in your current house?

6. How long do you plan to continue living in your current house?

7. Roughly, when was your house built?

Before 1964   1964-2002   2002-present   Don't know

8. Please use the space below to add any further comments you have from participating in this study

B Interview Guide for Energy Advisers

Part 1. Introduction/Confidentiality forms and permissions

6. Please tell me about your role as an energy adviser and how you approach energy reduction?
7. What do you think the main goal of X [energy advice centre] is?
8. What do you think is the biggest challenge to reducing home energy (or meeting x goals if different focus to previous question)?
9. What do you think is the most important recommendation?

Part 2. Comfort

10. I was wondering if you thought about comfort much in your work or in how the centre approaches energy?
11. What types of comfort do you consider to be relevant to energy reduction?
12. If mention comfort as warmth: do you think warmth is the most relevant aspect of comfort? Or are there other types?

Part 3. Ask for some reflections/brainstorming on some of my own findings around

comfort/connections with reducing energy demand

13. Explained an early figure with 12 meanings of home comfort and their interconnections
14. Reflected on householder's preference for conservatories, wood-burners, and larger homes and benefits/limitations to reducing energy and any relevant practical/policy recommendations.

Part 4. Other recommendations

- Do you have any other practical or policy recommendations about reducing home energy?

Part 5. Closing and Thank you

- Any other comments?

C Ethical Approval

11th February 2014
Katherine Ellsworth-Krebs
School of Geography & Geosciences

Ethics Reference No: Please quote this ref on all correspondence	**GG10800**
Project Title:	Homes don't use energy, people do
Researchers Name(s):	Katherine Ellsworth-Krebs
Supervisor(s):	**Dr Louise Reid & Professor Colin Hunter**

Thank you for submitting your application which was considered at the Geography & Geosciences School Ethics Committee meeting on the 6th June 2013. The following documents were reviewed:

1. Ethical Application Form 04/02/2014
2. Participant Information Sheet 04/02/2014
3. Consent Form 04/02/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years. Projects, which have not commenced within two years of original approval, must be re-submitted to your School Ethics Committee.

You must inform your School Ethics Committee when the research has been completed. If you are unable to complete your research within the 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' https://www.st-andrews.ac.uk/utrec/guidelines/ are adhered to.

Yours sincerely

Convenor of the School Ethics Committee   OR   Convener of UTREC

Ccs   Supervisor