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Loughborough Design School

Exploring the implications of cultural context for design for sustainable behaviour

By

Jak Spencer

Doctoral Thesis

Submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy of Loughborough University

February 2014
ABSTRACT

In this thesis the opportunities for designing products that are less resource intensive during use, in different cultural contexts is investigated. The research was divided into four phases: an extensive literature review, an online scoping study, an intensive qualitative study on laundry behaviours, and an international design competition.

The research drew on the background of design for sustainable behaviour, a relatively new field of enquiry concerned with reducing the social and environmental impacts of products during their use. Despite the increasing development of theories to change user behaviour through design, there is a lack of understanding of how different cultural contexts affect behaviour.

An extensive literature review established the current thinking on culture, development, and behaviour. The diverse nature of everyday household behaviour from different cultures and the effect it has on household resource consumption was uncovered and was investigated further in an online scoping study. In the study, participants from the UK, Brazil and India answered questions related to the themes of food, water, energy, materials and government schemes. The findings helped to highlight the differences in household behaviours and led to more detailed investigation of laundry behaviours in three sites in the UK, Brazil and India using in-context interviews, observations and household tours.

From these findings a series of culturally significant and culturally independent factors were established that can aid designers in understanding behaviours in a given context. A set of design guidelines were also created to facilitate the design of less resource intensive products during use. These were then tested with designers in an international design competition answering a brief to design a less resource intensive laundry process.

The research suggested a range of benefits for designers studying other cultures. The guidelines and cultural factors created can help designers to build empathy with users in a given context and boost creative thinking for more sustainable solutions. The research also offered insights into the possibility of, and application for, transferring behaviours between contexts as well as a new understanding of the aspirations of consumers in emerging markets, which could support other theories of sustainable development, such as leapfrogging.
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1 INTRODUCTION

1.1 Context of this study

Over the last two centuries the seemingly infinite demands of human activity have grated against the finite resources of the planet (Jackson, 2009). This intensity has accelerated rapidly in the decades since the end of the Second World War when the goal for continually increasing GDP (Gross Domestic Product) coupled with the burgeoning population boom has led to over consumption and exploitation of natural resources on such a scale that it has been hailed as the ‘Great Collision’ - where the paths of nature and man collide causing considerable damage to both (Speth, 2009). Over the last sixty or so years this over consumption and exploitation of the natural world has led to over half the world’s temperate and tropical forests being destroyed with deforestation occurring at about an acre a second. 75% of fishing grounds are now over fished or fished to capacity, 20% of the world’s corals have gone and a further 20% are severely threatened. Furthermore, animal extinction levels are thought to be as much as 1000 times greater than normal, and growing crops to feed the expanded population now requires so much fertiliser that dozens of toxic chemicals can now be found in each of us (Speth, 2009).

One of the main causes for this environmental degradation has been the industrialisation of developed countries (Green & Vergragt, 2002; Smith, 1997). If we all lived like the average person from the UK we would require 3.4 planets to support our resource use. This figure jumps to five planets if we take on the lifestyle of the average North American. The reason that the world average is just 1.5 planets is due to the lighter impact countries with a lower GDP, considered as ‘developing’, have. The average Indian resource use is just 0.4 planets,
whilst even China currently consumes on a level equal to what the earth can provide (Global Footprint Network, 2010).

Whilst currently the main damage is being done by the consumption patterns of world’s wealthiest nations (Schor, 2010), countries with a lighter environmental footprint continue to follow the West’s model of unsustainable development (Flavin, 2010). There are an estimated five billion people consuming less than one tenth as many resources per person as the average European (Flavin, 2010) yet growth through consumption continues rapidly in these areas under the guise of development. This surge in growth of the world’s consumer class, coupled with developed nations reluctance to reduce consumption means we could need as many as 2.5 earths to support ourselves by 2050 (Global Footprint Network, 2010).

Sustainable development has become an increasingly important issue in policy and academia, however discussions have tended to emanate from the wealthy industrialised nations and have focused on technological solutions driven by legislation and profitability (Seyfang, 2009; Smith, 1997). Despite a 30% increase in resource efficiency over the last three decades there has been a 50% increase in total global resource use over the same period (Flavin, 2010). It has been debated for decades that sustainable resource use requires not only technological changes but also changes on a systems level relating to human needs, habits, behaviours, attitudes and lifestyles (Fletcher et al., 2001; Papanek, 1984; Schumaker, 1973).

Design plays an important role on the impact of human activity on the environment as it influences people and their surroundings and also acts as an interface between consumers and the activities of consumption (Fletcher et al., 2001). It can help to change conventional systems by influencing the environmental and social impacts of the life-cycle of a product or service. Historically, sustainable design has tended to focus on reducing environmental impacts during the manufacturing or disposal stage of a product, however more recently, research has pointed to influencing users’ behaviour and interactions during the product use by adapting designs (Lilley, 2009).

Research has proven that the specific actions and behaviours of individuals in their everyday lives impact to a large degree the sustainability of a community or culture (Matsuhashi, 2009; Elizondo 2012; Wilhite 1999). However, research into the effect culture has on
sustainable resource use is generally limited and disconnected and it is this area that will be explored further.

1.2 Gap in Knowledge

Despite the excitement around the growth of new economies, and the emergence of new markets for companies to expand into, there has been very limited research into the successful implementation of products into a new market, and there still remains a high failure rate (Chavan, 2009; Deloitte, 2009). Designers are key in this process, as they “need to gain a deep, almost tactile awareness of the culture and context of their target market...It’s essential that they learn from the mistakes others have made in creating products for emerging markets...Products and services created for the American or European market are not necessarily relevant to a user in India or Africa – the conditions are different, the use patterns are different, the thinking is different” (Chavan et al., 2009; pp26-27). Resistance to the global standardisation of products is strong, despite corporations promoting it (Ono, 2006). Whirlpool had to completely restructure its business model after poor sales of its ‘World Washer’ in the Indian market. They had failed to understand the habits of Indian consumers, and saris, garments of particularly fine silk and cotton, were getting caught and tearing in the machines’ mechanisms (Chavan et al., 2009).

The need for understanding cultural behaviours, particularly in the context of designing new products and systems is evident in prior research (Pink, 2004, 2005; Shove, 2003; Laitala et al., 2012; Pakula & Stamminger, 2010). Pink suggests reconstructing new cultural moralities which will change sensory practices (Pink, 2005), whilst Shove (2003b), questions whether appliances are standardising important variations in product interactions by people from different cultures. She argues that culture plays a crucial role in the energy impact of household practices, and that it is an area that has been neglected in the research. “By what routes do ‘the same’ technologies become normal, and how are they integrated into different societies, and does the end-result...differ depending on the distinctive socio-cultural, sociotechnical trajectory followed along the way? Such questions are yet to be investigated on any scale but are, I think, central to a discussion of sustainable household consumption” (Shove, 2003b; p410).

It is possible to transfer behaviours between contexts, however research, particularly into emerging markets, is limited. “We can see some potential for transferring the knowledge to additional geographic and cultural contexts. Emerging economies such as China, India, and Brazil have increasing populations and a growing middle class. Will they follow our trends
with frequent washing? This will have great consequences for the water and energy use in these countries” (Laitala et al., 2012; p236).

Pakula and Stamminger (2010) also note that more research is needed in all household processes in different countries to understand how resources are best used and can be optimised in households. “Best practices for doing all kinds of housework with minimum amount of resources should be identified and disseminated to help in improving housework habits and practices” (Pakula & Stamminger, 2010; p379).

Despite the literature pointing heavily towards using culture as a source of inspiration for sustainable design there is still only very few introductory studies into the area. Whilst research by Elizondo (2012) and Matsuhashi (2010) has focussed on using culture to inspire designs for more sustainable washing up and bathing behaviours, the work predominately focuses on the methodological approach of building empathy with users rather than helping designers understand how to affect behaviour through design. The following research builds on the previous studies to help designers understand the antecedents of behaviour and how they can be affected in different cultural contexts and develops a set of culture-inspired guidelines to help designers act on behaviour change theory and create products which motivate more sustainable behaviours.
1.3 Research Aim and Objectives

The aim of this research is to identify and compare specific resource intensive household behaviours in different cultural contexts and develop resources to aid design for sustainable behaviour in different cultural contexts.

This will be achieved through the following objectives:

1) To draw on cross-disciplinary literature to outline theories relating to design and behaviour, define the terms culture and development, and identify factors that influence resource intensive behaviours.

2) To explore resource intensive household behaviours in the UK, Brazil and India through:
   a) An extensive online survey gauging perceptions and behaviours around several household themes
   b) In-depth, user-centred research on one particularly resource intensive behaviour identified in the previous phases of research.

3) To develop a theoretical understanding of the complex cultural factors that influence people’s behaviour.

4) To develop resources to enable designers to understand and affect behaviours in different cultural contexts.

5) To evaluate the application in design of the resources developed with international designers.
1.5 Thesis Structure

The thesis has been divided into eight chapters. The context of the study, gap in current knowledge, research aim and objectives have been introduced in Chapter 1. The subsequent seven chapters are outlined below:

In Chapter 2 the literature from a wide range of disciplines is reviewed. The terms culture, behaviour and development are defined, before consumption theory and design for sustainable behaviour within the context of this research are discussed. The chapter also includes the environmental impact of everyday household activities under the topics of food, water, energy and materials as well as other external factors such as governmental policy and climate.

In Chapter 3 the overarching methodology for conducting the research is outlined. The case study approach of the research and its relationship to exploratory and qualitative research is examined. Validity and reliability of the results are discussed as well as the ethical considerations for a study of this nature.

In Chapter 4 the approach and findings from the online scoping study are addressed. The main aim of this initial study was to gauge people’s views and behaviours related to the main topics outlined in the literature. The study was then narrowed to a specific direction for the main study.

In Chapter 5 the intensive case study is introduced. The scoping study helped to draw out interesting insights into laundry behaviours, and this was taken forward for further investigation. The chapter outlines the main literature into the laundry system before discussing the results of the in depth, cross-cultural, qualitative study.

In Chapter 6 the results of the intensive study are discussed in relation to the scoping study and literature review. Various insights have been discovered and are explored with respect to the research area. A series of cultural factors and design guidelines are identified for further research.

In Chapter 7 the details for an international design competition using the findings from the previous chapters are introduced. The cultural factors and design guidelines are used to inform designers on how to create products with a lower resource impact during use. The chapter concludes by identifying how the guidelines reportedly informed the designers and discusses their potential use in other design scenarios.
In Chapter 8 the overall discussion from the research is presented. The chapter links the discussions from the earlier phases of research and builds on areas of interest that have arisen during the course of the PhD.

Finally, in Chapter 9, the overall conclusions from the research are established. In this chapter the discussions and conclusions from the previous phases of research are discussed with respect to the aim and objectives and the actual contribution to knowledge of this PhD is presented. To end, the limitations of the research and recommendations for future work are discussed.
2 LITERATURE REVIEW

2.1 Plan of the Literature

The literature review was conducted to build up a body of knowledge of current research into domestic resource use across different cultures. In order to do this the term culture itself had to be defined within the context of the PhD. This led to questions arising regarding the definitions of development. Consumption and behaviour theory and their application in design have also been addressed to help define the boundaries of the PhD. Finally both the micro and macro aspects of domestic resource use are discussed to provide some application to the theory.

A further literature review has also been conducted on laundry habits as part of the more in-depth case study, and this is introduced in chapter 5.

The diagram below (figure 2.1) shows the various different topics reviewed in this chapter:
2.2 Defining Culture

The term culture is the source of considerable ambiguity and debate amongst academics. This is partly caused by the fact that to try to understand anything about everyday life in a human context can be described as a cultural research project (Wilhite, 1999). Sceptics are often critical of the term culture being used as an explanatory concept as the ambiguity of its definition reduces clarity and opinions can become confused amongst readers. In anthropology the term culture can be used to describe an individual, a family, the people within a selected region, a nation as a whole, a continent, or even internationally. The obvious criticism is then; if each individual’s culture is different how can we possibly use the term to measure differences between groups of people? The confusion increases when it is considered that the term is also used to describe age culture, consumer culture, ethnic culture, corporate culture, religious culture and so on. It is therefore critical to have a clear definition of what culture is in the terms of this research project.

Wilhite (1999) describes a cross-cultural project as one that “explicitly aims to highlight cultural similarities and differences in one or another aspect of everyday life, and use them to open avenues of theoretical inquiry” (p.1).
In classical anthropology Tylor’s definition of culture is still widely cited, suggesting culture is: “That complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society” (Tylor, 1871; p.4).

The influential anthropologist Clifford Geertz defines culture as “a system of inherited conceptions expressed in symbolic forms by means of which men communicate, perpetuate, and develop the knowledge about, and attitudes towards life” (1973; p.89). Whilst Hofstede (1984) defines culture as the “collective programming of the mind which distinguishes the members of one category of people from another” (p.51).

Over the years other anthropologists have tried to narrow down these definitions further. Kroeber and Kluckohn (1952) define it as the symbolic, meaningful and linguistic aspects of human collectives. Banks and McGee (1989) also place a heavy emphasis on the symbolic, ideational, and intangible aspects of human societies. They suggest “people within a culture usually interpret the meaning of symbols, artefacts and behaviours in the same or similar ways” (p.8).

Within design, research and application of culture into design research studies is generally limited, however, the few studies that have used this approach have generated varied and insightful results (Kuijer, 2010; Matsuhashi, 2009; Elizondo, 2012; Wilhite, 2008). Elizondo (2012) refers to the symbolic meaning of behaviour combined with a consideration of infrastructure, technology, economic and societal factors when defining culture for a design study. Kuijer and de Jong (Kuijer & de Jong, 2009) combine symbolism with the ‘collective ideas that exist in society of what is normal practice’.

Whichever definition of culture is being reviewed, within an anthropological and design sense the common themes that remain throughout are the importance of symbolic values, shared knowledge, and learned behaviour.

On the basis of these definitions, for the rest of this research culture will be defined as:

‘The shared patterns of behaviours, interactions and understanding learned by a collective group of people’
2.3 Development

As was introduced at the beginning of the thesis, the economic situation in a particular country has traditionally had a significant impact on its environmental footprint. One of the largest obstacles when conducting a study of this kind is the grey area of defining a developed country or a developing country. Many authors have tried to define development with varying degrees of success. Joseph Stiglitz, former chief economist of the World Bank, defines a developing country as one that is “marked by low incomes and high poverty, high unemployment and low education” (2007, p.26), whilst former secretary-general of the UN, Kofi Annan describes a developed country as “a country that allows its citizens to enjoy a free and healthy life in a safe environment” (2000). The World Bank looks purely at fiscal characteristics. If a country has a Gross National Income (GNI) of more than $12,616 per capita it is considered high-income (2012). The Human Development Index (HDI), published every year takes this further by measuring health (life expectancy), wealth (GNI), and education (years of compulsory schooling) (2013).

The discrepancy between definitions lies with trying to quantify a term that cannot be substituted with numerical values. A line cannot be drawn under any specific country to mark what stage of development it is at because of the vast range of different factors that have to be considered. Countries such as Cuba that haven’t followed the Westernised model for economic development are considered a developing nation by economic measures such as that of the World Bank because of their low per capita GNI, however by the definitions of Stiglitz and Annan, Cuba would be considered a developed country as they have a higher literacy rate and lower infant mortality rate than the developed USA (CIA, 2013). They are also one of the only countries to have an Ecological Footprint of a “genuinely sustainable economy” (Gaffney & Togtokh, 2010).

More holistic indicators of a country’s well-being such as the Happy Planet Index (HPI) confirm that “material consumption doesn’t necessarily correlate with happiness” (Marks et al., 2006). Plotting the ecological footprint of a nation against the happiness of its citizens helps to correlate human activity with the environment. Organisations such as The New Economics Foundation have worked hard to promote well-being measures to governments by introducing their dynamic model of well-being (Thompson & Marks, 2008); however uptake has been slow from governments typically run by traditional economists.

Table 2.1 below charts the more popular definitions and measures of sustainable development and their benefits and limitations:
<table>
<thead>
<tr>
<th>Who?</th>
<th>Definition</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>World Bank (2008)</strong></td>
<td>Developing country GNI of less than $11,905 per capita</td>
<td>Purely numerical. Doesn’t take into account social or environmental costs.</td>
</tr>
<tr>
<td>Kofi Annan (2000)</td>
<td>Developed country “one that allows its citizens to enjoy a free and healthy life in a safe environment”</td>
<td>Hard to measure and gives no indication of safeguarding resources for the future.</td>
</tr>
<tr>
<td><strong>Alan Durning (1992)</strong></td>
<td>Classifies into 3 groups: Poor (&gt; $700/pa), middle income ($700 - $7500), consumer class (&lt; $7500)</td>
<td>Purely numerical, similar to World Bank. Dated model - 20 years old.</td>
</tr>
<tr>
<td><strong>Human Development Index (2013)</strong></td>
<td>Ranks countries on quality of life based on health, wealth, &amp; education. (life expectancy, GNI, years of schooling)</td>
<td>Doesn’t link humans to the environment. “One might object that life expectancy only reflects damage to human health after a considerable time lag” (Neumayer, 2001)</td>
</tr>
<tr>
<td><strong>Human Sustainable Development Index (2010)</strong></td>
<td>Adds per capita carbon emissions to HDI.</td>
<td>Very simple, general model. Very new needs refining - lacks data (current &amp; historical). Does not take into account a country’s emissions due to imported goods. “whether a country uses energy efficiently or not does not determine its level of human development” (Neumayer, 2001)</td>
</tr>
<tr>
<td><strong>The Adjusted Net Saving</strong></td>
<td>Measures: Produced Capital, Human Capital, Social Capital, Natural Capital</td>
<td>Relies on the assumption of perfect substitutability between the different assets (Altiti et al., 2010).</td>
</tr>
<tr>
<td>Genuine Progress Indicator</td>
<td>Measure similar to GDP but takes into account the negative aspects of activity e.g. crime, social welfare, the environment.</td>
<td>Unclear definition of sustainability. Doesn’t account for degradation caused outside the geographical boundaries of the measuring area (Anielski, 2001)</td>
</tr>
<tr>
<td><strong>The Ecological Footprint</strong></td>
<td>How much land and water area a human population requires to produce the resource it consumes and to absorb its wastes, using prevailing technology.</td>
<td>Static indicator. No long term effects measured or development of technology. Doesn’t account for trade therefore county specific comparisons are not as useful as they might seem. (Fiala, 2008)</td>
</tr>
<tr>
<td><strong>The Happy Planet Index</strong></td>
<td>Shows ecological efficiency with which human well-being is delivered around the world</td>
<td>Combines ecological footprint, life-satisfaction and life expectancy. Good all-round measure.</td>
</tr>
</tbody>
</table>
Out of these measures, two will be used in the rest of this research. The GDP and GNI figures used by the World Bank will be used to portray people's economic development, as these are the traditional methods used by economists and politicians internationally. The Happy Planet Index will be used as an environmental measure as it relates human activity to the environment. Whilst many other measures record happiness or wellbeing, the Happy Planet Index is the only one that combines human life satisfaction with the environment and the economy.

These two measures have been taken forward as they often contradict each other and are therefore the cause of much debate depending on whether development is viewed as purely economic, or as a combination of life satisfaction and the environment. Generally speaking, countries with a high GDP often have a low HPI and vice-versa, unless the country has an especially low GDP in which case the HPI will also be low, for example Uganda which ranks 152nd in the world in terms of GDP per person and 117th in the world in the HPI.

2.4 Consumption and Behaviour Theory
As identified in the introduction, consumption, particularly by the world’s wealthiest countries, is the cause of a large proportion of negative environmental and social impacts (Flavin, 2010; Schor, 2010; Speth, 2009). It is therefore important to understand the concept of consumption to identify ways of moving towards a more sustainable future. Consumption, however, is a divisive term that spans across many fields of research. The areas of anthropology, sociology, economics, politics, psychology and cultural studies all offer differing perspectives on consumption and thus no clear definition of consumption or its related concepts exists (Edwards, 2000). The views of each discipline can typically be categorized into three main approaches; individual choice theorists, social theorists, and cultural theorists (Wilk, 2002).

Individual choice theorists see consumption by individuals as a satisfaction of needs. From a psychological point of view these needs will differ according to the various traits that make up an individuals’ personality, but generally include making a personal history, providing security and self-expression (Schwartz, 2006). Individuals seek goods which are associated with basic human drives such as sex, status and self-respect in order to feel happy and fulfilled (Wilk, 2002). Economists argue that the consumer is an unconstrained rational actor consuming to maximise short-term positive outcomes for personal satisfaction (Jackson, 2004; Edwards, 2000).
Social theorists argue that consumption allows groups to form and create a social order. Consumption is heavily linked to status under the assumption that a desire for social merit is human nature (Wilk, 2002). Goods are seen as markers of social identity – using manufactured objects as totems that symbolically represent particular social groups (Lury, 1997). Consumption creates an increasingly reflexive relation to self-identity whereby an individual can enhance their self-identity through lifestyle, taste, fashion etc. supported by other members of the same social group (Lury, 1997; Sanne, 2002). The content and scope of consumption is directly relevant to an individual’s position within a social structure (Bourdieu, 1984). Social theorists also argue that people consume out of habit and convenience determined by their social environment (Sanne, 2002).

Cultural theorists see consumption as an expressive act used to portray meaning and identity. The act of consumption allows individuals to communicate with each other and helps them to understand their lives and the world around them (Wilk, 2002). Cultural theorists argue that consumption is not restricted to commerce but is a cultural and economic phenomenon, as much to do with communication, as it is to do with exchange or trade (Lury, 1997). Others argue that consumption itself has become a cultural form, suppressing traditional customs and replacing them with irrelevant goods in a market place controlled by an elite few (Schor, 2010, Assadourian, 2010).

There is also contention over whether consumption is producer-led or consumer-led. Individual choice theorists argue that in a free market consumers will act rationally to choose goods they need or want and producers will manufacture goods to meet this demand. However, social theorists argue that through packaging, promotion and advertising, goods are designed to manipulate the relationship between objects and human wants, needs and emotions. Images of romance, fulfilment and satisfaction cause goods to embody symbolic codes that carry meaning in social situations, and therefore consumption is controlled by a small number of producers (Lury, 1997).

The way consumers think and act, therefore has a significant social and environmental impact. Theories of consumer behaviour have been created from the three dominant consumption groups listed above. The individual choice theorists see the ‘consumer as king’ – carrying out a cost/benefit analysis on each decision based on personal preferences and taking responsibility for those consumption decisions (Edwards, 2000). The social and cultural theorists argue however that the consumer can never make a rational choice as they are affected by other factors such as routines, habits or advertising cues (Lury, 1997).
They see the consumer as the victim, fooled into spending money they don’t have on things they don’t need (Edwards, 2000). Social theorists argue that consumers act based on their perception by others, or through habit with little cognitive thought put into their actions.

Consumer behaviour is affected by the following factors, depending on which consumption theory is being examined:

- on a macro scale developments in technology, economic growth, demographics, governmental or cultural factors will all affect behaviour;
- whilst on a micro scale behaviour is affected by the understanding, motivation, and ability of individuals to change their actions (Abrahamse, 2005; Steg, 2008)

Research has concluded that people in the developed world have a sound understanding of environmental issues and are in favour of environmental actions, however they are slow to change towards more sustainable behaviour (Jenson, 2008). This is due to attitudes and behaviour having a very tenuous relationship. A study found that after a three hour workshop teaching energy saving practices in the home to 40 pro-environmental participants their knowledge and attitudes towards saving energy increased dramatically, however three months later it was found that the same 40 participants had done almost nothing to implement this knowledge (McKenzie-Mohr, 2009).

A major influence on behaviour is personal motivations. As social theorists suggest, individuals’ perceptions of themselves and others will determine behaviour (Steg and Vlek, 2009). Changing behaviour and consumption patterns to fit into a social order is common amongst consumers (Wilk, 2002). Individual choice theorists would argue that consumers motivations would come from weighing up the greatest benefit from the lowest cost (Steg and Vlek, 2009). Other motivations such as money or health will adapt behaviours more effectively than the idea of becoming a sustainable citizen (McKenzie-Mohr, 2009).

Motivational factors are not, however, the only attributes to influence individuals’ behaviour. The context or physical arrangement of an individuals’ surroundings such as culture, social class, education, climate, geography, public policy, taxes, regulations, income, cost of goods etc. will also influence their behaviour (Stern, 1999). This behaviour is likely to be most relevant to the research, as the differences between individuals from different countries will be highlighted by this contextual habitual behaviour, rather than intentional, cognitive behaviour. Habitual behaviour refers to a behaviour that is performed regularly, without reflection, to a re-occurring event that has already been solved to a user’s
satisfaction; whilst cognitive behaviour is the result of a choice influenced by contextual factors, solved through reasoning (Jackson, 2005; Steg and Vlek, 2009).

This interaction between motivation and ability has been developed into a behavioural model by Fogg (2009) (figure 2.2) to help design products and services with a particular application in the Human Computer Interaction Field (HCI). In the model a ‘trigger’ is needed to perform behaviours where there is a high motivation and ease of ability to perform the behaviour. If there is a lack of any of the three concepts (motivation, ability and trigger) then a behaviour will not be performed.

![Figure 2.2 - Fogg’s Behavioural Model (2009)](image)

2.4.1 Consumption and Symbolism

One of the key factors when looking at consumption in different cultures is the notion that the same behaviours can have very different symbolic meanings in different contexts.

“Cultural differences manifest themselves in a culture’s choices of symbols, heroes/heroines, rituals, and values, all of which are critical for a product’s acceptance into daily life”
These differences within cultures show the importance of shaping meaning and the potential for influencing processes (Ger et al., 1999).

"Consumption practices can become established and acquire meaning over time. The meaning of an object, such as a car or a category such as organic foods, or a practice such as biking, reflects perceptions and judgements about how and in what ways it differs from or is similar to alternatives, and where, when, how, and by whom it is owned; consumed; or engaged in" (Ger et al., 1999; p2). Even simple things such as the choice of colour could have a huge impact on people’s response to the product (Ou et al., 2004).

An investigation into the use of pressure cookers in Turkey showed that the familial and social meaning of the cooker reinforce the view that it is an essential part of leading a modern life in a respectable kitchen; the fact that it is a less resource intensive alternative to normal cooking pots is an aside. "If low impact practices are to spread, multiple visions of modernity must become salient" (Ger et al., 1999; p12)

2.5 Practice and Behaviour Theory

Within the subject of putting users at the centre of the design process there are two predominant theories prevalent in design research; practice theory (from sociology) and behaviour theory (from social psychology).

Social Practice Theory (SPT) attempts to understand practice as a way of exploring the routines of users and applying the insights gained to innovate in design (Julier, 2007). It is a rather ‘catch-all’ approach under which various aspects of theory are explored, increasingly in the context of energy use and consumption (Morris et al., 2012).

A common definition cited in most practice theory research (Morris et al., 2012; Wilson, 2013; Julier, 2007) is that of Reckwitz (2002, p.249) who suggests a practice is: “A routinised type of behaviour which consists of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, things and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge...The single individual is not only the carrier of patterns of bodily behaviour, but also of certain routinised ways of understanding, knowing how, and desiring are necessary elements and qualities of a practice in which the single individual participates, not qualities of the individual.”
A further development of the definition of practice and attempt to integrate it into the design process is the 3 elements model first introduced by Shove (2008) and later developed by Darnton et al. (2011). In this approach, practice is the study of actions shaped through non-linear connections between materials, meanings and procedures rather than studying groups of individuals acting rationally and independently (Wilson, 2013).

The three elements are described by Morris et al. (2012) as:

**Materials:** The physical objects that permit or facilitate certain activities to be performed in specific ways.

**Meanings:** Images, interpretations or concepts associated with activities that determine how and when they might be performed.

**Procedures:** Skills, know-how or competencies that permit, or lead to activities being undertaken in certain ways.

(Morris et al., 2012; p11)

By mapping the process (Figure 2.3), the users involved in the practice are at the centre of the model and the tool can be used to identify the specific elements of the practice in question. The model has been used as an ideation tool to help stakeholders think differently about behaviour change from mobile phone use whilst driving to volunteering in the community (Darnton et al., 2011).

![Diagram of the Three Elements Model](image-url)
A further model relating energy practices to culture has been developed by Stephenson et al. (2010). The Energy Cultures framework (figure 2.4) aims to identify potential influences on behaviour, design research methodologies and identify possible interventions (Stephenson et al., 2010). In the research, culture is used as a ‘usefully broad’ term defined by the distinctive knowledge, belief, behaviour and material objects of individuals and groups.

Similar to the three elements tool, three components of behaviour are developed as highly inter-related components. The three components draw significant parallels to those in the three elements tool; cognitive norms (meanings), material culture (materials), and energy practices (procedures).

![Energy Cultures Framework with outer ring of external influences (Stephenson et al., 2010)](image)

Wider external influences will impact upon the three elements and change the system as a whole, for example the choice of materials within the home will be affected by household income (Stephenson et al., 2010).

The model can be used to identify which interventions will be most successful within given cultures and be used on different scales (individual vs business) and in different sectors, however currently its application is limited. The model is a useful tool for understanding the complex nature of behavioural interactions; however trying to apply it to a multitude of situations means it is somewhat broad in its definition. It also doesn’t offer the potential for transferring behaviours between contexts.

Practice theory therefore offers a very open and wide-ranging route to understand user behaviour, primarily focusing on social practice (particularly the interaction between practice and material contexts), rather than individual behaviour (Morris et al., 2012).
Behaviour theory, typically from the field of social psychology, focuses directly on the individual as the locus of behaviour (Morris et al., 2012), where behaviour is viewed as a rational decision making process (Wilson, 2013). The behaviour is preceded by an individual’s intention to act. The intention is characterised by a set of internal or external prompts, attitudes and values constructed within certain constraints (Jackson, 2005; Chatterton, 2011).

One of the most widely cited and applied behavioural theories (Morris et al., 2012) is the Theory of Planned Behaviour (Ajzen 1985; Ajzen, 1991). It suggests three types of considerations guide human action:

- “Beliefs about the likely consequences of the behaviour (behavioural beliefs);
- beliefs about the normative expectations of others (normative beliefs); and
- beliefs about the presence of factors that may facilitate or impede performance of the behaviour (control beliefs)” (Ajzen, 2002; p107)

These three considerations motivate an individual’s intention to act. The model adds a further consideration; perceived behavioural control and contends that with a favourable attitude regarding the outcome and subjective norm and a perceived level of control, the individual will have a strong intention to perform the desired behaviour (Ajzen, 2002).

The model can be used to explain and predict behaviour and identify particular influences on behaviour that could be targeted for change (Morris et al., 2012), however it is only an instrument to generate cognitive determinants of behaviour and provides little supporting evidence for the translation of intentions into desired behaviours (Taylor et al., 2006). It is therefore not considered effective in designing interventions that change behaviours, only in providing information that needs to be converted into a tangible proposition for change.

Further models such as the Attitude-Behaviour-Context (ABC) model by Stern (2000) suggest that behaviours are created by an interplay of personal attitudinal variables and contextual factors. It implies that there is virtually no link between attitudes and behaviours when contextual factors are either very positive or very negative (Jackson, 2005). As an example, in places where recycling is either very easy to do or very hard, people’s pro-recycling views are irrelevant. Where it is easy, most people will recycle, where-as where it is hard, most people won’t recycle. Where it is possible, but not necessarily easy to recycle will be where pro-recycling attitudes and recycling behaviour is strongest (Jackson, 2005).
One aspect overlooked by both of these models however, is the effect of past behaviour. The Theory of Interpersonal Behaviour by Triandis (1977) (figure 2.5) recognises intentions as antecedents of behaviour, much like the previous models, however importantly includes habits as a key factor in the enactment of intention (Wilson, 2013; Jackson, 2005). Both habits and intentions are moderated by ‘facilitating conditions’ - a set of contextual factors similar to those identified in the ABC model (Jackson, 2005).

![Triandis Theory of Interpersonal Behaviour](image)

Habits act as a mediator between intention and behaviour. They are a routinised action, conducted without conscious thought; however just relying on frequency of past behaviour is superseded by current literature that suggests strength of habit is determined by lack of awareness of decision making, efficiency of mental capacity, identity of one’s own style and difficulty of controlling behaviour; not just frequency of past behaviour (Verplanken, 2006; Wilson, 2013).

The various theories discussed above introduce the idea of either defining the psychological rational antecedent of an individual’s behaviour as an actor, or to define it based on how societal elements create action or practice. Although Shove’s Practice Orientated Product Design Manifesto (Shove, 2006) has introduced the idea of practice into the design process, the number of design studies that have used this approach are still fairly limited (Kuijer & De Jong, 2009; Haines et al., 2012; Kuijer & De Jong, 2012). Shove’s definition of design focussed
on isolated, individual and non-temporal components is also argued to be a limited and out-
dated way of thinking about design, with current thinking focused around the user’s 
relationship with the internal and external factors that impact and define their context of 
use and experience (Wilson, 2013).

The behavioural models, particularly those of Azjen (1985) and Triandis (1977) provide the 
most defined and applied behavioural understanding within a design context, whilst practice 
theory is still limited by its broad and ill-defined concept (Wilson, 2013).

2.6 Design for Sustainable Behaviour

Understanding the cause of behaviour and how to moderate it is useful to designers trying 
to change people’s interactions with the products they create. Over the last decade there 
has been a rapidly growing research area concerned with using the theory from behavioural 
studies to design strategies that influence user behaviour and promote more sustainable 
use of products and services (Elizondo, 2011). Whilst still in its infancy, the research subject 
has a number of predominant scholars that have helped to expand the area rapidly, most 
notably Lilley (2007), Wever et al. (2008), Tang & Bhamra (2009), Lockton et al. (2010), 
Zachrisson & Boks (2010), Wilson (2013), and Renström et al. (2013). In the following 
section the major theories that are relevant to the research are discussed.

Lilley et al. (2007) introduce the idea of Design for Sustainable Behaviour (DfSB) Strategies. 
One of the central themes in Lilley’s work adapts a form of ‘scripting’, introduced by Jelsma 
and Knot (2002), in which the designer can use the physical attributes of a product to 
prescribe a desired behaviour in the end user (Wilson, 2013). Lilley’s work also builds on 
Fogg’s theory of ‘Captology’ (2003), which focuses on the development of technology to 
change how people behave (Lilley, 2007).

Lilley (2009) argues that there is an axis of influence between the user and the product that 
determines where the power in decision making lies (figure 2.6). At one end the user makes 
an informed decision to change behaviour based on real-time aural, visual or tactile 
information or feedback. At the other end of the axis are technology driven solutions that 
use intelligent technologies to dictate the mode of use entirely. Whilst in the middle is 
behaviour steering where designers can control user interaction without forcing behaviour.
Understanding this axis of influence allows the designer to position an intervention which balances the needs of the user with the nature of the targeted behaviour (Hanratty et al., 2012). Whilst powerful in their intent, these design intervention strategies can only be effective if the various approaches are correctly matched to users’ needs, understanding and motivations (Hanratty et al., 2012).

Wever et al. (2008) develop Lilley’s strategies further by proposing eco-feedback, scripting and forced functionality. The forced functionality strategy is more comprehensive than Lilley’s definition of persuasive technology as it combines intelligent products with strong obstacles to prevent undesired behaviours. This is more useful to designers as there is more of an obvious split between inducing and forcing behaviour change (Wever et al., 2008). Wever et al. (2008) also propose a second branch to the model; functionality matching, which aims to eliminate mismatches between delivered functionalities and desired functionalities (2008). With functionality matching they suggest adapting a product to suit consumers’ actual use thus minimising negative side effects e.g. clustering or increasing the capacity of bins in a park to avoid excess littering.

Elias et al. (2008) build on the idea of a theoretical minimum in which each behaviour (for example boiling a kettle) has a minimum energy requirement and through changing behaviour or changing technology (or both) this minimum can be achieved or reduced. They propose a matrix with old and new user behaviour and old and new domestic products
which correlate with the axis of control proposed by Lilley et al. (2007) and Wever et al. (2008).


Figure 2.7 - Design Behaviour Intervention Model (Tang, 2010)

Through the extended seven design approaches, Tang suggests that information, choice and feedback should be applied to influence the intention of behaviour whilst at the declarative stage of habit formation. More coercive strategies such as spur and steer should be applied when the habit is in the knowledge compilation stage, and strategies that focus on control such as technology and clever design should be applied when the habit is ingrained at the procedural stage.

Whilst introducing habitual behaviour to the axis of influence is an interesting step, the model as a tool to change behaviour has considerable limitations as critiqued by Wilson (2013). The model misrepresents the complex inter-relationship of intention, habits and control which are present in all behaviours. In its current form, the model shows that a change in attitude could not result in changing behaviour using a technology agentive strategy, which is not the case (Wilson, 2013).
Lidman et al. (2011) propose a model based on the original axis using the strategies developed by Tang (2010) and Wever et al. (2008) to suggest a classification with five strategy categories along the axis of control: Enlighten, Spur, Steer, Force and Match (figure 2.8).

![Figure 2.8 - A classification of design strategies for sustainable behaviour (Lidman et al., 2011)](image)

Enlighten uses strategies that influence knowledge, values, and norms; Spur uses strategies to encourage sustainable behaviours (carrots and sticks); in the Steer category the sustainable behaviour is the evident choice through the design; and Force requires the user to behave in a certain way (Renström et al., 2013). In the final category, Match, no behavioural change is needed as the design of the artefact is matched to the current behaviour or behavioural intent of users (Renström et al., 2013), building on Wever’s (2008) concept of functionality matching.

A further behaviour change theory, developed by Lockton, a contemporary of Lilley and Tang, is Design with Intent (DwI) (Lockton et al., 2008) which aims to collate a broad range of existing behaviour change solutions, presented through a series of lenses, as a suggestion or inspiration tool for designers (Lockton et al., 2008). The lenses (error-proofing, architectural, security, cognitive, visual, & persuasive) were developed by observing patterns of behaviours from current products and services and aim to make the designer consider the problem from another perspective.
Whilst useful in promoting ‘outside-of-the-box’ creative thinking from designers, the method doesn’t provide a means to understand the underlying normative and motivational causes for why users act, only methods to affect how they act (Wilson et al., 2010). In this way, “the decisions made by the product may not be in line with the actual intention of the user, and furthermore the delegation of the learning act to the product, may negate or impinge upon the education or motivation of the individual” (Wilson, 2013; p49).

Two further contemporaries that have been working to advance the field of DfSB are Wilson (Loughborough University) and Daae (previously called Zachrisson) (Norwegian University of Science and Technology). Zachrisson et al. (2011) builds on the work of Lilley and Tang by identifying a link between the factors that affect a behaviour and the control element of the approaches (figure 2.9). Zachrisson suggests that the more control a user has, the more cognitive load the behaviour requires (Zachrisson et al., 2011).

Zachrisson builds in further factors to the model to include not only habits, but also intentions and constraints, values and norms, and importance and annoyance to guide change (Zachrisson et al., 2011). This development allows designers to understand the impact of their designs on the relevant antecedents of behaviour (Wilson, 2013).

Wilson (2013) uses the case study of a feedback intervention with social housing tenants to apply DfSB strategies in a real setting. The work introduces a user centred design process for intervention creation as well as intervention evaluation. The evaluation of the success of a DfSB intervention is through a tripartite questioning framework by asking:

- *Did the produced design solution function for the specified context?*
- *Has the user’s behaviour changed as a consequence of the design intervention?*
- *Is the change in user’s behaviour sustainable?* (Wilson, 2013)

The most recent research undertaken on the theoretical side of DfSB is by Renström, Strömberg and Selvefors (2013) from the Chalmers University of Technology, Sweden. They concede that few empirical studies have attempted to understand which DfSB strategies to
adopt for specific artefacts and situations, and how to create artefacts that reduce consumption whilst being accepted and embraced by the users (Renström et al., 2013). They present 5 ‘pathways’ of sustainable behaviours (figure 2.10) that chart the different routes users can follow to reduce environmental impact during the use of a product and link these pathways to DfSB strategies to develop a guide to design effective and accepted products for certain behaviours in particular situations (Renström et al., 2013).

The 5 pathways are described as follows:

- **Path 1: Changed Use:** this path concerns using the artefact differently and is split into 3 categories; using the artefact in a different way, changing the use situation, or curtailing the use of the artefact.

- **Path 2: Mediated Use:** this concerns using a secondary artefact to mediate the use of the primary artefact. The same 3 categories as above can be followed with the secondary artefact supporting the primary one.

- **Path 3: Regulated Artefact:** This is where a secondary artefact is used to regulate the resource consumption of the primary artefact, reducing resource consumption regardless of how the primary artefact is used.

- **Path 4: Maintenance and Repair:** Maintaining the artefact in good condition and repairing where necessary to reduce resource consumption.

- **Path 5: Choice of Artefact:** Choosing a different primary artefact to lower resource consumption.

The idea behind the pathways is to provide a starting point for the selection of design strategies when applying DfSB (Renström et al., 2013). The pathways therefore offer a means for designers to understand and anticipate how their designs can influence behaviour and which design strategies would be more suited to a particular context or use. This is particularly valuable when combined with the methodological approaches of Daae (2013) and Wilson (2013b) mentioned above. The research approaches provide insights into which behaviour is most suited to a particular pathway, which in-turn can be used to select an appropriate design strategy.
MAP OF PATHWAYS OF SUSTAINABLE BEHAVIOURS

REFERENCE PATH
An artefact is obtained and used without consideration to its resource use

PATH 1: CHANGED USE
Use the artefact differently
- change use style
- adapt use situation
- curtail use

PATH 2: MEDIATED USE
Use a secondary artefact that mediates the use of the primary artefact
- consult a secondary artefact to change use style when using the primary artefact
- consult a secondary artefact to adapt the primary artefact’s use situation
- consult a secondary artefact to curtail use of the primary artefact

PATH 3: REGULATED ARTEFACT
Let a secondary artefact regulate the primary artefact’s resource use
- use the artefact without consideration to its resource use or follow other paths

PATH 4: MAINTENANCE & REPAIR
Maintain the artefact in good condition
- maintain the artefact in good condition

PATH 5: CHOICE OF ARTEFACT
Choose an artefact that uses less resources during use and/or requires a less harmful resource than other alternatives
- use the artefact without consideration to its resource use or follow other paths

FIGURE 2.10 - The 5 Pathways model (Renström et al., 2013)
Despite the possibly huge potential of the 5 pathways model it is still in its very early stages of development and therefore, by its authors’ own admission, has the following limitations in its current form:

- The model does not link the pathways to other important factors in sustainable design such as the relationship to the behavioural determinants.
- Only financial investments are included in the model, and a further development would be to include other barriers such as time, skills and commitment.
- The model only details possible behaviours and not to what degree they can reduce resource consumption.
- Rebound effects are not considered.
- Multiple users and shared resources are not considered. (Renström et al., 2013).

Despite these limitations it is anticipated to become a very influential model in the research field as the area continues to grow rapidly and the model develops to overcome these limitations.

The literature gives a good grounding in behavioural theory and the factors that affect individuals in different contexts. Table 2.2 gives an overview of the models discussed and shows how academics within the field have collaborated to progress the research area in just a few short years.
<table>
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<tr>
<th>Year</th>
<th>Authors</th>
<th>Comments</th>
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<tbody>
<tr>
<td>2007</td>
<td>Lilley, D.</td>
<td>Develops axis of control using feedback, steering &amp; technology.</td>
</tr>
<tr>
<td>2008</td>
<td>Wever, R., Van Kuijik, J. &amp; Boks, C.</td>
<td>Develops forced functionality concept as well as 2\textsuperscript{nd} branch of model; functionality matching.</td>
</tr>
<tr>
<td>2008</td>
<td>Elias, E., Dekoninck, E. &amp; Culley, S.</td>
<td>Argues each behavior has a theoretical minimum energy requirement</td>
</tr>
<tr>
<td>2010</td>
<td>Lockton, D., Harrison, D. &amp; Stanton, N.</td>
<td>Introduces real world examples through a series of lenses to inspire designers.</td>
</tr>
<tr>
<td>2012</td>
<td>Zachrisson, J. &amp; Boks, C.</td>
<td>Uses the axis but builds in further antecedents and factors such as values/norms, intention/constraints &amp; importance/annoyance to guide change</td>
</tr>
<tr>
<td>2013</td>
<td>Wilson, G.</td>
<td>Proposes user centred method to create interventions based on DfSB strategies &amp; framework to assess successfullness of DfSB interventions</td>
</tr>
<tr>
<td>2013</td>
<td>Renström, S., Strömberg, H., &amp; Selvefors, A.</td>
<td>Develop the 5 pathways model to aid selection of DfSB strategies at the start of a design project.</td>
</tr>
<tr>
<td>2013</td>
<td>Lilley, D &amp; Wilson, G.</td>
<td>Integrates evaluation criteria and ethical assessment tool.</td>
</tr>
</tbody>
</table>

The rapid advancement of the theoretical element in this relatively young research field is testament to the interest and importance of it. The factors that constitute behaviour are highly influenced by cultural factors and therefore understanding the strategies to design for sustainable behaviour are central to this research. The study by Elizondo (2011) attempted to understand how culture could inform the DfSB strategies, however, it culminated in a methodological approach for gaining empathy with users in different
cultures, rather than a theoretical understanding of what influences behaviours in different cultures and a process of informing designers looking to change behaviours.

One of the objectives of this research is to investigate the behaviours of individuals regarding their interactions with key resources as well as the external factors that may influence these behaviours. In the next sections literature relating to the use of key resources, from countries at varying stages of development, has been reviewed, along with external factors such as politics, trade and geography. A broad overview of the situation between developed and developing countries is given from a macro perspective, together with examples of specific behaviours from individuals at a household level.

2.7 Resource Use

2.7.1 Food

One of the greatest strains on the environment over the last century has been the industrialisation of the agricultural industry. Producing fertilizers for nitrogen fixing crops to feed livestock has been linked to global warming, photochemical smog, acid rain and biodiversity loss (Kalaugher, 2010). It is estimated that agriculture is responsible for almost 30% of greenhouse gas emissions, with the raising, processing and production of livestock accounting for the bulk of this figure (Pellitier & Tyedmers, 2010). The main issue has been the soaring demand for meat. The average person from the UK consumes 79.6kg of meat per year and the average North American 125kg (Browne, 2009); over double the recommendations of both the respective health departments (Gitig, 2010). Part of this can be attributed to the disproportionately low cost of food in the developed world. Recent research shows the average Indian family spends proportionately twice as much of their income on food than in the UK, whilst in the Philippines they have to spend four times as much (Oxfam, 2011).

In developing countries, meat is still relatively expensive and eaten sparingly. In Nicaragua just 14.9kg of meat is eaten per person per year (Browne, 2009). Traditionally diets with a low consumption of meat use plant protein such as soybean which has a cumulative effect of two orders of magnitude less resource impact than diets that use animal protein (Kalaugher, 2010). Demand for meat, however, is set to double by 2050, predominantly caused by increasing populations and larger middle classes in developing countries (Kalaugher, 2010). China’s meat consumption doubled from 25.8kg - 52.4kg between 1990 - 2002 for exactly that reason (Browne, 2009).
Inefficiencies in the production and consumption of food contributes to the misuse of resources such as water, land, energy, and labour. It is estimated that one third of all food produced goes to waste, with consumers in wealthy countries wasting almost as much food (222 million tonnes) as the entire food production of sub-Saharan Africa (Cederberg et al., 2011). This does not tell the whole story, however. A recent study by the Food and Agriculture Organization of the U.N suggests that food losses from developing countries are similar to those of developed countries - with 630 million tonnes per year wasted compared to 670 million respectively (Cederberg et al., 2011). The point in the cycle at which the food is wasted is however very different in each case.

In developing countries the majority of food is wasted during the production, processing and distribution phases - with the solution being to improve technology and infrastructure. In developed countries nearly all the food is wasted at a consumer or retailer level - throwing edible food into the bin, with the solution being to improve behaviours and attitudes. Average consumers in North America and Europe waste around 100kg of food each year, compared to just 6-11kg per year in sub-Saharan Africa and most of Asia (Cederberg et al., 2011).

This resource inefficiency and misuse is ever more clear when considering the packaging and distribution of foodstuffs. As previously discussed, if correctly implemented, processing, packaging, and distribution of food can lead to more efficient production and considerably less wastage. However there is a fine line between less wastage and efficient production. Modern supermarkets often come under scrutiny for their excessive packaging and food miles due to the centralised distribution model. As consumers have become more aware of their environmental impact they have started to demand more local, seasonal goods, however this is not always as it seems in the supermarkets. Strawberries are one example of this; some strawberries grown in Cambridgeshire are transported up to Aberdeen in Scotland to be packaged before being taken all the way back down to Cambridge supermarkets and labelled ‘locally grown’ (Simms, 2007).

In today’s modern society, where brand is key, packaging is as much of a marketing tool as it is a method of protecting food. As a result, individually packed products wrapped in all manner of materials with no secondary use can now be seen lining the supermarket aisles. A recent study concluded that on average 40% of the packaging from UK stores was not recyclable and would end up in landfill (Local Government Association, 2011). Whilst increasing the recyclability of packaging is important, environmentally aware consumers will
know that it makes more sense not to package goods at all if possible. Menzel has created a good visual portrait of this in the book ‘What the World Eats’ (2008) whereby the weekly shopping for a family in a developed country is covered in glossy, bright packaging, compared to the natural food with limited or re-useable packaging in less developed countries (Menzel, 2008) (figure 2.11).

Figure 2.11 - Packaging differences between UK & India (Menzel, 2008)

The most common reusable item seen in the developing world is the refillable glass bottle. In the developed world single-use glass bottles are collected from the home and transported to recycling centres by the local authorities. They are then sorted, crushed, and remoulded to form more bottles – an energy intensive process. In developing countries, rather than recreating a bottle, empty bottles are taken to a central plant, cleaned and refilled (Medina, 2000). The empty bottles hold a small value which ensures few bottles are wasted. This system is also practiced in some parts of Europe, notably the Scandinavian countries, and also historically in the UK; however, it has been phased out in favour of low cost, single-use PET bottles. Whilst the energy involved in the beverage packaging industry is completely determined by the distribution model, in terms of waste generation, refillable containers are considerably more favourable (Salhofer et al., 2007).

The mass industrialisation of agriculture has created an over-reliance on energy to produce basic foodstuffs. A generation ago, when farming was smaller scale and less industrialised, one unit of energy in the production of food accounted for one unit of energy ‘in the mouth’, today it requires three units of fossil fuel energy in production for one unit ‘in the mouth’ (Speth, 2008). Unlike the developed world, where the countryside is dominated by medium- and large-scale agro-industrial units, the developing world rely more on small-scale, community based farming operations (Toledo, 1997). “The United States uses three times as much energy per capita for food production as developing countries use for all energy-
consuming activities combined, including food production” (Princen, 2002, p.88). In fact due to the diverse conditions of developing countries such as price volatility, politics, climate, security and infrastructure, these small scale farms can be much more productive than larger farms (Flora, 2010). Rather than trying to change these small scale practices to larger industrial agriculture - placing an over-reliance on the increasingly scarce resource of energy, a new strategy for rural modernisation rather than industrialisation would be a more efficient use of time and resources (Toledo, 1997).

One of the main components of industrialising agriculture is specialisation by planting monocrops. By specialising in one crop, the yield, the production per unit area of a single crop, will increase. By contrast, planting multiple crops mixed together will result in low yields of individual crops, but a high total output of food. Mayan peasant farming is considered unproductive because it produces just two tonnes of corn per acre compared to the 3 – 4 tonnes of modern agriculture, however the overall food output is 20 tonnes per acre when other crops such as vegetables, beans, and fruits are taken into account. Planting monocrops also has serious consequences; the large number of crops in one area means they are prone to pest attacks and disease which spread quickly; they are very resource intensive - requiring large quantities of water and fertilizers, which in turn, adds to the cost of growing them and has serious environmental effects; and they are generally controlled by large multinationals who control the supply of seeds, fertilizers and other equipment (Shiva, 2001). Farmers can also suffer from an overdependence on a single crop which is vulnerable to price fluctuations from the larger macro-economic system which is beyond their control.

2.7.2 Water

Clean, unpolluted water is the building block for all life on earth. The surface of the ‘Blue Planet’ is 71% water, yet only 3% of this is fresh, unsalted water, and only 1% of that is available to us (Blue Gold, 2008). Whilst it can be considered a renewable resource as part of the water cycle, pollution and over-extraction of ground water at a rate faster than it can be replenished endangers the availability and re-use of this vital resource. There are three main areas of water use: agriculture, industry, and domestic use.

Agriculture takes up the lion’s share of water consumption with 70% of the water used globally, whilst industry takes up 22% (Kirby, 2003). Inefficient farming and production techniques mean simple goods require large quantities of water to produce. By far the most water intensive products are animal based, with beef using 15,500 litres of water per kg (Hoekstra & Chapagain, 2007). This has knock on consequences as food goods such as beef,
rice and sugar have country specific import/export regulations, yet water consumption is a
global issue. Freshwater supplies are being depleted because of the emphasis of trade, and
measures to improve the efficiency of water footprints rely on industrialisation using fossil
fuel energy (Hoekstra, 2010).

Governments have come under intense pressure from environmental groups for selling the
rights to reserves of groundwater to multinational corporations. The extraction of hundreds
of thousands of gallons of water per day impacts greatly on the environment, often
contaminating aquifers, drying up streams and rivers, reducing lake levels, damaging
habitats and wildlife and restricting water supply to local residents (Ayma et al., 2011). In
Nottingham, New Hampshire, USA the local residents did everything in their power within
the law to stop a multinational extracting 400,000 gallons of water per day, yet the local
government still sold the permit to do so (Ayma et al., 2011). In developing countries
multinationals have also caused controversy. There have been cases in parts of Africa where
Coca-Cola have controlled the local water supply and have sold bottles of cola cheaper than
potable water to local residents (Blue Gold, 2008). The problem with privatising the water
supply is that it turns water into a commodity, with multinationals more concerned with
profit for shareholders than preservation of the environment or a fair deal for local
residents; therefore, water is often hard to obtain by poor members of the community who
cannot afford the prices. Defendants will argue, however, that a similar situation occurs
with state run water management departments which are often inefficient and lack
resources to expand water supply networks to be accessible to all (Scanlon et al., 2004).

Country specific water consumption data can be misleading. Goods consumed by the
inhabitants of one country may have been produced in another country and, therefore, the
real water demand of a population is much more than national water withdrawals suggest.
The reverse is also true, whereby countries with a high water withdrawal rate may produce
goods to export for consumption elsewhere (Hoekstra & Chapagain, 2007). Nearly 95% of
water consumption is hidden in the food, energy, products and services we consume
(National Geographic, 2013). Generally speaking in the developed world, countries with a
high water footprint consume more water intensive products (e.g. beef), where as in the
developing world high water footprints can be due to export led manufacturing and poor
agricultural practice as a consequence of limited adoption of technology (Hoekstra &
Chapagain, 2007; Blue Gold, 2008). In developed countries the water loss is due to the
attitudes and behaviours of consumers, where as in the developing world, water loss is
caused by a lack of modern technology. This point is illustrated by the treated, potable water used in developed countries for such tasks as flushing the toilet, washing clothes and watering the plants, unlike the grey water used in many developing countries for these activities.

Domestic water consumption has multiple factors; comfort, convenience, availability, cleanliness, as well as cultural background and household occupancy all influence domestic water consumption. People living in single-occupancy households can increase water consumption per capita by up to 40% (DEFRA, 2007). This dramatically impacts a country’s water consumption levels considering in the UK 30% of households are single occupancy (ONS, 2003) compared to just 5% in Latin America and Asia (TGI, 2007).

In developed countries the availability and low cost of water has meant “most water related actions are continuously performed as part of habits or routines that are more complex than one single action” (Elizondo 2010, p4). People often opt for the most convenient solution rather than the most sustainable.

Bathing practices within the home is one of the main areas of interest for previous research, largely because of its resource intensive nature. A recent study in the Netherlands showed that bathing accounted for 41% of all household water use, with showering accounting for 95% of this figure (Kuijer & de Jong, 2009). In the UK figures show that bathing accounts for one third of the 153 litres of water used per day in the average home compared to 25 litres of total water use in the average Indian household (Dardel, 2008). In fact showers account for the largest single water consumption practice in the home in the Netherlands at nearly 50 litres per person per day (Karakat, 2009). One cross-cultural study investigated the differences in bathing habits between the Netherlands, India and Japan (Matsuhashi, 2009). The findings showed that Dutch participants used only showering as a technique for bathing, using between 50 – 100 litres of water per shower, compared to Indian participants who used a reservoir bathing technique which used 20 litres per wash. Japanese participants used a mixture of showers, reservoirs and baths with a considerably greater water consumption rate than both India and the Netherlands (Matsuhashi, 2009).

Studies by Wilhite (1996) support the idea of the Japanese bathing technique to be more resource intensive as it involves numerous transitions between the shower and the bathtub. The bathtub is filled with hot water and used as an indulgent relaxation tool important within the values of Japanese culture (Wilhite, 1996). Values play a huge part in the resource
intensity of bathing, as different people will bathe for different reasons. Some may simply bathe for hygiene reasons – to keep clean, whilst for others bathing will be a process of relaxation, body temperature regulation, waking up or winding down, or purification of the body and mind (Karakat, 2009).

These relatively recent and exploratory studies have resulted in a wide array of insights into sustainable behaviours and have allowed different perspectives to be addressed surrounding the context of bathing and the values of the bather. In this instance the insights have been taken forward to develop a reservoir style product, originally based on the Indian bathing technique, that can be adopted by people who typically shower to reduce energy inputs by up to 90% (Kuijer, 2011), which is currently in testing in the Netherlands.

Recently Whirlpool withdrew a new washing machine model from Brazil as sales were so poor. They had spotted the opportunity to sell washing machines to the emerging Brazilian consumer class, however had failed to recognise the difference in behaviours from their usual European or North American markets. In Brazil they wash clothes more regularly but fewer items than in the USA or Europe. Whilst eventually a washing machine was designed to fit the market, there was no published research into how the difference in washing behaviours affected sustainability (Sirkin et al., 2008).

Cross-cultural observations have also been made regarding washing up habits. A study by Wilhite (1996) made cultural comparisons between Norway and Japan. In Norway all the participants of the study used a basin to wash up in whilst in Japan the majority left the tap running whilst washing dishes. It is thought the main reason for this is because Japanese sinks are small and therefore leaving the water running is more space efficient. Another reason is that dish washing habits are not linked to a traditional routine in the same way bathing and washing clothes are. Another interesting insight is that Japanese respondents varied the temperature of the water used for washing dishes depending on the season, suggesting that the temperature has more relevance to personal comfort than to hygiene or cleanliness (Wilhite, 1996). A more recent study into the habits of dish washing and their impacts has been conducted between the UK and Mexico (Elizondo, 2011). The findings showed great differences in the process of dishwashing between the two regions. Mexican participants used an ‘open/close tap’ approach to washing dishes, soaping the dishes and then rinsing them, whilst British participants filled a large bowl with hot, soapy water, and didn’t wash off the soap after cleaning. Elizondo concluded that energy related routines are based on habits influenced by people’s personal and environmental contexts. From these
findings ‘Personas’ were created which designers used to empathise with the user, creating concept designs aiming to reduce the impact of the dishwashing process (Elizondo, 2012).

2.7.3 Energy
The main factor in the development of the world’s wealthiest countries has been the abundance and availability of cheap sources of energy. There is a clear and strong correlation between increased energy supply and increased GDP and economic growth (Meier & Munasinghe, 2005; Klare, 2008). This development, however, has been at the expense of finite fossil fuels such as coal, oil, and gas. As these resources have been extracted greenhouse gas emissions have poured into the atmosphere causing climate change and pollution (Walker & King, 2008). This over reliance on cheap fossil fuels, however, is so ingrained into our consumer culture that changing the way we use it is a very hard task.

The world is, however, at a turning point. Many feel that the days of cheap available fossil fuels are ending as reserves of fuel are getting harder to find and extract from the earth (Klare, 2008). Disasters such as the Gulf of Mexico oil spill could potentially become more common as companies employ more daring and risky extraction techniques to access resources that have been traditionally inaccessible. This will have serious consequences on the environment and the cost of fuel to the consumer, leading policy makers and scientists to debate the future of development.

The global energy debate is a web of political and economic deliberation. Protocols that have tried to be implemented globally have been ignored by different countries at different stages and thus fall short of achieving their aims. The two main antagonists are the USA and China. Whilst it can be concluded from historical and per capita emissions that the USA is the greatest cause of environmental problems, China has recently overtaken the USA as the largest polluter in the world due to growth led by the extraction of cheap coal (Walker & King, 2008).

One of the figures often cited is the opening of a new coal fired power station every week by China. However, it is not as simple to conclude that this increases Chinese emissions because the expansion in the coal sector has been caused by the growth of the manufacturing sector of goods, typically exported to other countries.

Whilst developed countries drag their heels over the adoption and retrofitting of greener energy the developing world has the opportunity to build their economies around new
green technology. Brazil’s per capita power emissions are very low because of the high uptake of hydropower in the country. Similarly, India has low power emissions due to a large investment in wind farms. One of the reasons developing countries are turning to green technology is because they have seen first-hand the destruction climate change can have through extreme weather and natural disasters because many of these countries have been affected by these issues (Walker & King, 2008).

On an everyday level it is fairly obvious to suggest that the more developed nation will use more electricity. Higher consumption levels and greater disposable income means more gadgets and bigger houses. In Brazil 91% of homes have four rooms or fewer compared with 44% of British homes having more than seven rooms (Greendex, 2010). No surprise then that the UK’s per capita primary energy consumption was 161.7 million btu (British thermal units) compared with just 51.2 in Brazil or 12.8 in Nicaragua in 2006 (Energy Information Administration, 2006). Ultimately, however, the behaviour of individuals from these countries, motivated by values ingrained by their culture also contributes to the lower energy consumption rates (Wilk, 2002).

As previously suggested, people from Brazil have different behaviours when it comes to washing clothes. A recent study by Globescan for the National Geographic concluded that out of the 17 countries tested Brazil was “the most likely to use cold water to wash clothes to save energy”, whilst people from UK “were very unlikely to use cold water to wash clothes” (Greendex, 2010).

It is also more common in developing countries, particularly in rural areas, to use bio fuels as a source of heat generation. Whilst there can be health implications if the right technology is not adopted and sustainability issues depending on where the bio fuel has been sourced, there is potential for the behaviour itself to be very sustainable if the correct fuel and technology are implemented (Bhattacharya & Salam, 2002).

Recent developments in technology have, to some extent, increased the consumption of fossil fuels. Alternative technologies such as passive cooling, which allow the temperature of a building to be regulated by the design of the building itself, have been slow to be implemented due to the ‘quick-fix’ of air conditioning units that have seen a surge in demand over recent decades in developed countries due to availability of cheap fossil fuel (Engelfried, 2010). In developing countries where actively cooling the air is expensive, less
energy intensive techniques are sometimes used to regulate the temperature such as thick clay walls and insulated roofs (Sanjay & Chand, 2008).

Heating and cooling within the home is commonly associated with building size, use, technology implementation and climate of the area, however the behavioural aspect has, until recently, often been overlooked, partly because of its complexity (Wilhite, 1996; Shove, 2003a). Whilst critiques of cross cultural comparison will claim there are too many variables between locations to draw significant conclusions, the few studies that have adopted the approach have found the differences and similarities between the contexts are relevant to the formation of household culture and resource use behaviours (Wilhite, 1996).

In his study of energy use between Oslo, Norway and Fukuoka, Japan, Wilhite (1996) noted that the infrastructure of both cities is similar with comparable living standards. In both cities the residential sector constituted the largest demand in energy increasing at a rate of about 3% annually. Houses were of a similar size although the insulation greatly differed partly down to the vastly contrasting climates. He compared energy prices – which were higher in Japan but in line with the comparatively higher wages there. Work and gender roles between the two cultures also varied greatly. Using these comparisons he was able to analyse the resource intensity of a particular behaviour and relate it back to the similar or differing factors observed between the two locations. From this a hypothesis was created for the reasons of the behaviour and the likelihood of being able to change that behaviour.

The most significant difference in space heating between Norway and Japan was the area which was being heated. Norwegian participants used central heating or electric heaters to heat all rooms in the household so they were able to move freely between rooms without experiencing discomfort. In Japan, participants only heated one room, or even only part of a room using electric personal heaters and electric blankets (Kotatsu). This explained partly the requisite for having a hot water bath for comfort and relaxing.

These differences in heating of space are as a consequence of various cultural reasons. In Norway space heat has an important symbolic value as, along with lighting, it creates a ‘cosiness’ to the home that is important to family togetherness and social affirmation when friends or family visit. Cosiness has become a ‘cultural energy service’ which is deeply rooted in the social, cultural and symbolic presentation of the home. The Japanese were more akin to lowering temperatures at night or when they were away from the house. This is partly due to high energy prices and fire safety with electric heaters, but also culturally as
the Japanese are more accustomed to entering cold rooms, where-as Norwegians prefer to enter pre-heated rooms. It was also noted that the Japanese preferred a single, central fluorescent light for a room, rather than the four or five bulbs the Norwegians preferred to get the ‘cosiness’ right. These energy intensive behaviours may have been caused by habit formation during decades of cheap energy in Norway, or by the fact that bills are paid yearly. Estimates show that billing bi-monthly (similar to Japan) led to a 10% reduction in energy usage (Wilhite, 1996).

In the study Wilhite argues that the energy intensive behaviours such as heating for Norwegians and bathing for Japanese are culturally significant forming ‘cultural energy services’ and he advises promoting technologies which provide the same cultural service with less energy.

As with water, single occupancy homes are much less energy efficient due to economies of scale. Many people living under one roof are much more energy efficient on a per capita basis due to the sharing of water heating, refrigeration, space heating and appliances (Wilk, 2002). Generally speaking, household sizes in developing countries are far greater than in developed countries.

2.7.4 Materials
The use of materials in the home directly influences resource impact. One of the major noticeable changes that has occurred with industrialisation and globalisation has been the devaluation of consumer goods as cheap products from abroad have flooded the market. This has had various knock-on effects - not least the increase in product obsolescence as new products can be bought more cost effectively than repairing old products. This, in turn, has meant that there is a limited market for second hand products. Whilst the Internet has brought about fairly recent improvements to this situation e.g. Ebay and Freecycle, the abundance of cheap consumer goods means many perfectly usable items are still going to landfill (Schor, 2010).

In the developing world the difference in monetary value of getting something repaired or buying a new item often means that it is possible to repair something for a fraction of the cost - thus increasing a products lifespan. Even after its intended use it is often re-used for another purpose. Whilst recycling is now an integral part of society in the developed world, it has become a privatised industrial process and is, therefore, costly and controlled by legislation. A lack of emotional bond between a person and the ubiquitous object coupled
with a reduction in craft skills, means the object is unlikely to get re-used or re-purposed as something else (Flavin, 2010).

This growth in consumption of ‘things’ has been directly linked to economic growth, as more disposable income allows for the consumption of more ‘things’. The term ‘fast moving consumer goods’ was traditionally coined for products such as toothpaste or cleaners that are used up and replaced often. Recently however this term can now be used to describe clothing, furniture and electronic goods (Schor, 2010). This has caused a cyclical paradox called ‘backfire’ or the ‘rebound effect’ whereby changing to a more ‘green’ lifestyle, for example by installing insulation in the home, means energy consumption is lower, but disposable income becomes higher, and thus consumption increases (Druckman et al., 2011).

2.8 External Factors

2.8.1 Leapfrogging
One way to reduce the environmental impact in developing countries is to ‘leapfrog’ to more sustainable consumption. Rather than adopting ‘western’ inefficient and fossil-fuel dependant technologies, emerging economies can use more modern, clean technologies and sustainable consumption patterns in their rapid development; a process known as ‘leapfrogging’ - essentially skipping the ‘dirty’ industrialisation phase of traditional development (Perkins, 2003; Tukker, 2005; Schäfer et al., 2011).

Supporters of leapfrogging policies indicate that as well as the environmental advantages, leapfrogging would help alleviate poverty, facilitate new business and increase economic growth, possibly surpassing current economic development levels in mature markets. Despite this, leapfrogging remains controversial with opponents arguing that developing countries are being pushed into expensive leapfrogging strategies at the expensive of faster development through traditional means (Fong, 2009). Others point towards the high failure rate of modern technologies in developing countries because of a lack of intermediate technologies. They advocate a ‘lavatories before laptops’ approach based on the understanding that some developing countries have more pressing problems than computers and high speed internet; such as basic sanitation and healthcare (The Economist, 2008).
Defining what leapfrogging means in practice is difficult; however Perry (2003) argues that five conditions need to be met:

- A shift towards ‘clean’ production approaches;
- Action from the outset;
- Technology transfer from developed economies;
- Strengthening the incentive regime; and
- International assistance.

Whilst an admirable goal, discussions and strategies on leapfrogging typically have ambiguous objectives, make simplistic assumptions regarding leapfrogging technologies, and have an incomplete understanding of the requirements of leapfrogging in potential economies (Perry, 2003). Furthermore, in emerging economies there is often little data available on the different economic classification groups and their consumption habits and aspirations, making it hard to develop target-group-specific products and services (Schäfer et al., 2011).

A further challenge is the ‘lock-in’ effect, which suggests that countries that have already invested in traditional industrialisation methods, even those in the early stages of their industrialisation process, will be ‘locked’ into those environmentally damaging technologies with ever-increasing costs to escape to more sustainable processes (Perry, 2003).

One recent study showed that consumption in Southern Brazil was similar to the Western model. Comfortable housing, cheap electronic devices, personal mobility (private car), and modern leisure activities were all regarded as highly important aspects of everyday life. There were no signs of leapfrogging to sustainable consumption, with well-being, social and sustainable strategies not compensating for tendencies towards resource-intensive lifestyles (Schäfer et al., 2011).

Products and behaviours are steeped in symbolism, as discussed in section 2.4.1, and thus sustainable alternatives will only be adopted by those minority consumers wishing to portray a sustainable image. “If alternatives are to compete with dominant practices, they must be laden with attractive symbolism. Unless the image of low impact practices attains the attraction and allure of consumption, that is the symbolism of being joyful, passionate, exciting, fun sociable, modern, and progressive, not more than a few deliberately alternative consumers will turn to it” (Ger et al., 1999; p12).
2.8.2 Socio-cultural factors

Consumerism is the defining characteristic of modern developed nations (Flavin, 2010; Speth, 2008). From a young age people are exposed to hundreds or thousands of consumer symbols such as logos, jingles, slogans, and celebrity endorsements every day. A study in 2002 (cited in Assadourian, 2010) concluded that British children could identify more Pokemon characters than common wildlife species, whilst other studies have found that youngsters can identify brands before they learn to read (Assadourian, 2010).

Relatively recent developments by organisations such as the New Economics Foundation have altered the traditional view that high consumption levels lead to well-being and success. Governments have taken note of these findings and have tried to implement happiness measures, most notably in the UK and France, however there still remains a dilemma that to pursue growth requires increasing consumption as outlined in the previous section on development (chapter 2.3).

Governments have, therefore, promoted consumption often by advocating large multi-national corporations as these are seen to increase export led growth and increase employment. The strategy of these brands to sell more stuff, to more people, more often, has led to a culture of resource misuse and obsolescence. A ‘keeping up with the Joneses’ mentality means people grow tired of their purchases as fashions change or technology gets superseded (Ingram et al., 2007). Cheap, homogeneous goods where the consumer is completely detached from the production process means less of an emotional attachment is made by the end user to the product and thus the user is more inclined to replace the product whenever possible (Hirsch, 1976). This continuous throwaway cycle has serious effects on the waste disposal system and is another serious drain on the earth’s resources (Schor, 2010).

Traditionally, developing countries have showed fewer consumerist traits as a lack of disposable income has meant large multi-national corporations have tended to view these nations more as producers rather than consumers (Wilk, 1998). However in recent years with the emergence of a middle class, many developing countries are now increasing consumption - which could have huge environmental consequences if the same pattern of ‘Western’ consumption is followed (Flavin, 2010). Many fear that emulation of the ‘Western’ model will occur as the developed countries control most of the mass media and advertising, however studies have demonstrated that people are more likely to emulate local elites than
a generic, global consumption model, and in many cases - foreign models for consumption are rejected (Wilk, 1998).

One of the key differences between developed and developing countries regarding their cultural identities is the notion of individualism or collectivism as defined by Hofstede (1980). The most common and noticeable differences between Hofstede’s five ‘Cultural Dimensions’ outlined in table 2.3 below is that developing countries such as those in Asia, Africa, and Latin America show very high rates of collectivism, compared to the high rates of individualism seen in developed nations such as the USA and Europe. In a collectivist society individuals are integrated into strong, cohesive groups such as the extended family, religious, political or social groups; whilst in an individualist society ties between individuals are loose and people are generally expected to look after themselves (Hofstede, 1980). This cultural difference between societies can play a large part in the protection and sharing of resources that are, ultimately, meant to be accessible to all.

Table 2.3 - Hofstede’s Cultural Dimensions (1980)

<table>
<thead>
<tr>
<th>Cultural Dimension</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>Power Distance Index</td>
<td>How much the less powerful members of organisations and cultures accept and expect that power is distributed unequally e.g. in Australia the power ratio between normal employee and boss is low where as in China it is high.</td>
</tr>
<tr>
<td>Collectivism / Individualism</td>
<td>How much members of the culture associate themselves with a group or just do things typically for themselves. The UK and USA have high individualism, where as Latin America has low individualism.</td>
</tr>
<tr>
<td>Masculinity / Femininity</td>
<td>Masculine cultures have high values in competitiveness, ambition and wealth creation, whilst feminine cultures have high values in relationships and quality of life e.g. Japan vs Denmark.</td>
</tr>
<tr>
<td>Uncertainty Avoidance Index (UAI)</td>
<td>Avoiding anxiety by minimising uncertainty. High UAI are cultures with rules and structured activities e.g. Japan vs Jamaica.</td>
</tr>
<tr>
<td>Long-Term Orientation</td>
<td>In long term oriented societies, people value actions and attitudes that affect the future: persistence/perseverance, thrift, and shame. In short term oriented societies, people value actions and attitudes that are affected by the past or the present e.g. China vs UK.</td>
</tr>
</tbody>
</table>
Other external factors within a society or culture have massive consequences for the environment. As previously discussed diet is one of the single most influential aspects of an individuals’ environmental impact, with the high consumption levels of meat, particularly beef, in the developed countries contributing heavily to their poor environmental footprints. In other cultures diet and, consequently environmental impact, is greatly affected by religion. In India, approximately 80.5% of the population are Hindu and therefore do not eat beef on religious grounds, in total 31% of the population are completely vegetarian (India Census, 2001), compared to just 3% in the UK (Food Standards Agency, 2011).

2.8.3 Macro-economic / Political

Large organisations and governments have created a culture of consumerism over the last half-century or so to promote economic growth in the hope of increased well-being (Speth, 2008). This growth is achieved by shifting non-renewable resources from one economy to another; eventually however, the resources become scarce and expensive and thus growth becomes less profitable (Schor, 2010). This growth is often at the expense of the environment, which due to its global nature has been, until recently, considered a free resource with little retribution for its exploitation.

As governments have pushed consumer led economic growth they have been slow to introduce environmental regulation, as it is a global issue that is seen to hinder profits (Stiglitz, 2007). In 2005 George Bush, then president of the USA, the world’s largest polluter, rejected the International Climate Treaty’s Kyoto Protocol as it would damage economic growth (Speth, 2008; Walker & King, 2009). Other authors such as Stiglitz put particular blame on organisations such as the IMF “Finance ministers discuss global finance matters at the IMF, paying little heed to how their decisions affect the environment or global health” (2007, p.21).

One of the biggest causes for debate is the influence of industry lobbyists on policymakers. Many environmental policies in both Europe and the USA seem to get blocked after pressure from industry groups. Examples include the elimination of the ‘ZEV’ mandate in California, which required 2% of all new vehicles sold to be zero-emission following significant, prolonged pressure from auto and oil industry lobby groups (Who Killed the Electric Car, 2006). In agriculture, advisory boards and regulatory bodies set up by governments to control the industry have been headed by former employees of large agri-industrial corporations who have been seen to introduce policies that advantage larger scale farming at the expense of the quality of the food they produce and the environment (Food
inc., 2008); even plastic bag manufacturers lobbied to overturn a ban on using plastic bags in San Francisco (Huus, 2008).

Whilst some economists will admit there is an over-reliance on finite resources, many believe using up finite resources to aid development is a worthwhile sacrifice, as technology will develop before the resources become too scarce. Essentially they advocate using future wealth to avoid what they perceive to be a future problem (Walker & King, 2009). However as the previous sections have shown, technology is only a small part of the solution and often leads to complacency when using finite resources. As an example, cleaner diesel cars, which reduce emissions from 164 g/km of CO2 to 151 g/km of CO2 on a per car basis, have increased overall transport emissions as people are driving them more often; a problem known as the rebound effect (see chapter 2.6.4) (Swedish Transport Agency, 2011).

There have also been unintended impacts resulting from global political decisions. The trade embargo imposed by the USA on Cuba in 1960 meant the Cuban economy relied heavily on trade with the Soviet Union. Much of the Cuban farmland was turned into industrial, energy intensive sugar plantations that used harsh fertilizers. Since the fall of the Soviet Union, however, with Cuba still unable to trade with their nearest neighbours the USA, these sugar plantations have been turned into organic farm cooperatives (Rosset, 2000). Investment has been in alternative technologies such as biopesticides and biofertilizers and research conducted into growing cycles and techniques. This has resulted in 90% of the country supplied by local, organic produce, urban farms in the capital Havana supply the residents with 80% of their vegetables, and Cuba is now the world leader in sustainable, organic agriculture (Fairweather & Asquith, 2010).

If implemented correctly, government policies can dramatically change people’s behaviour and the effect they have on the environment. 60% of Brazilian households buy their electricity from ‘green sources’ because of the government’s large investment in hydropower and bio-ethanol (Greendex, 2010). Increasingly, as energy prices continue to rise consumers are demanding more energy efficient products, and this can also affect environmental footprints as large organisations are coerced into designing more efficient services for the market. As discussed earlier, attempts by governments, notably the UK and France, to introduce happiness measures to try to gently invoke social reforms in the direction of sustainability and well-being could bring about potential change if the conflicting interest of consumption and growth can be controlled by governments. Only time will tell if this can be achieved.
2.8.4 Geographical

As well as the numerous human factors identified there are also physical geographical factors that have influenced the level of development of a country and the behavioural patterns of its people. One of the largest of these factors is climate. Generally speaking, the majority of developing countries, or the ‘Global South’, are located in hot, tropical climates, rather than the temperate zones of the developed world. In these hot climates the land is less fertile, water is more scarce and diseases can flourish, as well as sporadic rain patterns contributing to a short growing season for crops. Whilst climate may be perceived as a hindrance to agriculture, it potentially promotes sustainable behaviours in a variety of different activities. House sizes are smaller in developing countries as more of the daily activities can be done outside therefore less energy is used to heat homes (Greendex, 2010). Water for bathing is also at a lower temperature, as the ambient air temperature is so hot (Matsuhashi, 2010).

The physical location of the country itself also has an effect on the development of the nation and the resources it uses. Traditionally, countries have developed around maritime trade routes, whereas developing countries may suffer from not being able to gain access to waters to trade with their neighbours. “Many of the world’s poorest countries are severely hindered because they are landlocked; situated in high mountain ranges; or lack navigable rivers, long coastlines, or good natural harbours” (Sachs, 2005, p.57). The level of development of neighbouring countries also affects the development of a country as trade is easier and mutual growth can be achieved.

There is also an historical context to development. Countries that industrialised earlier have been able to exploit raw natural materials from less developed countries, usually paying very little money to very few people, for the resource. This has hindered the development of such nations, whilst also contributing considerably to environmental degradation, with limited consequences for the more advanced nation (Loomba, 2005).

2.9 Conclusions

The findings from the literature review have given a greater understanding of the complexities of designing for sustainable behaviour and the factors that affect the design process. Starting from the broad perspective of defining the relevant terms (culture, development, and behaviour), the review then narrows to consider the various consumption and behaviour theories, before considering the resource impact of everyday behaviours in different contexts and relating this to design opportunities. By reviewing the
relevant theories and literature of the research area, this chapter therefore completes objective 1, presented at the beginning of the research (Chapter 1.3). Figure 2.12 highlights the key areas that have been reviewed and their inter-relationships.

Figure 2.12 - Theories reviewed

The following main conclusions can be drawn from the topics reviewed in the literature:

2.9.1 Defining the terms

The terms that are used to frame this research enquiry are constructed from a complex mix of cross-disciplinary research fields. As a result, clear definitions of recognised concepts are debated considerably amongst scholars.

The term culture can be applied to individuals, groups, religions, regions or countries and even corporations, ethnicities, age as well as many others. When beginning a cross-cultural research project, Whilite suggests highlighting differences and similarities in aspects of everyday life to open avenues for theoretical enquiry (1999). In anthropology the common themes that appear in many definitions are the importance of symbolic values, shared knowledge, and learned behaviour (Tylor, 1871; Geertz, 1973; Hofstede, 1984; Banks & McGee, 1989). These complexities around the term have meant culture has often been underused as a tool to aid sustainable design (Elizondo, 2012; Matsuhashi, 2011).

Similarly the term development has an enormous array of measures that are often contradictory, incomplete in terms of their scope, and show little consensus in their application. Some measures, such as those from the World Bank (2012) look purely at the monetary outlook of GDP or GNI, whilst other measures, such as the Human Development
Index (2013), consider health, wealth and education. However, because there is such a vast array of measures, there is little common consensus over the best measure to use. Recent developments by governments such as in France and the UK have attempted to introduce happiness and well-being measures into government policy, however adoption has been slow by departments typically run by traditional economists and confusion of representation of happiness and well-being figures (Thompson & Marks, 2008).

2.9.2 Behaviour and Designing Behaviour Change

As the research enquiry is related to the behaviours of individuals from different contexts, it was important to understand the various theories and strategies that affect behaviour and the implications for design.

Broadly speaking, consumption theory can be classified into three main approaches; individual choice theory, social theory, and cultural theory (Wilkinson, 2002). Individual choice theorists see consumers as rational actors making a cost-benefit analysis on all decisions (Edwards, 2000). Social theorists see consumption heavily linked to status and the human need to form social order (Wilkinson, 2002). Where-as cultural theorists see consumption as an expressive act heavily laden with symbolism (Lury, 1997). The literature suggests that consumer’s behaviour is affected by their understanding, motivation and ability to change the course of their actions.

There are two predominant theories that make up the behaviour change field; from sociology is practice theory and from social psychology is behaviour theory. In practice theory the emphasis is on people as ‘carriers’ of behaviours arranged by various interconnected internal and external elements. It lacks application in design research, as the understanding of design as isolated and non-temporal components is out-dated (Wilson, 2013). Behaviour theory concerns the individual as a rational actor at the centre of behaviour and is a well-defined concept applied in design practice.

Design for Sustainable Behaviour is a relatively new, but incredibly fast-growing area of research concerned with influencing user behaviour towards more sustainable action during the use phase (Lilley, 2009). A key theme central to all researchers working within this area is an axis of power in decision making between the user and the product or designer. However, due to its rapid expansion in recent years there is still confusion and disagreement over the adoption of certain strategies and the terminology used (Wilson, 2013). Furthermore, its rapid advancement means keeping up and building upon prior research is
dependent on publishing dates. Recent models by Daae and Boks (2013), Wilson (2013) and Renström et al. (2013) have progressed the area, and helped in forming a background to the research; however they were published after the main data collection for this study was completed.

Nevertheless, the novel aspect of this research enquiry to look at how culture affects sustainable behaviour can significantly add value to the growing DfSB research field, as there are currently very few studies that attempt this (Elizondo, 2011).

There is a considerable overlap in the theoretical definitions of the factors that constitute behaviour and the concept of culture as shared and learned behaviours. Peoples’ habitual behaviours due to their context and physical location such as culture, social class, education, climate, geography, public policy, taxes, regulations, income, cost of goods etc. have a real social and environmental impact on resource use. The DfSB theory identifies antecedents of behaviour but does not demonstrate how these differ between different cultures and how this information is useful to designers looking to create products that change behaviour – an area this research advances.

2.9.3 Household Resource Use

Resource misuse and waste is common in both developed and developing countries. In developing countries, however, the resource is wasted in the production, processing and distribution stage of the good. The solution is to improve production technology, infrastructure, and delivery logistics. People’s everyday actions and behaviours when using the resource tend to be less wasteful and have a relatively low environmental impact. In developed countries, on the other hand, the misuse and waste of resources is due to the actions of individuals on an everyday level. The solution is to alter attitudes and behaviours of individuals to lower their environmental impact.

Whilst improving the production, processing and distribution of goods can reduce the amount of waste, the industrialisation and reliance on technology means an over-dependence on energy, often fossil fuel based, is created.

Per capita or country specific water, energy, or material footprints can be misleading as high figures could be due to exports of resources to foreign markets. Similarly countries with relatively low resource footprints could be importing most of their goods from abroad.
2.9.4 External Factors

The relentless ambition to grow economically has created a culture of consumerism in developed countries which has led to product obsolescence with large quantities of usable goods or materials being dumped in landfill. In developing countries it is cost prohibitive to continually change goods and therefore products and materials are re-used or recycled more often. Also, a greater influence in the production or collection of a good means that a greater emotional attachment, or awareness of origin, is made to that good and it is less likely to be wasted.

Rapid growth in emerging markets has, however led to consumers following the West’s model of over-consumption. One theory to progress to sustainable development is leapfrogging; skipping the ‘dirty’, fossil-fuel intensive stage of development straight to clean technology and sustainable consumption. However, this is a complicated concept steeped in symbolism with greater positive connotations of low impact behaviours necessary for it to be fully adopted (Ger et al., 1999).

Current research and data on individual behaviours from different cultures relating to sustainability are limited and disconnected. Surveys such as Greendex (2010), commissioned by National Geographic, are solely quantitative, make no clear definition of developed or developing countries, and do not account for external factors such as geography, religion, or politics. Other research has tended to focus on the broader picture of policies to promote sustainable development, rather than looking at individuals or households.

2.9.5 Next Steps

There is a distinct lack of literature specifically related to the effect that culture has on sustainable behaviour. A lack of consistency when defining and measuring development, together with a limited understanding of behaviours of people from different cultures, ensures that any insights generated from primary research will aid both designers and policy makers in the creation of new products, systems and services for social and environmental gains.

The literature has offered valuable insights into the work currently available on the themes of this research enquiry. The DfSB strategies and behavioural models offer an interesting platform for which to develop research regarding the cultural aspects of DfSB. In the following chapters, the existing research will be taken further by understanding, using
primary research, the exact resource implications of households from different contexts and how this can affect designers when looking to promote sustainable behaviour through design.
3 RESEARCH METHODOLOGY

3.1 Introduction
The following chapter outlines the overarching approach and strategy under which this research is structured in order to meet the aim and objectives introduced at the beginning of this thesis. Firstly the nature of the research strategy is introduced along with the phases of research used to implement this strategy. Various different research approaches are then presented with their relevance to the aim of the research. Finally, the validity, trustworthiness and ethical implications of the research are discussed.

3.2 Research Strategy
Research is typically divided into two types of data collection: qualitative and quantitative. In quantitative research links between two or more variables can be analysed to support an existing hypothesis (Golafshani, 2003), usually in the form of numerical data - with the end result expressed as a statistic (Charles, 1995). It can be criticised for failing to provide a relevant practicality to ‘real world’ situations (Silverman, 2000). Qualitative research, on the other hand, is typically used by social researchers to gain an understanding of human behaviours where numerical information would not provide all the relevant knowledge about the study area (Robson, 2002). Typically it “uses a naturalistic approach that seeks to understand phenomena in context-specific settings…seeking illumination, understanding, and extrapolation to similar situations” (Golafshani, 2003). The research can therefore be described as qualitative user study as it reflects the human reality being investigated.

There are typically three different classifications for carrying out research in a particular field as defined by Robson (2002):
Table 3.1 - Classification of enquiry (adapted from Robson, 2002)

<table>
<thead>
<tr>
<th>Exploratory</th>
<th>To investigate emergent issues and seek new insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive</td>
<td>To portray a situation or problem</td>
</tr>
<tr>
<td>Explanatory</td>
<td>Explanation of a situation or problem</td>
</tr>
</tbody>
</table>

Research into sustainable behaviour is a relatively new field of enquiry and available resources regarding the effect culture has on sustainable behaviour are limited and disconnected as the literature has shown. This, together with the aim of the investigation to seek new insights, means the research will be exploratory in nature.

The research process can be described as iterative; where each phase along the journey informs and enriches future phases and the project as a whole. In total there are four main phases to the research:

- Phase 1: Review of the research field; in depth literature review (Chapter 2).
- Phase 2: Scoping study to elicit user behaviour and inform the direction of the intensive study (Chapter 4).
- Phase 3: Laundry behaviour exploration through qualitative user research (Chapter 5).
- Phase 4: Testing and validation of findings with designers (Chapter 7)

Within each section the data collection techniques have been selected to provide the most relevant data for the aim of the study. Figure 3.1 shows the stages of data collection and the techniques involved at each stage. Detailed information on the exact methods used to collect and analyse the data can be found in the relevant chapters, preceding the findings.

Figure 3.1 - Stages and Techniques of Data Collection
3.3 Research Approach

The qualitative exploratory nature of the study means data collection is both fluid and flexible, where the research is designed as a one off process aimed at answering the specific research questions rather than an ‘off the shelf’ process as followed in fixed design research (Robson, 2011). As such, writing a specific advanced blueprint of the study is inimical and unhelpful (Mason, 2007). Having said that, there should be a well-designed research strategy implemented to make observations in the field more relevant and insightful (Mason, 2007).

In qualitative research there are a multitude of different approaches from various different disciplines that can be applied in qualitative data collection. Robson (2011) categorises the various approaches of flexible design research into three main topics; case study, ethnographic studies, and grounded theory studies; whilst Creswell (2007) narrows down over thirty approaches to add three more key ones to Robson’s list; narrative research, phenomenology and participatory action research. Table 3.2 summarises the different approaches and their relevance to the research study.
<table>
<thead>
<tr>
<th>Approach</th>
<th>Definition</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case Study</strong></td>
<td>The study of a specific case, taking context into account, to understand a specific issue</td>
<td>Concentration on a small set of cases studied in their own right with importance on context.</td>
</tr>
<tr>
<td><strong>Ethnographic Studies</strong></td>
<td>Description &amp; interpretation of the culture and structure of a social group.</td>
<td>Typically used to describe cultural scenarios rather than apply theory. Long time-frames with groups of 20 or more participants.</td>
</tr>
<tr>
<td><strong>Grounded Theory</strong></td>
<td>Development of a theory of the social situation under investigation. The theory is derived from the study itself.</td>
<td>Based on having no relevant theories, therefore not appropriate based on literature on DfSB and Shove’s framework</td>
</tr>
<tr>
<td><strong>Narrative Research</strong></td>
<td>Collecting the stories of individuals and reporting those experiences chronologically by meaning</td>
<td>Storytelling of lives and experiences more commonly used in descriptive rather than exploratory studies.</td>
</tr>
<tr>
<td><strong>Phenomenology</strong></td>
<td>Describes commonalities in participants’ experience of a phenomenon</td>
<td>Descriptions of experiences, not explanations or analysis</td>
</tr>
<tr>
<td><strong>Participatory Action Research</strong></td>
<td>The researcher collaborates with participants to find a solution to a social problem within the research context</td>
<td>The research is to aid a specific group or community rather than build on theories to influence designers</td>
</tr>
</tbody>
</table>
Due to the numerous different approaches, used in a variety of different studies from a wide range of disciplines, it can sometimes be hard to determine which methodological approach is best suited to the research study. Ethnography, Narrative Research and Phenomenology all present possible strategies for the research, however as the research is focused on understanding the theoretical possibility for using culture in sustainable design by comparing a small number of selected cases, the case study approach was taken forward.

A case study method can be described as the “development of detailed, intensive knowledge about a single ‘case’ or a small number of related ‘cases’” (Robson, 1993, p.40). It can be used to understand a real-life phenomenon in a specific context relevant to the enquiry (Yin, 2009). Case studies deal with the ‘how’ or ‘why’ questions typically in a contemporary setting in which the investigator has no control over the events (Yin, 2009). It is most commonly adopted for cross-cultural research in the form of quasi-experiments in which previously existing, intact groups are compared (Cook & Campbell, 1979). In this sense “culture is seen as an independent variable...that is beyond experimental control” (Leung & Vijver, 1997, p3). Importantly case studies combine evidence from a range of sources and can be used in situations with multiple methods of data collection (Yin, 2009). The flexible nature of this enquiry technique and use of detailed data from a wide range of sources allows comparisons to be made between multiple cases.

It can sometimes be beneficial to think of case studies as ‘site’ studies as the context; the specified social and physical setting, is central to the outcome of the study (Miles & Huberman, 1984; cited in Robson, 2011).

Whilst case studies cannot be used as a tool to generalise behaviour from a small number of selected cases to an entire population, the initial case can provide evidence to support theoretical views regarding the situation being investigated. A multiple case study approach can then be used as further case studies can provide support to the theory and help link evidence between cases that has not already been exposed or explored in the theory (Yin, 2009).

3.4 **Trustworthiness/Validity**

Trustworthiness of qualitative research is established when the findings reflect the exact meaning described by the participants of the research (Lietz et al., 2005). “Trustworthiness is not something that just naturally occurs, but instead is the result of ‘rigorous scholarship’
that includes the use of defined procedures” (Lietz et al., 2005; p444). The term ‘Trustworthiness’ was first coined by Lincoln and Guba (1985) as they developed the notion of validity and reliability using four key terms; credibility, transferability, dependability, and confirmability. The terms have been developed by various qualitative researchers over the years to make available more rigorous guidelines to follow when undertaking research. Whilst the four terms are separate, there is considerable crossover, particularly when implementing strategies for ensuring trustworthiness (Lincoln & Guba, 1985).

Credibility can often be presented as internal validity; a process to ensure the study measures or tests what is actually intended. Shenton (2004) lists factors that demonstrate credibility which include; using well established research methods, often building on previous comparable projects; random sampling of individuals with no prior knowledge of the study; triangulation involving the use of different data collection techniques as well as previous relevant studies; frequent debriefing sessions between the researcher and the wider study group; and peer scrutiny of the research project by other academics, peers and colleagues (Shenton, 2004). In this research credibility was ensured by adhering to the factors mentioned in this list. The data collection techniques are varied but established in previous exploratory case study research; the participants had no prior knowledge of the study area; and the findings have been presented at international conferences and papers for review by academic peers.

Transferability is commonly referenced as external validity and deals with the extent to which the findings of one study can be applied to other situations (Merriam, 1998). Although results from qualitative research will always be constrained by the specific situations in which they occur, allowing the reader to make the leap to possible generalisation will help with transferability. Providing detailed information regarding the context of the specific study and research methods, as well as other projects using similar methodologies in different contexts considerably helps with transferability (Shenton, 2004).

Ensuring dependability relies on the assumption that if the same methods were applied in the same context, similar results would be obtained (Shenton, 2004). There is a large crossover with credibility in ensuring dependability and by certifying the research is credible will go a long way to show that it is dependable (Lincoln & Guba, 1985).

Confirmability could also be described as objectivity. Results of the research should be the experiences of participants rather than the pre-conceptions and ideas of the researcher.
Having members of the team who are invested in the project and its accuracy are crucial as well as regular review with peers and stakeholders (Easton et al., 2000).

3.5 Ethics

Adhering to a set of clear and established ethical guidelines at the start of any qualitative research project is crucial to its success (Robson, 2011). This is particularly important given the delicate nature of cross-cultural research. “Being an ethically skilled qualitative researcher involves more than respecting the integrity of the research subjects. The ethical researcher also needs to take into account the cultural context of her research” (Brinkmann & Kvale, p162, 2005).

Guillemin and Gillam (2004) establish there are generally two dimensions of ethics in research: procedural ethics – the completion of predetermined questions usually to satisfy an ethical board or committee; and ‘ethics in practice’ – the day-to-day ethical issues that arise when doing the research. Whilst procedural ethics can be seen as ‘hoops to jump through’ it can help researchers in considering and reflecting on the fundamental principles that govern research integrity as well as serving as a reminder that risks, both to the participant and researcher, are present in all forms of qualitative data collection (Guillemin & Gillam, 2004).

Often procedural ethics are viewed with some trepidation because the questions are very generic to cover a range of different research types. Research that involves deception, withholding information, physically altering a person’s state, invading privacy or vulnerable people amongst other things need to be reviewed by an ethics committee. If the research is seemingly straight forward, i.e. observing a participant in their everyday environment performing a routine task, these questions can seem a little unnecessary. However, even the seemingly most straight-forward research, can have ethical pitfalls. Ethical problems in qualitative research arise because of the complex nature of investigating people’s private lives and publishing the findings in the public arena (Brinkmann & Kvale, 2005). Informing the participants of exactly what the research is intended for is central in ethical data collection. Educating the participant of the exact nature of the study and informing them that they can withdraw at any time, can in part, help (Robson, 2011).

The data collection period for this research required both procedural ethics and ethics in practice. Before the research was conducted several documents were completed to minimise the risks involved with the research. An Ethical Clearance Checklist as provided by
the Ethical Advisory Committee at Loughborough University was first completed to assess the main ethics of the project. Secondly, a risk assessment was carried out to understand any potential hazards during the research phase. During the data collection phase participants were given information sheets (which they were already familiar with) and were required to sign consent forms which guaranteed anonymity, detailed the use of data and recording equipment and informed participants of the safe storage and disposal of the data. Details of the research visits including timings and addresses were given to the country contact as well as a contact at Loughborough University, and the researcher messaged both contacts before and after each data collection visit to ensure it ran smoothly.

The methodology chapter has highlighted the three phases of primary research involved in this study. The research takes the form of *qualitative exploratory* investigation using a *case study* approach. The sampling sites of Bangalore, India; Loughborough, UK; and Curitiba, Brazil have been chosen for their comparatively different cultures and economic situations and for logistical reasons. The data collection is divided into three phases:

- **Scoping Study:** Using an online survey.
- **Intensive Study:** Using contextual interview, observation and household tours to examine laundry behaviours.
- **International Design Competition:** To test the application of the proposed framework in a design context.

Participants were selected for each phase based on consumer classifications of young, middle-income consumers in each location. Trustworthiness was ensured using Lincoln and Guba’s (1985) definitions of *credibility, transferability, dependability and confirmability*. Finally steps have been taken to ensure the research is ethical in its intent and application.

In the next chapter the data collection methods and results for Phase 2, the Scoping Study, are presented and how these results inform the intensive study are discussed.
4 SCOPING STUDY

4.1 Introduction
The scoping study was carried out at the beginning of the research as a consequence of the literature into the different resource impacts of everyday household behaviours from people in different countries. It took the form of an online survey distributed throughout the UK, India and Brazil and asked questions on the themes of food, water, energy use, materials, government schemes and the environment.

The scoping study had three aims:

- To investigate findings drawn from the literature review further
- To identify specific resource intensive behaviours
- To inform the intensive study of potential areas of focus and identify issues with data collection

4.2 Data Collection
The scoping study took the form of a targeted self-completion online survey, as this is a relatively cost effective and fast way of obtaining data (Robson, 2011). Other potential data collection techniques such as interviews and focus groups were discarded at this early stage as the logistics and practicality of carrying out those techniques on a global scale would have been prohibitive. The online survey had the advantage of providing access to groups of people who would be hard to access face-to-face because of time and cost constraints, and also allowed participants to be more open with their responses than face-to-face communication (Wright, 2005).
Despite the many advantages of online surveys there are also several limitations. Representative sampling is difficult as depending on where the survey is promoted will determine the characteristics of the participant, whilst access to internet connectivity, particularly in emerging countries, determines the type and personality of participants (Wright, 2005). However, the online survey technique is still considered the most appropriate for this research as it is young, middle income consumers who are being targeted and these are likely to have access to the internet.

The aim of the survey was to gain a broad overview of people’s perceptions and their everyday behaviours regarding domestic resource use. Data from the survey was then validated through triangulation, comparing to other similar research and also through future more detailed investigation (Robson, 2011). The survey was divided into seven sections. The first sought to gain general information about the participant such as age, gender, location, income band etc; the second asked their environmental views to determine the degree of pro-environmental attitudes displayed, the following sections were divided into food, water, energy, materials, and governmental schemes, before ending with an optional contact page so that, if the participant desired they could be contacted regarding the results of the survey (full survey can be found in Appendix A).

The survey was focussed predominately on reaching participants in the UK, India and Brazil. These countries were chosen as the main area of focus as they showed a significant range in terms of level of development on different scales and were also central to the themes developed in the literature. These countries also showed the most significant potential for future, more detailed inquiry.

The survey was created in two languages; English and Portuguese so as to be as natural to the participants from the selected countries as possible. The original survey was written in English (by a native speaker) and then back-translated to Portuguese so as to ensure the translated content was as close to the original meaning as possible (Liamputtong, 2010). In the Portuguese version the translator was a native speaker from Brazil as this was the region where the research would be carried out. The translated version was then cross-checked by another Brazilian who was familiar with the research project, following guidelines by Liamputtong (2010).
The survey consisted of pre-coded quantitative questions, with a few open ended qualitative questions where more detail into participants’ personal insights were required.

Before the survey went ‘live’ a pilot was conducted with three test participants from the different regions. Whilst these three participants all currently lived in the UK, they were originally from the three main regions being studied. The test participants were used to check the language of the survey as well as check whether the questions were relevant to the context they were directed to. Small tweaks to the wording of some questions proved this to be a useful exercise to ensure the survey was as clear and understandable as possible.

The survey was distributed via the internet as this was the simplest way to reach a global audience and could be completed by the participant at their convenience. It also meant the survey gained momentum in a snowball type effect (Goodman, 1961).

### 4.2.1 Sampling Strategy

The survey took on a **purposive** sampling strategy, using a small representative sample of relevant cases as identified in the literature and through the author’s personal contacts. These contacts acted as representatives to help draw out further individuals for research through a cascade or snowball effect. This small sample size of pre-selected representative individuals also allowed for a greater rapport to be created between the participant and researcher and aided in increasing response rates, a factor that lowered the impact of any perceived bias (Robson, 2011). The construction of the survey to measure identical content across countries also aided in avoiding bias (Leung & Vijver, 1997).

### 4.2.2 Sampling Sites

The aim was to obtain a large amount of data from as many different perspectives as possible; therefore, there were no specific requirements as to which region the participants were from. However, to minimise any potential translation issues and help provide a relevance to the examples outlined in the literature, data collection was concentrated in the UK, Brazil, and India.

The countries were chosen as they show a contrast in levels of economic development and environmental rankings whilst also having large populations and either established or growing markets. Table 4.1 compares the three countries chosen using data from the CIA World Factbook (CIA, 2011).
<table>
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<th>Table 4.1 - Sampling Site Country Comparisson</th>
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<tbody>
<tr>
<td><strong>UK</strong></td>
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<td>Economic</td>
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<td>Urban population</td>
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Climate | Temperate; moderated by prevailing southwest winds over the North Atlantic Current; more than one-half of the days are overcast | Varies from tropical monsoon in south to temperate in north | Mostly tropical, but temperate in south

The countries were also chosen for their clear differences in terms of Hofstede’s Cultural Dimensions (explained in Chapter 2.8.2). The graph below (fig 4.1) charts the different scores of the three countries as defined by the Hofstede Centre (2013).

The UK has a fairly low Power Distance Index suggesting that inequalities amongst people should be minimized and people should, to some extent, be treated as equals. In Brazil and India this is a fairly high score suggesting there is an acceptance of inequality amongst people and hierarchy is respected. In both Brazil and India it is important to show respect to elders and those powerful in society, whilst in the UK there is a belief that the context in which you were born should not affect what you can achieve.

The UK has one of the highest individualism scores in the world, with children taught to think for themselves early and find out how they can uniquely contribute to society. There is a strong culture of consumerism with aspirations to further personal goals. Brazil and India are very strong collectivist societies where belonging to strong, social groups with shared goals is the norm. Behaviours are heavily influenced by the perceptions of others within the group, with rejection from the group unthinkable.
The UK is considered a masculine society which values success and a driven performance ambition. India is also a masculine society, however it has clear contradictions. Displays of wealth and power are common; however the highly religious overtone portrays values of modesty and humbleness. Brazil’s score shows signs of both masculinity (with status and success) and femininity (avoiding conflict and consensus important).

Brazil has a very high Uncertainty Avoidance score suggesting that rules and legal measures are important to structure life; however acceptance of these measures is not always obeyed. This is typically portrayed by the very passionate, demonstrative and emotive people. India scores relatively low suggesting there is an acceptance of imperfection, where not everything has to be planned. The UK scores even lower, suggesting people are happy to change direction and less likely to plan for the future. This typically results in a creative people, as change is encouraged.

Finally, The UK is considered a short-term orientated society where there is a focus on achieving quick, short-term results rather than looking considerably into the future. Brazil and India can be considered long-term orientated societies with tolerance of differing views and expectations that things can, and will, take time.

4.2.3 Analysis
The majority of questions in the online pilot study were quantitative closed questions and could therefore be best analysed as basic statistics; frequencies, proportions, and percentages. Qualitative data was coded manually and analysed by matching patterns and links in the responses as well as insightful comments that could prove inspiring for further developments of the study. A priori codes were created relating to the themes of the survey to aid analysis. During the analysis further codes started to appear, known as empirical codes, which helped direct further study (Gibson, 2009).

The responses from different countries were analysed separately and then separated into themes where the different contexts could be brought together.

4.3 Participant Information
In total there were one hundred and fifty eight participants; 63 from the UK, 63 from Brazil and 32 from India. In Brazil the survey was answered by at least one participant in each of the five regions, with 86.8% of participants from the south or southeast regions. In the UK, participants lived in five of the nine geographic regions, with the majority of the participants
(56%) from the East Midlands. In India participants were generally split between the North and South.

The majority of Brazilian and Indian participants (57.6% and 79.3% respectively) were in the 18 – 30 age brackets, with 31 – 50 year olds being the next most common. In the UK this was reversed with almost 50% of participants in the 31 – 50 age range. The UK was also the only country with a participant over the age of 65. In the UK and Brazil there were more female participants than male with roughly a 60 – 40 split, whilst in India it was the opposite.

Figure 4.2 shows the income levels of the participants. The majority of Brazilians (62.8%) earned in the lowest three income bands (US$0 – US$20,000), whilst the majority of participants from the UK (70.1%) had an income in the top three income bands (US$20,000 +). Indian participants had a similar income to Brazilian participants (Figure 4.2). The Indian sample had the highest rate of students at nearly 26%, whilst the UK and Brazil had similar rates of 13.8% and 15% respectively.

In all of the countries surveyed more than 80% of the participants were educated to degree or postgraduate level. This might be due to the contacts used to gather the data, with participants tending to be recruited via friends or family of an individual at a university. Most participants lived in households with five people or fewer.

Nearly all of the participants considered themselves to be ‘pro-environmental’. The majority believed environmental issues are critical and therefore try to consume less environmentally damaging products where possible. India had the highest number of participants (20%) who wanted to do more to protect the environment but didn’t think they could in their current situation, whilst the UK was the only country that had participants (3.5%) who believed environmental issues had been exaggerated.
4.4 Findings

The following section presents the findings from the survey relating to the main themes of food, water, energy, materials, and governmental schemes. The subsequent section then discusses findings which are particularly relevant to the direction of the research.

4.4.1 Food

In Brazil, 55% of participants eat meat at least once a day, compared with 28% of British participants and 17.2% of Indian participants. India had the highest percentage of vegetarians at 27.6% (Figure 4.3). Interestingly the UK had the largest range when looking at the budget for meat each week. 35.1% of the meat eating UK sample spent less than US$10 per week on meat, similar to that of India at 37.9%, with the Brazil sample at 21.7%. The majority of Brazilian participants (53.3%) spent over US$10 per week on meat, a similar figure to the UK at 52.7%, with Indian participants less likely to spend highly on meat (24%). It should be noted, however that a large proportion (18.3%) of Brazilian participants preferred not to answer this question.

![Figure 4.3 - Frequency of meat consumption](image)

The UK had the highest number of participants that ate imported foods either every day or a few times per week at 68.4% compared with 16.7% of Brazilians and 34.4% of Indian participants, whilst 20% of Brazilian participants and 13.8% of Indian participants responded that they never ate imported foods compared with 0 participants from the UK. It should be stated however that in many cases the participants did not know how much imported foods they ate each week (Brazil: 28%, UK: 15.8%, India: 20.7%). In terms of eating locally grown food, in all regions eating local food every day or a few times a week was by far the most common answer, although once again it was common for participants to not know the origin of their food (Brazil: 31.7%, UK: 17.5%, India: 24.1%).

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In all regions the most common place to buy meat was the supermarket, with a similar range in packaging materials across the regions. The UK participants were more likely to grow food with 45.6% of participants growing food themselves compared to 23.3% of Brazilians and 37.9% of Indian participants.

4.4.2 Water

In all regions the most common bathing type was showering. In Brazil none of the participants used a bath to wash compared to 8.8% in the UK and 24.1% in India. Brazil and India both had participants (1.7% and 17.2%) who used the reservoir bathing technique whilst the UK had no participants using this technique. Having a fully plumbed in shower was noted by all of the Brazilian participants and 93% of the British participants, whilst 79.3% of Indians had a fully plumbed in shower.

In the UK a gas boiler was the most common way of heating water, whilst in Brazil it was the electric shower. Interestingly, in India use of a ‘geyser’ was mentioned (28.5%). A geyser is a small electric hot water heater designed to save electricity when showering by only heating the water needed, it is often solar powered, although the participants did not mention this.

Indian participants were most likely to have non-potable water supplied to household appliances (shower, toilet, tap etc.), with 38.5% of participants having non potable water direct to appliances compared to 23.7% in Brazil and 10.9% in the UK.

Brazil, the UK and India all had high levels of washing machine use (95%, 94.5%, and 85.7% respectively). For those who didn’t regularly use a washing machine there was a fairly even split between using a launderette, doing it manually, or using a friend’s washing machine.

Indian participants washed their clothes the most regularly, 24.1% stated they washed clothes everyday compared with 5% in Brazil and 7.1% in the UK. Washing clothes once or twice per week was the most common practice in all regions studied.

Average washing temperatures had interesting results. 88.1% of Brazilian participants stated that they always washed clothes in cold water. This figure was also relatively high in India (55.2%), whilst the UK had a lower response of 10.9%. UK participants were more likely to never wash clothes in cold water with 47.3% of participants suggesting this compared to 20.7% in India and none of the participants in Brazil (Figure 4.4).
4.4.3 Energy and Materials

The UK participants had the highest number of electrical appliances. Out of the list provided the majority of participants had most of the appliances with the exception of a lower ownership of tumble dryers, blenders, and dishwashers. The majority of Brazilian participants also had most of the appliances listed, although low ownership was noted of kettles, toasters, tumble dryers, dishwashers, and vacuum cleaners. Unlike the UK most Brazilian participants owned a blender. The Indian participants showed a low ownership of the appliances noted by both the UK and Brazilian participants.

In Brazil and the UK the most common amount spent on electricity was between US$50 – US$80 per month (35% and 37.5% respectively), whilst in India the distribution was more evenly spread with 19.2% of participants spending US$10 – US$20 per month (Figure 4.5). Brazil had the most participants who bought ‘green energy’ or bio-fuel with 20% compared to 3.5% in the UK and none in India.
The UK participants were most likely to own something made by themselves (33.3%). In terms of buying used or pre-owned products, 82.5% of UK participants suggested they try to buy used products where possible, compared to 43.3% of Brazilians and 40.7% of Indians.

4.4.4 Government Schemes

All regions showed a lack of awareness by participants of any government schemes that could help them reduce their environmental footprint. In Brazil 75% were unaware of any schemes, whilst in the UK it was 63.2%, and India with 64.3%.

Recycling was an interesting issue. The UK had high rates of recycling, with all but one participant in the UK declaring they recycle. In Brazil and India there was a much more mixed response, with 40% of Brazilian participants confessing they don’t recycle and 57.1% of Indian participants (Figure 4.6).

![Figure 4.6 - Recycling rates](image)

4.5 Discussion

The survey was not designed to draw out statements that could be considered indicative of the behaviours of an entire nation. As well as being an over-simplification of the subject, the sample size was too small and the sampling was not representative for this to be achieved. However, the results did illuminate some interesting insights, which support findings from previous research and literature, as well as opening new avenues for exploration.

Overall there was a good response rate over a widespread area. The majority of Brazilian participants coming from the South and Southeast regions was generally expected as these regions are by far the most populated in Brazil, accounting for well over half of the total population and containing the major cities of Rio de Janeiro, Sao Paulo, Belo Horizonte, and Porto Alegre. They are generally regarded as the economic powerhouses of Brazil (CIA, 2011). The majority of UK participants coming from the East Midlands is due to the proximity of the researcher to this area, but there was also a good spread of participants
from other regions of the UK. In India the main split between the North and central-south is influenced by the major cities of Mumbai and Delhi.

Census population data suggests the median age in Brazil is 29.3 years and 26.2 years in India, compared with the older age of 40 years in the UK (CIA, 2010). This helps to explain the younger age of the participants from Brazil and India compared with the older participants in the UK. Similarly in terms of income, the results from the survey generally fit into global economic data. GDP per capita in Brazil is US$10,800, compared to US$34,800 in the UK – correlating with survey responses. The income levels with this relatively small sample size will also be affected by other personal factors, for example the generally higher incomes in the UK may be due to the older nature of the participants, as they will potentially be further along their career paths. Other individual factors may also contribute such as the type of job, although generally there was an even distribution and good range of jobs in the sample. The proportion of students in each sample was also very similar which helped make the results more comparative.

Meat eating figures in Brazil and India were generally as expected. According to 2002 data Brazilians eat on average 82.4kg of meat per person per year compared to just 5.2kg in India (Earthtrends, 2002), whilst India has a very high proportion of vegetarians, which was reflected in the study. High consumption rates in Brazil can generally be attributed to traditional patterns of meat consumption within the cuisine and also because the agricultural sector is a major contributor to the Brazilian economy, with cattle farming accounting for a large proportion of this (CIA, 2011; Marcelo & Fernando, 2005). In India low consumption of meat and a high rate of vegetarians is due to religious beliefs deeply embedded within the traditions of the country, although meat consumption can generally be linked to GDP and is expected to rise as GDP rises (Speedy, 2003). The surprising figure was from UK participants. Data suggests that the UK population also eat a large amount of meat, close to that of Brazil, with the average person consuming 79.6kg of meat per year (Earthtrends, 2002), yet data from the survey suggested the sample were more conservative with their meat consumption only eating meat a few times per week. The reasons for this are varied; general perception within the UK that too much meat, particularly processed and red meat, is unhealthy and thus a change in behaviour since the last per capita measurements were taken in 2002 (Hughes, 2011). It could also be due to participants trying to answer the question in a way that reflects well on them (Robson, 2011), or the fact that
the question did not specify which meals to measure or a potential confusion over whether fish counts as meat. Further closer investigation would help to clarify results.

India had the highest levels of adoption of the reservoir bathing technique, and subsequently the lowest levels of a fully plumbed in shower. Matsuhashi (2009) and Karakat (2010) suggest that this is by far the most resource efficient bathing technique, using just 20 litres of water compared to 100 litres in the shower and nearly 200 litres in the bath. Interestingly Brazilian participants also used this technique, but in much fewer numbers. Perhaps as part of ‘development’ one of the first changes is a fully functioning shower. It will be important however to understand in further research why the reservoir technique is adopted; is it due to the climate of the region – not needing a shower for comfort or is it based on water wastage views or deeply embedded within the culture.

Gas was the most common water heating fuel in the UK compared with electricity in Brazil, which was as expected given the dominance of both energy sources in their respective countries. The high use of geysers in India poses an interesting insight as geysers are designed to only heat a certain amount of water. As with all energy orientated devices it is impossible to calculate the exact efficiency of this, as measurements will depend on the specific model being tested, the environment it is situated in, and the patterns of use of the consumer. However, the behaviour of using a geyser is very different to that of a boiler or electric heater which have instant, on demand hot water. With a geyser there is a time delay between switching the geyser on and receiving hot water, whilst there is also the knowledge that the hot water is limited. This is also true of standard hot water tanks seen in other regions, although these tend to be a lot larger than a geyser, which are often used for just one appliance e.g. the shower. It may therefore be possible to observe various interesting water saving behaviours in houses that have geysers.

Brazilian participants conformed to countrywide data from Greendex (2010), suggesting Brazilians are unlikely to wash clothes in warm water whilst the UK participants were unlikely to wash clothes in cold water. This follows previous research that suggests Brazilian people have very different perceptions of the design of a washing machine (Shimp, 2010), and the link between cleanliness and hot water is clearly a major difference.

As expected there was a lower ownership of tumble dryers and dishwashers across the samples, predominantly because these were the most expensive items on the list. Other factors could also influence this low ownership, such as climate in some regions reducing
the need for a tumble dryer. Interestingly, some appliances, which would not have a significant cost to the household, have a very different uptake. Products such as toasters and kettles, owned by nearly all the British participants, had a much lower uptake by Brazilian and Indian participants, suggesting that they either have a different way of boiling water or making toast, or they have different customs and routines that do not require the services of those appliances. Paradoxically, the blender was an item most Brazilian participants owned which was less common in British responses.

In terms of cost, Brazilians pay the highest cost for their electricity as a proportion of their income – spending much the same as UK participants despite their relatively lower incomes. This is interesting considering a significant proportion of participants have no heating costs at all. One area where the extra cost on energy may be going, that was not asked in the survey was on air conditioning. The participants who don’t spend any money on heating may spend on cooling instead, and in hindsight this should have been more thoroughly investigated in the study.

The lack of knowledge of governmental schemes to aid in reducing the house-hold environmental footprint from all the participants was a surprising outcome. This shows that there is either a lack of schemes to help people cut their footprint or a lack of advertising and knowledge of any schemes by the individual house-holds. This is particularly strange in the UK given the high rates of recycling, and may show how recycling has become a habitual behaviour that is not cognitively thought of in households anymore. Recycling by the other samples was low, which again, was a surprise given that nearly all participants viewed themselves as ‘pro-environmental’ and consumers normally associate recycling with sustainability. Perhaps the lack of recycling schemes in those areas reduced this response rate, which would suggest why many Indian participants didn’t feel like they could do much in their current situation.

4.6 Conclusions
The survey gives a good general overview of resource related behaviours in the home which have helped to validate existing research and open new avenues of enquiry for future research. The survey has proven particularly useful in identifying differences in resource intensive behaviours, however due to the nature of the study the reasons behind people’s behaviours were not identified. Understanding the motivations behind people’s behaviours is key to developing products to reduce resource intensive behaviours. This research study,
therefore, completes objective 2a presented at the beginning of this research (Chapter 1.3) and provides a solid base for further qualitative investigative inquiry.

The findings tell us that UK consumers are more aware of their meat consumption than quantitative per capita data tells us, whilst Brazilian consumers generally follow the quantitative data (Earthtrends, 2002) by responding that they eat meat the most regularly. The UK participants have either tried to cut down on their meat consumption, or portray the appearance of reduced meat consumption. As discussed this could be due to campaigns in the media, whilst the Brazilian attitude may be caused by a relatively recent increase in GDP which may have resulted in a higher demand for meat. In both cases meat consumption is deeply embedded within the culture. From a design perspective qualitative data will help us to understand the effectiveness of any media campaigns in reducing meat consumption and generate insights for possible designs for new tools or systems in the kitchen environment to help reduce resource impacts.

We can also conclude that Indian participants have a less resource intensive bathing behaviour. Research by Matsuhashi (2009), Karakat (2010), and Kuijer (2009) has already looked at the bathing routine and tried to implement a more energy efficient bathing behaviour based on cultural insights. The results from this testing will be extremely valuable to the subject area, as will investigating in more depth the motivations behind the reservoir bathing technique to see if it is possible to design and implement a product based around this low resource impact behaviour in countries where a higher impact behaviour (such as taking a bath) is common.

Results also clarify the difference in behaviours, and subsequently attitudes, to washing clothes. As expected the Brazilian participants didn’t wash clothes in warm water, conforming to the hypothesis drawn out by previous research that Brazilian consumers don’t make a link between hot water and hygiene or cleanliness (Greendex, 2010). Investigating further why they do not have this link will help to create products for regions, such as the UK, where it is common to wash clothes in hot water. In a similar respect the use of geysers in India require more of a cognitive thought than simply turning the tap on, and it may be possible to observe lower hot water use in households that use a geyser, and thus implement some of the findings into new designs for water heating in high impact cultures.

This insight into the differences of doing the laundry has significant cultural impacts as doing the laundry is one of the most widespread habitual household chores with a significant, but
often hidden resource implication. Using laundry as a case study to understand the
differences between cultures will help draw out further insights into other aspects of daily
household life that may be impacted upon by designers.

Finally, the observed lack of knowledge and awareness of all participants regarding
government schemes to help reduce a household’s environmental impact despite recycling
being high in the UK, is of interest. Wilhite (1999) has suggested ‘cultural energy services’
such as bathing, lighting and space heating, are embedded into the culture and informs us
that the most effective way to increase resource efficiency is to implement efficient
technologies that keep the same cultural identity. However the recent research and
investigation into behaviours suggests that resource intensive habits can be changed by
successful implementation of different designs.

Although the survey proved incredibly useful in identifying different household behaviours,
there were also some limitations which would need clarification in further study. Although
the questions were designed to be as neutral as possible, some participants may have felt
the need to answer some questions with ‘what the researcher wants to hear’. Other
questions could have also been more specific, for example a better clarification of meat
consumption or the addition of air conditioning to the questions regarding appliances. In
general however, responses provided a good level of general background knowledge to the
research area and a strong platform of insights to build upon in further, more in-depth
studies.


5 CROSS-CULTURAL CASE STUDY: LAUNDRY BEHAVIOURS

5.1 Introduction
Laundry is an interesting subject that has been researched extensively in a range of different disciplines over the last few decades. Traditionally it has focussed on research into the technology involved within the process such as washing machine efficiency and detergent composition, however more recently the social and behavioural aspects have also been investigated (Pink, 2005; Shove, 2003).

Laundry is an important area of study as it is one of the most widespread household chores in the world and plays a large part in the everyday logistics of running a house and establishing self-identity (Pakula & Stamminger, 2010; Pink, 2005). It is a multifaceted process that involves much more than just cleanliness. Social and technical aspects of laundry (what needs to be washed, when does it need to be washed, what tools will be used, by whom) make it a complex household system (Shove, 2003).

5.2 Energy Impact of the Laundry
Laundry is an incredibly energy intensive form of housework. Whilst years ago it was hard, mechanical work (and in some countries still is), today washing machines do the majority of the work with the use of water, electricity and chemical substances (Pakula & Stamminger, 2010). Working out the precise energy consumption of the laundry process is, however, very difficult as the system is made up of a huge range of variables influenced by technological, cultural, social and moral norms (Shove, 2003). The age and type of a washing machine...
affects the energy intensity of the act of laundering as much as the climate of the region in
which it takes place or the upbringing of the launderer (Laitala et al., 2011). However one
thing is clear, the most energy demanding time during the lifecycle of clothing is the use
stage (Madsen et al., 2007 – cited in Laitala, 2011). Figure 5.1 shows the most significant
energy impacts during the life of a pair of Levi jeans, whilst figure 5.2 shows the water

In recent years there have been great technological advances in the energy efficiency of
washing machines. In the last 10 years for example, a 30% water and electricity efficiency
improvement has been achieved in horizontal axis machines in Europe, with all machines
sold in Europe now belonging to the energy label category ‘A’ (Pakula & Stamminger, 2010).
These technological improvements have, however, tended to be counteracted by the
laundry habits of consumers, as they decide the method and frequency of washing and
drying (Laitala et al., 2011). A study in the Netherlands showed that the amount of laundry
washed per person has increased by a factor of 6.7 since 1950 and this trend is common
amongst other ‘Western’ countries (Uitdenbogerd, 2007). Part of the reason for this is that
energy consumption, particularly when bound up by routine and habit with the use of tools
or appliances in a household environment, is simply invisible to the consumer (Shove, 2003b). Consumers tend to associate environmental issues with clothing at the end of life, giving it to charity or recycling, rather than throwing it away (Laitala et al., 2011). However, washing habits and the energy implications of those habits vary greatly between cultures with behaviours adjusted to local conditions (ibid).

Pink suggests that sensory experiences are linked to cultural values which can be changed (Pink, 2005). When washing machines were first introduced manufacturers cleverly redefined ‘cleanliness’ as ‘whiteness’ rather than the removal of germs to change the belief that boiling was needed. Nowadays the need for washing clothes has shifted again, with consumers washing more frequently for ‘freshness’ of clothes rather than cleanliness, invoking important sensory attachments to the process of laundering (Pink, 2005, Shove, 2003). Indeed it can now be seen that clothes are washed purely out of habit rather than the build-up of any visible dirt (Mintel, 2010; Laitala, 2011).

In the UK, ownership of washing machines is almost universal amongst households (96%). Tumble dryer ownership rose slightly from 54% of households in 2001 to 57% of households in 2010 (ONS, 2011). In 1998 the British Consumers’ Association found that almost everyone had outside drying facilities, but a third of all tumble dryer owners used the tumble dryer all year round. If the weather was good the average dryer load per week was four, if the weather was bad, the average was six (BCA-RandTC, 1998 – cited in Uitdenbogerd, 2007). However in more recent studies this trend has been seen to be decreasing, with a higher tendency to line dry clothing (Mintel, 2011). Two to three washing loads per week is generally the most common, with household size and presence of children the biggest influence on wash frequency.

In Brazil on the other hand, washing machine ownership is much lower. In 2009, 41.5% of households had a washing machine (IBGE, 2009). They are however experiencing a surge in growth for consumer goods. In 2006, 35.8% of households owned a washing machine, showing a total growth of 5.3% in 3 years (IBGE, 2006). Washing is done an estimated 3.9 – 5 times per week (Corbett et al., 2011) and nearly always at low temperatures (Greendex, 2010).

In India, 14% of urban households and 7% of rural households own a washing machine (Euromonitor, 2011), however they are expected to see rises of up to 19% by 2015 (ibid).
According to a study on global households, 65% of participants are likely to wash clothes in cold water, 2nd only to Brazil (Greendex 2010).

Whilst there are cross-cultural studies in laundry (Pakula & Stamminger, 2010; Lin & Iyer, 2006), they tend to focus on quantitative technical data and compare countries with readily available technical machine information from Europe and Japan. Studies comparing the specific laundry habits of consumers from different cultures, particularly in emerging markets, are limited.

5.3 Laundry as a system

Literature into laundry can generally be divided into two main groups; the social/behavioural aspects, and the more technical aspects, although there is a large crossover as social and technical characteristics are different sides of the same coin, where changing behaviour also requires a socio-technical change (Shove, 2003a; Laitala, 2012).

Pink’s work uses a sensory ethnography approach to laundering in the home. She suggests individuals use sensory metaphors to narrate their everyday experiences and practices. She contends that the senses play a vital role in the everyday experience of the domestic environment and that there is a relationship between everyday activities and sensory experience, self-identity, domestic practice and changing conventions. Everyday practices help to carve out individual identities and morals and by resisting existing conventions change can occur (Pink, 2005).

Shove (2003) introduces the idea of a ‘ratchet-like’ path dependency, using the metaphor of a ratchet to describe standardisation and difficulty to change as manufacturers aim to converge the paths of technology and practices. In her example, homes and offices have been designed for air-conditioning, thus condemning people to an air-conditioned way of life, with no other alternatives and no-way back (Shove, 2003).

Shove points out, however, that the simplicity of the ratchet model only works where there are scientific specifications and precise conditions such as the regulations on thermal comfort within building design. There are no set conditions or regulations for the act of ‘doing the laundry’ and as such, Shove suggests thinking of the laundry as a ‘system of systems’ “formed, shaped and given meaning by a complex of ‘ingredients’: by what there is to wash, what washing involves (who does it, with what tools), and when and why it’s done” (Shove, 2003b; p401). These ‘ingredients’ are dimensions in their own right, but are
interdependent on other dimensions; changing one dimension will have knock on effects on
the other dimensions, and change the system as a whole (figure 5.3).

Continuing the mechanical metaphors, Shove describes the ‘service’ of laundry as an
"assembly of cogs (textiles; tools, e.g. detergents, washing machines; rationales; skills and
expertise) each of which can turn one way or another, but that together constitute the
system as a whole" (Shove, 2003b; p405). Some cogs will be more dominant, such as the
washing machine which has an ability to re-script behaviour, whilst individual experience
will determine the arrangements of the cogs according to differing ways of doing the
laundry (figure 5.4).

Figure 5.3 - The whirlpools of laundering (Shove, 2003)
5.4 Energy Efficient Laundry

As discussed above, the laundry procedure is a complex combination of consumer behaviour and technology interventions affected by social, cultural and moral norms. To implement a socio-technical change for a more efficient laundry system, we must first understand the most efficient laundry techniques and how we can design the system to promote them. A recent study by Laitala, Boks and Klepp (2011) used laboratory tests to measure the environmental consequences of various different washing variables: washing temperature, machine filling, detergent dosage, spin speed, and drying method. The tests were carried out using a washing machine with energy label ‘A’ for washing and ‘B’ for spin-drying. The results of the tests were compared against the various different EU regulations for clothing care (Laitala, 2011).

Reducing temperatures from the average of 40ºC in Europe to 30ºC is one way in which the environmental impact can be reduced. Average washing in the UK at 40ºC consumes 4.4 TWh annually; reducing to 30ºC would save approximately 0.5 TWh per year (Bain et al., 2009). In the UK there has been a visible change in behaviour – in 2002 only 3% of survey participants washed at 30ºC where-as in 2007 this had increased to 17% (World Business Council for Sustainable Development, 2008). Results show that there was, on average, only a 1.9% difference in cleaning ability between washing at 40ºC and washing a 30ºC (Laitala et al., 2011). Washing at lower temperatures also increased the life span of clothing (ibid).

Similarly having a reduced detergent dosage from the manufacturers’ recommendations made little difference on the cleaning performance on all clothing types other than ‘heavily soiled’ garments (Laitala et al., 2011). Other recommendations include increasing the RPM (revolutions per minute) of the spin cycle to significantly reduce drying time and ensuring that the machine is full for each wash. “Washing a 500g garment needs almost seven times
more energy and five times more water if it is washed separately in comparison with washing in a full machine” (Laitala et al., 2011; p261).

Uitdenbogerd (2007) also investigated possible energy reduction options in a Dutch context, using telephone interview as the methodological approach. Table 5.1 highlights possible savings areas.

<table>
<thead>
<tr>
<th>Aspects of textile care and related energy reduction options</th>
<th>Savings Aspect (%)</th>
<th>Savings Textile Care (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing at lower temperatures, from 50° to 40°C**</td>
<td>-19</td>
<td>-3</td>
</tr>
<tr>
<td>A higher than average wash load, from 3.5 to 5kg*</td>
<td>-16</td>
<td>-3</td>
</tr>
<tr>
<td>Smaller washing machine, 3kg instead of 4-7kg**</td>
<td>-16</td>
<td>-3</td>
</tr>
<tr>
<td>Using the most efficient washing machine</td>
<td>12</td>
<td>-2</td>
</tr>
<tr>
<td>Using a hot-fill/CV connected machine</td>
<td>-9</td>
<td>-1</td>
</tr>
<tr>
<td>Use of E-button*</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Drying</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line drying</td>
<td>-91</td>
<td>-15</td>
</tr>
<tr>
<td>A gas-fired dryer**</td>
<td>-50</td>
<td>-8</td>
</tr>
<tr>
<td>Most efficient dryer</td>
<td>-18</td>
<td>-3</td>
</tr>
<tr>
<td>A higher average load, from 3.3kg to 4.5kg*</td>
<td>-12</td>
<td>-2</td>
</tr>
<tr>
<td>Better spin drying, from 1100rpm to 1600 rpm*</td>
<td>-12</td>
<td>-2</td>
</tr>
<tr>
<td>Extra space for line drying (1.2m²)**</td>
<td>+7</td>
<td>+1</td>
</tr>
<tr>
<td>Use of appliances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share the use of appliances by 4 households (W+D)ᵇ</td>
<td>-2</td>
<td>-0</td>
</tr>
<tr>
<td>Lifetime extension (W+D)ᵇ</td>
<td>-4</td>
<td>-1</td>
</tr>
<tr>
<td>Outsourcing (W+D)ᵇ</td>
<td>+25</td>
<td>+4</td>
</tr>
<tr>
<td>Use of materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthetics under present circumstances (W+D)ᵇ</td>
<td>-1</td>
<td>-0</td>
</tr>
<tr>
<td>Blends of PE/CO (50/50) in bedding** (W+D)ᵇ</td>
<td>-10</td>
<td>-2</td>
</tr>
<tr>
<td>Three sets woolen clothing: effects on washing**</td>
<td>-1</td>
<td>-0</td>
</tr>
<tr>
<td>Three sets woolen clothing: effects on space heating</td>
<td>3</td>
<td>-15</td>
</tr>
</tbody>
</table>

ᵇ (W+D): Washing and drying. *Practice investigated; **practice and acceptance of energy saving option investigated.

Using this information to change behaviour, however, is a difficult task as consumers are typically reluctant to change their washing habits. Generally people repeat what has worked before and avoid situations that they are unfamiliar with or that have caused problems in
the past (Jegou, 2010). Steering change will need to integrate behavioural systems with new technology to overcome barriers for change (Laitala et al., 2012). Knowledge and environmental benefits alone are not enough to overcome other barriers including individual psychological barriers based on earlier experiences or upbringing, political barriers, economic barriers, and cultural norms (Laitala et al., 2011).

5.5 **Vertical axis and horizontal axis efficiencies**

There are two common types of washing machine; vertical axis machines (top-loading) and horizontal axis machines (front loading). Within the two categories there are a wide array of differing technologies and features which make a comparison between unspecified models extremely difficult.

A study comparing water and energy consumption of automatic washing machines between 38 countries found that in general, countries with a high adoption rate of vertical axis machines consumed much less energy as the water wasn’t heated by the machine. In contrast, countries (mainly in Europe) that used horizontal axis machines used half as much water (60L compared to 120L) per wash as countries where vertical axis machines were prevalent (Pakula & Stamminger, 2010).

Traditionally vertical axis machines with agitators have been viewed as less efficient as they require the fabric to be suspended in water, often as much as 40 gallons, whilst a central agitating rod removes dirt from the clothes. However, recent improvements in technology, using agitator plates at the base of the machine has meant a reduction in energy and water use, making the machines as efficient, in general terms, as horizontal axis machines (Alliance for Water Efficiency, 2012)

Horizontal axis machines have been traditionally viewed as more water efficient as they do not require the fabric to be fully immersed in water to clean. However, until the recent advancement of detergents, their cleaning ability was generally enhanced by using hot water and faster spin revolutions, making them more energy consuming.

In truth, understanding which machine is more efficient can only be done accurately by comparing two specific machines in a controlled environment. The reality is, the age of the machine, manufacturer, settings, positioning within the home, frequency of use, wear and tear, installation, relation to other household appliances (e.g. boiler), and environmental elements, amongst other factors will all influence the efficiency of the washing machine. The study by Pakula and Stamminger (2010) showed Japan had the highest yearly water
consumption for laundry per household (62m²) because of a high frequency of wash cycles per week and the use of vertical axis washing machines, however it noted that it was common to re-use water from bathing in the washing process, water that in other countries is usually wasted. Similarly, a washing machine in the warm climate of California will consume a vastly different amount of energy to heat the water to 30ºC than an identical machine in the colder climate of Iceland, for example.

Figures that show the exact percentage of which type of washing machine technology is most prevalent in each country are scarce. Estimates suggest that in Western Europe 98% of households have horizontal axis washing machines (Pakula & Stamminger, 2010). Exact figures for Brazil are not available; however anecdotal evidence suggests that it is a country with a ‘top-load’ culture (Industry Today, 2012) that has traditionally followed technology from the USA with over 90% of households owning a vertical axis machine (Pakula & Stamminger, 2010). Again data is scarce from India; however it is apparent that it is traditionally a ‘top loading’ country with increasingly high sales for front loading models because of the perceived benefits (DNA, 2012).

5.6 Cultural aspects of laundry
As previously discussed, changes of a social nature are heavily influenced by cultural values. In the context of laundry it is important to pay attention to the role of cultural practices on the dynamics of consumption and behaviour. So-called ‘normal behaviour’ is steeped in cultural preferences and it is the co-evolution of these preferences through the interaction of different socio-technical systems that determines the resource efficiency of a behaviour or practice (Lin & Iyer, 2006).

Studies from China offer interesting insights into the effect a new technology has on laundry habits. There are currently two main washer types vying for dominance in the Chinese market: impeller washing machines (vertical axis), imported from the Japanese context; and drum washing machines (horizontal axis), imported from the European market. Both have various advantages and disadvantages based on design, purchase price, and perceived cleaning ability, however in recent years the drum machines have increased in popularity with advertising campaigns suggesting they are more resource efficient and provide better cleaning performance. The authors of the research point out that Chinese consumers do not get the full picture when purchasing a washing machine as, although the drum machines use approximately half the water of an impeller machine, the water is heated to much higher
temperatures, and in some cases the drum machines are up to 10 times less energy efficient than the impeller machines from Japan (Lin & Iyer, 2006).

Chinese consumers may not be aware of the high energy use of the new machines, and may not see the need to wash at such high temperatures. Often there is a strikingly different attitude between hot water and cleanliness or hygiene between cultures. Studies have shown, for example, that Japanese consumers do not share the same link between hot water and hygiene as ‘Western’ consumers (Wilhite et al., 1996). Interestingly, studies have shown people from different cultures who have experience of using different washing technologies have a strong affinity to ‘their own’ washing technologies although are content with the washing ability of other technologies (Lin & Iyer, 2006).

In Europe the main differences are washing temperatures and frequencies. In Spain cotton shirts are generally washed in cold water, whereas in Greece and the Netherlands they are washed at 40ºC and in Norway at 60ºC (Arild et al., 2003). However the studies that look solely at washing temperatures fail to see laundry as a ‘system of systems’ as discussed in the social literature from Pink and Shove. In countries such as Spain where garments are washed in cold water there is often knock-on effects to the other laundry ‘dimensions’ (Shove, 2003a), such as a potentially higher dosage of bleach-based detergents (Pink, 2004).

5.7 Appliance Energy Rating Schemes

In all three countries under investigation there are different appliance energy rating schemes, however information on the exact technicalities and boundaries of these schemes is disjointed and difficult to come across.

In Brazil appliances are rated under the PROCEL Scheme (figure 5.5) which was first introduced as a voluntary labelling scheme in 1993 and became mandatory in 1997 (Harrington & Damnics, 2004). It works as a bar system rating appliances from A (most efficient) to E (least efficient). Within the washing machine sector appliances are rated on the kilowatt hours per cycle per kilogram of clothes washed in cold water with the majority of models in category A and a few in category B (Inmetro, 2013).
In India the Bureau of Energy Efficiency manages the labelling scheme. Labelling of energy performance is mandatory on certain household appliances such as refrigerators and air conditioning units, however is voluntary for washing machines (Harrington & Damnics, 2004). Washing machines are rated on a star system from 1 star (least efficient) to 5 stars (most efficient) based on the kilowatt hour per kilogram of clothes (figure 5.6). The most efficient rating is anything under 0.0126 KWh/Kg (Bureau of Energy Efficiency, 2013).

In the UK the energy rating scheme is mandatory for washing machines as part of EU wide legislation (figure 5.7). Similar to the system in Brazil, appliances are rated on a bar scale from A (most efficient) to G (least efficient) (Harrington & Damnics, 2004), although as efficiencies have increase ratings of A+++, A++ and A+ have been introduced. The rating is based on the kilowatt hour per kilogram of clothes on a typical 40ºC wash.

### 5.8 Case Study: Jegou’s slow washer (Jegou, 2010)

Despite the wide-ranging literature on the subject of both the social and technical side of the laundry system, there is little published material regarding the application of the research, particularly from a design perspective. Jegou (2010) has used the findings from other studies as well as first hand primary research to create a prototype washing machine to promote energy responsible behaviours, through a co-design approach. The idea was to engage participants in the design process of a washing machine for sustainable behaviour so that they would be more inclined to use the system.

The research was carried out in four stages:

1) Online discussions with 16 families; talking about energy consumption in the home, exchanging pictures of living contexts and generally building rapport.

2) Immersion of design researchers within participants’ homes to invoke empathy with the participants.

3) Designers working with participants to co-design new product concepts.
During the co-design stage, two families were invited to take part in two design exercises (approximately one hour each). As suggested in the previous literature, the participants seemed open to washing for freshness rather than for cleanliness. The first design exercise explored the notion of shifting the washing machine from a private sphere into a social sphere - exploring washing programmes as a result of strategic conversation and peer-to-peer exchanges of experiences. A mock-up was devised where washing programs could be downloaded from the internet, either from other users, or from the manufacturers. Although families liked the idea of customisation, they tended to stick to their old habits, ‘downloading’ the same program that they used on their old washing machine. It was concluded that a more powerful and disruptive setting is necessary to ‘kick’ users out of their habits.

The second design activity explored ‘softer washing options’ – introducing a longer cycle time but using much less energy. A mock-up was created with three washing options simulated (refreshing, light, normal), where the cycle time can be adjusted between 8 hours, 4 hours, 2 hours and 1 hour with the energy consumption indicated on a scale from green to yellow to red. The benefits of the ‘long wash’ system were demonstrated through a mock TV advert, and participants were asked to ‘sort and wash’ different garments.

The participants demonstrated that there was perceived less user time in the laundry process and more machine time. Participants used the long cycle for a ‘normal’ wash and short cycle for ‘refreshing’. A change in habit was illustrated as users changed from doing the laundry at the weekend to doing it every 2 or 3 days, and laundry was sorted depending on how dirty it was. Participants showed little negativity to the fact that it would be washing for up to 8 hours, as this didn’t affect their
current behaviour – setting the machine before they went to work or bed, and coming back to it after an extended period of time.

Jegou’s research shows that change of behaviour can occur and that it doesn’t require a ground-breaking innovation in technology. All the interventions in his research were made with existing technology or off the shelf components. He argues that we would not need a major socio-technical structural adjustment to limit the consumption of energy and extend the washing time to 6-8 hours. His research concentrated on a small number of families from Belgium, therefore washing was conducted in a very similar context with similar habits prevailing. Looking further afield at other contexts and habits could help inspire other low energy solutions. It should also be noted that Jegou’s interventions were purely conceptual rather than functional and therefore any evaluations are limited to creative thinking rather than empirical findings.

5.9 Introduction to cross-cultural intensive study on laundry behaviours

The intensive study was informed by the results of the scoping study which suggested laundry behaviours by people from different cultures were very different and offered interesting avenues for contrast and comparison. The intensive study therefore had the following aims:

- To identify differing behaviours by people in different countries related to the laundry routine.
- To understand the influence that culture has on household behaviours; in this case specifically relating to laundry behaviours.

5.10 Data Collection

To collect the relevant data for the intensive study, three data collection techniques were employed. These were; contextual observation, household tour, and contextual interview. These methods, and the reasons they were used are discussed below.

5.10.1 Contextual Observation and Contextual Interview

Contextual observation and interview are common data collection techniques in qualitative research. Contextual observation is, however, very broad and involves a range of different methods that help in collecting information relating to people’s behaviours and activities as they occur in real-world settings rather than a controlled environment (McClelland & Suri, 2005). Contextual observation is an excellent way of seeing how products and artefacts are
used in everyday life and what the implications of this are (ibid). In context observations also allow investigators to validate what participants say in interviews. “One distinct advantage of the observation technique is that it records actual behaviour, not what people say or believe they do” (Guðjónsdóttir & Lindquist, 2008; p169).

The human-centred nature of the study provides more of a grounds for informal observation as the researcher is as much a subjective participant in the lives of those being studied as an objective observer (Angrosino, 2007). This ‘participant-as-observer’ method provides a means to enrich the data from the survey and literature as the researcher can change the course of the particular activity to explore a pattern or behaviour that is deemed interesting to the research (Gaver, 1999).

In their comprehensive review of methodologies specifically related to design, McClelland and Suri (2005) outline what contextual observations can reveal:

- The physical and social environmental factors that need to be taken into account
- The realities of people’s practice in contrast with formal processes
- Insights concerning user preferences and attitudes, and the impact of socio-cultural issues
- Work-arounds developed to cope with design inadequacies and/or people’s own physical/cognitive abilities
- The functional and emotional significance of specific artefacts or rituals
- Opportunities for design improvements in terms of people’s processes and experience
- Unusual physical or cognitive demands where dynamic behaviour in space and temporal factors may need to be accommodated.

Within the context of laundry, other social and anthropological researchers have used contextual observation as the main means for gathering data (Pink, 2005; Shove, 2003; Laitala, 2010). As a result, the previous research has identified key concepts within the system of laundry, and the frameworks and models that have been developed can be used to inform an exploratory study on the effect of culture on laundry behaviours, an area that is currently under researched. The methods undertaken in the data collection can therefore be tied into the five laundry dimensions identified in Shove’s ‘Whirlpool Model of Laundry’
(2003) and Laitala et al’s. research into best washing practice (2011) as outlined earlier in the chapter (5.3 & 5.4).

There are various observation approaches that have been described by social researchers which the study can fall into. Kusenbach (2003) has developed the ‘go along’ approach as a hybrid between observation and interviewing, where the researcher accompanies participants on their natural outings and asks questions and observes. “Ethnographers are able to observe their informants’ spatial practices in situ while accessing their experiences and interpretations at the same time” (Kusenbach, 2003; p463). In essence it is a method very similar to ‘shadowing’ outlined by McClelland and Suri (2005) which involves “following selected individuals as they conduct everyday activities through space and over time” (McClelland & Suri, 2005; p303). They recommend engaging the participant in conversation rather than an interview to maintain naturalism (ibid).

The in-context interview was carried out by the investigator in the participant’s home. “Contextual interviews are an effective method for eliciting user requirements because they are a combination of interview and observation” (Guðjónsdóttir & Lindquist, 2008; p168). The method is useful as the participants can give more relevant descriptions when they are in the environment around the relevant tools. The investigator also has a clearer understanding of the environment, observes the tools and activities performed and has a better chance to ask relevant questions (ibid).

Questions were asked related to the themes of laundry in the home and notes were taken along with recording the interview on a dictaphone. The themes included questions on pre-treatment of clothes, the washing routine, drying, post-treatment and general questions (see Appendix B). The interview had a flexible feel to it and was designed to draw out information about the participant and their routines within the home. The informal and flexible nature of the interview helped to build a rapport between the researcher and the participant before conducting the household tour and contextual observation.

Data collection was conducted with one main participant in each household, generally the one who performed the laundry most regularly. Whilst it would have been interesting to have all household members present to discuss the inter-relationship between the different members, the logistics and practicality of getting everyone together in one place at the same time was unattainable in a study of this size and scope. Focusing on the main
‘launderer’ within the household helped to get a more in-depth knowledge of the process of ‘doing the laundry’.

5.10.2 Household Tour (with video)

The household tour allowed the participant to narrate relevant information regarding the research subject to the investigator. The participant reveals their thoughts regarding artefacts and experiences within their environment whilst the investigator interprets these thoughts relevant to the research (Wilson, 2012; Pink, 2007). Walking with the participants in their environment can prompt the participant to reveal their thoughts or actions around certain artefacts or actions that would not have otherwise been apparent using just the interview method, whilst the investigator can always probe for more information if there is a particular aspect that is of interest (IDEO, 2003).

Over various studies Pink (2004, 2005) has developed a sensory ethnographic methodological approach to narrate people’s everyday practices through sensory metaphors. She uses video and audio to help ‘sense’ the environment or practice in which the participant is engaged.

In one study, with a sample of 20 participants, an in-depth interview was conducted focusing on the participants’ life, self-identity, laundry routines and priorities, followed by a video tour with the participant demonstrating the practice in their environment. Sensory aspects about their decision-making, experience and laundry items were discussed to embody participant’s emotional experience of laundry in the home.

In a review of her own methods, Pink suggests that participants performed ‘for the camera’ when they knew they were being recorded, in the same way people perform oral narratives when being tape recorded, but that “in the absence of long-term participant observation, video therefore provides alternative routes into other people’s lives that can produce both a record of the research encounter as it happened, actions as they were performed and experienced, and spoken and embodied narratives” (Pink, 2005; p277).

The household tour was conducted after the contextual interview and usually led to the contextual observation of the laundry procedure. Like the contextual interview, the household tour was kept fairly informal and led by the participant, with the investigator interjecting if there was a particular aspect of interest where more details were required.
Throughout the study there was also a considerable amount of in-context immersion; where the researcher spent a substantial amount time with the research participants during their everyday lives. This can add substantial value to the data as “meeting people where they live, work and socialize provides new insights and unexpected opportunities” (IDEO, 2011).

In The Human Centred Design (HCD) Toolkit it is suggested that:

“By being with people in their real settings and doing the things they normally do, you can talk to them about their experiences in the moment. By immersing yourself in their context, you’ll gain empathy and come to understand the people you are designing for on an intellectual and experiential level” (IDEO, 2011)

5.10.3 Pilot Studies

Before the main data collection for phase 3 was conducted a pilot study was completed. Pilot studies act as a test bed for potential models and theoretical framework which influence the variables being studied (Robson, 2011). Their advantage is the broader and less focused scope than the final investigation allows for potentially new insights to appear and be explored. They also create a ‘test laboratory’ for which to try out data collection techniques before the main trial. They are therefore useful to inform the intensive study of both substantive and methodological issues (Robson, 2011; Yin, 2009).

The pilot study was completed in two households, one familiar to the researcher and one unfamiliar. The studies were incredibly useful in determining the individual nuances and potential complications surrounding data collection in people’s homes, and ultimately helped shape the final data collection techniques.

In one of the households, despite arranging a time with the participant when she would be free, she was still finishing off dinner with her husband and a friend when the researcher arrived. This was not a problem for either party and in fact helped in building an immediate rapport with the participant; it did however highlight the dynamic nature of household life and difficulties in slavishly sticking to a predetermined schedule. The introduction of the researcher allowed the general ‘dinner time’ conversation between the 3 people to turn to the reason why the researcher was there and thus a rich and detailed discussion was had by the group about their different laundry habits and the habits of those they knew. Whilst this proved useful and really ‘set the scene’ for the forthcoming research, the conversation was
spontaneous and almost immediate from the researchers’ arrival. It was not deemed appropriate to interrupt their dinner further by asking them to read and sign consent forms before speaking and thus all recording equipment was switched off at this point. This informed the intensive study, meaning that, where possible, consent forms would be sent out prior to the researchers’ arrival or would be one of the first things to complete upon arrival to ensure that recording equipment could be on for all of the relevant discussion.

The order of the data collection was also changed as it seemed more appropriate. The participant was more willing to sit and discuss her laundry habits first, before conducting a household tour and demonstrating their laundry procedure. In hindsight this made more sense as the time spent with the participant discussing and chatting helped to build a rapport, rather than a researcher walking straight around the house as soon as they arrived. This made the household tour more appropriate as the participant was familiar with what was being asked and more comfortable and would describe things that came up earlier in the conversation.

One key element where the pilot helped to inform the intensive study was the inclusion of a video camera. Initially video cameras were deemed too intrusive and too hard to manage for just one researcher, and it was thought that observation of the process would be more effective. However, during the first pilot a camera was not used and it became hard during the analysis to depict the exact actions of the participant. In the second pilot a video camera was used and it proved incredibly useful in showing the situational context of the participant and their actions. It was found that if the camera was held at waist level along with the other paperwork, the participant would take much less notice of it than if it were at eye level and thus they were much more natural.

5.10.4 Sampling Strategy
The participants chosen were young, middle income consumers. Research on consumer segmentation is generally limited, particularly in emerging markets (Schäfer et al., 2011) and little cross-country comparisons exist. Table 5.2 highlights the consumer groups that were identified in each country and the characteristics associated with each group.
Table 5.2 - Consumer classifications in Brazil, India and the UK

<table>
<thead>
<tr>
<th>Brazil</th>
<th>India</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Class C (SAE Survey)</td>
<td>• Annual Income Rs 3.4 lakh to Rs 17 lakh</td>
<td></td>
</tr>
<tr>
<td>• Household monthly income R$1100 – R$4500</td>
<td>(approx. £3500 – £18000)</td>
<td></td>
</tr>
<tr>
<td>(approx. £300 – £1300)</td>
<td>• Some formal education</td>
<td></td>
</tr>
<tr>
<td>• 80% with access to internet</td>
<td>• Fastest growing sector</td>
<td></td>
</tr>
<tr>
<td>• 46% of all Brazil’s purchasing power</td>
<td>• Spending on durable goods</td>
<td></td>
</tr>
<tr>
<td>• Higher level of schooling than parents</td>
<td>(Economic Times, 2011)</td>
<td></td>
</tr>
<tr>
<td>• Proportionately younger than other sectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fastest growing: 30% growth in last decade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Secom, 2011)</td>
<td></td>
<td></td>
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</tbody>
</table>

Participants were chosen from these groups of society as they are a large consumer of modern household appliances, with an available disposable income and an ability or desire to change consumption habits based on societal norms/cues.

The boundaries between different sampling strategies in qualitative research are often blurred and unclear (Coyne, 1997). The necessity for participants to fit into the category of young, middle income consumers would suggest a criterion sampling strategy was adopted (Schwandt, 1997). However, as such a broad and open-ended set of criteria would provide a huge number of possible participants, further convenience and snowball sampling (Robson, 2011) was used to identify the small number of cases required.

Participants in the UK were recruited around the Loughborough region through advertisements on local notice boards, a small amount of local media coverage, and using the snowball sampling strategy through the author’s personal contacts in the region. In Curitiba, Brazil, participants were recruited with the aid of the Design and Sustainability Research Centre at the Universidade Federal do Paraná (UFPR). Whilst in Bangalore, India, participants were recruited via a local architectural office, Biome Solutions, who answered a notice placed on the O2 Sustainability Network.
In each case, participants were selected to give a range in demographics within the specified criteria. Participants with a close affiliation to the project or research group were specifically left out as they may have given answers based on their learned knowledge of the study area. Equally, suggestions through snowballing to interview family members in different houses were not included as these may have skewed the results based on the participants’ upbringing being too similar – an area under investigation in the research.

In each case, one participant from each household was interviewed. This was the person who was mainly responsible for the laundry of that household, or in the case of a flat-share, a person who washed their own clothes. The decision to interview only one person from each household was taken due to the time and organisational difficulties of having every household member present.

5.11 Sampling Sites

For the more in-depth user centred research, regions in the UK, Brazil and India were chosen as study areas. These 3 countries were chosen as they show extensively different cultures with the potential to generate a wide array of insights. The regions within each country were chosen for a variety of reasons. The following section introduces each region and the reason for its selection as a study area.

5.11.1 Site 1: Loughborough, United Kingdom
Loughborough is the second largest settlement in the county of Leicestershire with a population of approximately 60,000. As with the rest of the UK, Loughborough experiences a maritime climate with mild summers and winters. The average high in summer is 21ºC with average lows in winter of 1.2ºC. There is a yearly average of 606mm of rainfall over approximately 160-170 days of precipitation (Met Office, 2000).

The smallest of the three sites, Loughborough has two distinct areas, the town centre and the large Campus University. Whilst small, Loughborough boasts excellent transport links with road and rail services connecting it to the nearby cities of Leicester, Nottingham and Derby as well as good links to the capital, London, and East Midlands airport for national and international flights. Historically a manufacturing town, the University has grown steadily to replace the decline of industry in the region and is by far the largest employer in the area.

The borough of Charnwood, in which Loughborough is situated, has a large proportion (approximately 20%) of 20-24 year olds demonstrating the dominance of the university. Conversely the age range of 25-29 is the lowest working age proportion as students move away from the area after graduating (Leicestershire County Council, 2005).

Loughborough was also chosen for pragmatic reasons as the researcher obviously has contacts and knowledge of the local area and resources to be able to carry out the research.
5.11.2 Site 2: Bangalore, India

Bangalore is the capital of the South Indian state of Karnataka. It has an estimated population of 8.5 million inhabitants, making it the 3rd most populous city in India (CensusIndia, 2011). Bangalore has a tropical climate with distinct wet and dry seasons. It has an average high in summer of 33ºC and low in winter of 15ºC. There is a yearly average of 974.5mm of rainfall over 58.5 average days of precipitation (World Meteorological Organization, 2012).

Bangalore is a demographically diverse city with a multilingual, tolerant and cosmopolitan culture (Nair et al., 2007). It is commonly known as the ‘Garden City of India’ due to its abundance of green spaces and parks. It is home to many higher education institutes and is one of the top ten preferred entrepreneurial locations in the world (Economic Times, 2012).

Bangalore is commonly cited as the Silicon Valley of India due to its position as a hub for information technology industries (Silicon India News, 2005). With an economic growth rate of 10.3% it makes it India’s second fastest growing region (Rediff Business, 2008). Many multinational corporations have set up in Bangalore due to the abundance of skilled labour, amongst other things, including Microsoft, as well as many large Indian corporations such as Wipro and Tata Consultancy Services.
The research in Bangalore was carried out with the help of Chitra Vishwanath from Biome Environmental Solutions following the call for study participants on the O2 Sustainability Network.

5.11.3 Site 3: Curitiba, Brazil

Curitiba is the capital of the southern Brazilian state of Parana. The Metropolitan Region of Curitiba has a population of 3.2 million people whilst the city centre has a population of 1.8 million making it the 8th most populous city in Brazil (IBGE, 2010). Curitiba has a high literacy rate and its education system is considered to be one of the most developed in Brazil (Schäfer et al., 2011). Curitiba has a temperate climate with few extremes in temperature. The average low in winter is 7°C whilst the average high in the summer months is 18°C. There is a yearly average of 1408mm of rainfall over 164 average days of precipitation (World Meteorological Organization, 2012).

Curitiba has a long history of successful sustainable urban planning, winning many accolades and being used as a model for the redevelopment of cities around the world. The city has the highest rate of public transport use in Brazil at 45% of all journeys, whilst its fuel usage is 30% lower than Brazil’s other major cities (UNEP, 2009). It also benefits from some of the country’s lowest rates of urban air pollution and congestion. At the same time the introduction of progressive planning legislation has meant that despite a three-fold increase
in population density in the city centre from 1970 - 2008 the average green space per person has increased from 1m² to over 50m² (ibid).

Curitiba’s economy is nearly completely made up by industry, commerce and service sectors. It has the second largest car manufacturing industry in the country and is home to many multinational corporations, including Electrolux, ExxonMobil, HSBC, Volkswagen, and Audi as well as many others. The city receives approximately 2 million tourists every year and has an economic growth rate far higher than the national average (Brazil Pime Design, 2008).

Curitiba was also chosen as a study area for practical reasons, as Aguinaldo dos Santos, head of the Design and Sustainability Research Centre at the Federal University of Paraná was a contact of the Sustainable Design Research group at Loughborough University.

5.12 Analysis
The data collected using contextual observation and interview is most suited to thematic analysis. Thematic analysis is often poorly represented and misunderstood within qualitative research (Braun & Clarke, 2006). Thematic analysis is defined as:

“A method for identifying, analysing and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail. However, frequently it goes further than this, and interprets various aspects of the research topic” (Braun & Clarke, 2006; p79).

Data from the contextual interviews, observation and household tours was first transcribed using NVivo software. Transcription, integrated with notation of non-verbal behaviour is critical to the reliability, validity and trustworthiness of qualitative research (Maclean et al., 2004). Whilst in some cases full transcription is not required, it can help to familiarise the researcher with the data and draws out meanings and patterns that can be used for coding later in the analysis process (Robson, 2011).

The analysis of the intensive study data took on a theoretical thematic analysis whereby codes were originally focussed on relevant themes identified in previous research, predominantly by Shove (2003). Using this approach the original influential research by Shove could be expanded upon and the study area progressed (Braun & Clarke, 2006).
In some instances data were coded on a semantic level, dealing with the obvious description of the activity undertaken, purely at a surface level. However, further coding and analysis at a latent level went beyond the surface to identify underlying ideas and assumptions creating themes that are not just descriptive, but already theorised (Braun & Clarke, 2006). The full list of codes can be found in Appendix C.

Generally speaking the analysis was carried out following the ‘Phases of thematic analysis’ (Table 5.3) identified by Braun and Clarke (2006):

Table 5.3 - Phases of thematic analysis (Braun & Clarke, 2006)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description of the process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Familiarizing yourself</td>
<td>Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.</td>
</tr>
<tr>
<td>2. Generating initial codes</td>
<td>Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.</td>
</tr>
<tr>
<td>3. Searching for themes</td>
<td>Collating codes into potential themes, gathering all data relevant to each potential theme.</td>
</tr>
<tr>
<td>4. Reviewing themes</td>
<td>Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic ‘map’ of the analysis.</td>
</tr>
<tr>
<td>5. Defining and naming themes</td>
<td>Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.</td>
</tr>
<tr>
<td>6. Producing the report</td>
<td>The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.</td>
</tr>
</tbody>
</table>

Throughout the data collection period measures were taken to aid the analysis of data at a later stage under the ‘Good Housekeeping’ guidelines identified in Robson (2011, p473). After each data collection session a summary sheet was produced reflecting on the main outcomes of the meeting, the relevance and implications to the research questions, and any interesting or anomalous occurrences. Interim summaries were also written after each round of data collection in the different regions to summarise what was discovered and any potential gaps that could be explored in the further research trips. Memo and note taking was also commonly completed throughout the data collection and analysis processes.

NVivo was used as the software package to analyse the data as it can deal with large volumes of different types of data. The benefits of using a software package such as NVivo ensure that codes can be easily assigned to different sections of the data and can be easily modified and grouped to allow efficient analysis. The various organisational and search features also make it easy to arrange and classify the data or to find particular extracts that might be missed otherwise; whilst clear data visualisations can be created with relative
simplicity. This reduction in the possibility for human error has been thought by some to add rigour to qualitative research (Richards & Richards, 1991).

As Welsh (2002) establishes: “It [NVivo] serves to facilitate an accurate and transparent data analysis process whilst also providing a quick and simple way of counting who said what and when, which in turn, provides a reliable, general picture of the data” (Welsh, 2002, p5).

5.13 Participant Information

The participants were made up of members of six households in the UK and India and seven in Brazil. The data was collected between May and September 2012. The tables below give an outline of the participants’ characteristics.

Table 5.4 - UK Participants

<table>
<thead>
<tr>
<th></th>
<th>UK01</th>
<th>UK02</th>
<th>UK03</th>
<th>UK04</th>
<th>UK05</th>
<th>UK06</th>
</tr>
</thead>
<tbody>
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<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Household members</td>
<td>2</td>
<td>2 adults, 2 children</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>2 adults, 1 child</td>
</tr>
<tr>
<td>Occupation</td>
<td>Administration</td>
<td>Researcher</td>
<td>PhD Student</td>
<td>Sports coach</td>
<td>Engineer</td>
<td>Marketing</td>
</tr>
<tr>
<td>Washing machine type</td>
<td>Front Load</td>
<td>Front Load</td>
<td>Front Load</td>
<td>Front Load</td>
<td>Front Load</td>
<td>Front Load</td>
</tr>
</tbody>
</table>

Table 5.5 - Indian Participants

<table>
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<tr>
<th></th>
<th>IN01</th>
<th>IN02</th>
<th>IN03</th>
<th>IN04</th>
<th>IN05</th>
<th>IN06</th>
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<tbody>
<tr>
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<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Age</td>
<td>35-40</td>
<td>30-35</td>
<td>30-35</td>
<td>25-30</td>
<td>35-40</td>
<td>30-35</td>
</tr>
<tr>
<td>Household members</td>
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<td>2 adults, 1 child</td>
<td>2 adults, 1 child</td>
<td>2</td>
<td>2 adults, 2 children</td>
<td>2</td>
</tr>
<tr>
<td>Occupation</td>
<td>Journalist</td>
<td>Engineer</td>
<td>Administration</td>
<td>Architect</td>
<td>Housewife</td>
<td>Translator</td>
</tr>
<tr>
<td>Washing machine type</td>
<td>Front Load</td>
<td>Top Load</td>
<td>Front Load</td>
<td>Front Load</td>
<td>Front Load</td>
<td>Top Load</td>
</tr>
</tbody>
</table>

Table 5.6 - Brazilian Participants

<table>
<thead>
<tr>
<th></th>
<th>BR01</th>
<th>BR02</th>
<th>BR03</th>
<th>BR04</th>
<th>BR05</th>
<th>BR06</th>
<th>BR07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Household members</td>
<td>3</td>
<td>2 adults, 1 child</td>
<td>3</td>
<td>2 adults</td>
<td>1</td>
<td>2 adults, 1 child</td>
<td>3</td>
</tr>
<tr>
<td>Occupation</td>
<td>Banking</td>
<td>Masters Student</td>
<td>Accounting</td>
<td>Lawyer</td>
<td>Copyrighter</td>
<td>Shop owner</td>
<td>Admin</td>
</tr>
<tr>
<td>Washing machine type</td>
<td>Top Load</td>
<td>Top Load</td>
<td>Top Load</td>
<td>Top Load</td>
<td>Top Load</td>
<td>Top Load</td>
<td>Front Load</td>
</tr>
</tbody>
</table>
5.14 Findings

The data collection from the intensive study provided an enormous amount of rich visual and contextual information regarding laundry behaviours in the three different contexts. The following section is divided up into the themes that were highlighted in the research and their comparisons across the three study areas. In figure 5.9 the themes that were derived from the literature (e.g. Shove’s whirlpools of laundering, and energy efficiency ratings) have been highlighted in orange. Themes that were developed from the research, such as perceptions, aspirations and experience have been highlighted in blue.

![Figure 5.9 - The complexity and interconnectedness of the laundry system](image)

5.14.1 How to Launder

Drying Clothes

In Brazil there was a common dislike of drying clothes when it was cold or humid because it took longer to dry them. In some instances this led to washing being delayed because of the poor drying conditions. This was also linked by the participants to smell, as clothes that took longer to dry did not smell as ‘fresh’.
Some participants used the balcony to dry clothes when it was sunny, although the majority used drying racks located in the laundry room (Figure 5.10). Interestingly, the only participant to own a front loading machine was the only participant to use a tumble dryer (BR07). She did not have a big enough laundry area to dry the clothes and therefore did not like the aesthetic of leaving clothes around the apartment to dry – so she used the dryer.

In India all the participants dried their clothes outside in the sun – due to the climate being good and stable for 300 days of the year. In the wetter months where rain is more regular there was more loathing towards washing clothes as drying became more tricky. Clothes would be left to hang undercover, but would take longer, and as a result people washed less frequently. Brazilian participants noted they washed less frequently when it was humid or raining because it is hard to dry the clothes and can leave a smell of damp clothes, with one participant (BR07) admitting she used the dryer when it was too hard to dry clothes naturally, simply because of the smell.

Interestingly a couple of the Indian participants linked the spin cycle of the machine to the drying process (IN02, IN05). They stated that the spin cycle ensured the clothes were partially dry when they came out of the wash and therefore didn’t need as much time in the sun.

In the UK there was more of a mix between the participants, with 50% suggesting they dried their clothes outside when possible because they dried with a nicer smell, and it was free.
50% of the participants never dried their clothes outside because it was too much effort or they couldn’t rely on the weather.

During winter the participants dried their clothes inside, on radiators or clothes racks. One participant admitted to turning the heating on to dry clothes if they needed a particular item for an event and had forgotten to wash it earlier (UK04).

**Frequency of wash**

In Brazil the frequency of wash ranged from once per week to five times per week. Generally speaking, washing only once or twice per week was from the single people or those that lived in flat shares, whilst the most washing (5 times per week) was by a family with young children.

In terms of frequency of wash per item of clothing – there was a divide between those participants who used senses (visual, smell, touch) to determine when something was dirty, and those who made decisions purely on time. Some participants had a strict ‘one wear, one wash’ policy for t-shirts and shirts, with a similar policy for trousers (2-5 wears), whilst other participants went purely on sensory indicators.

In India all participants used the washing machine 2 to 3 times per week. Once again there was a split between ‘time related washers’ and ‘sense related washers’. Shirts were generally washed daily and trousers weekly.

In the UK the frequency of wash ranged from 1 – 3 times per week, with the lowest for single people in flat shares and 3 times a week for the family with children. There was a similar split in washing techniques between senses and time, although interestingly one participant showed signs of doing both; using the time related ‘one wear, one wash’ policy for his work clothes, but the sense related washing technique for casual clothes (UK05).

The majority of participants from all the regions actively stated that they wait for a full load before doing the laundry, most of the time. If they need to wash a particular garment for an event they will try to put it with other clothes that need washing.

**Sorting clothes**

All of the Brazilian participants sorted clothes by colour, with 5 separating into 3 colour groups – white, black, and colours; and 2 participants just separating whites and darks.
Some participants separated materials, with wool being washed separately and delicates sometimes by hand. Bed sheets and towels also went in separately to normal clothes.

Similarly in India participants separated colours from whites. It was also common to wash bed sheets separately as well as jeans all together in one wash. One participant admitted to washing all white clothes by hand (IN03), whilst another separated informal from formal clothes (IN02).

In the UK all participants sorted colours and darks except for one who admitted to not sorting clothes unless there was an obvious bright red thing present. Sports gear was also mentioned by one participant as being washed separately (UK03).

Routine

In Brazil, by far the most common time to wash clothes was at the weekend as this is when participants stated they had the most free time. Occasionally it would be done in the evenings, but most of the time on the weekend – sometimes in 2 batches if needed.

In India there was less of a consensus for a particular time to wash. Participants washed clothes at their convenience, sometimes at the weekend, sometimes in the evening, or sometimes in the morning before they went to work. It must be noted however that this ties in considerably with the house help (see section 5.9.5), as they would often be asked to do the laundry.

Similarly in the UK there was no common time when all the participants washed their clothes. One participant (UK03) washed them in the morning but then waited for the cycle to finish so he could take the clothes out immediately (one reason why he always used the shortest cycle time). Whilst another participant suggested she put them in the morning and went to work – taking them out in the evening, although she often forgot to do so (UK02). Others (UK05, UK01, UK04) suggested it would just be whenever there was a build-up of clothes and they had some free time.

5.14.2 The Built Environment

This was one of the biggest factors in washing technique and routine. All the Brazilian households had some form of laundry room, either a large room off the kitchen or just a small separation (figure 5.11). A couple of participants mentioned their desire for this room – with older apartments having bigger laundry rooms – and that they are starting to be phased out in the newer apartments. They considered it very useful to have a laundry room.
Those participants with small laundry rooms pointed to a distinct lack of space in the apartment – especially for drying clothes.

Figure 5.11 - Small laundry area off of kitchen, showing drying rack above the top loading machine, Brazil

In India the common mention was of the Indian environment being grubby and dirty as well as hot and sweaty. One participant (IN04) admitted the centrifuge on the machine was a must because in their apartment they didn’t have much space to dry clothes.

The layout of the laundry environment has a profound effect on the laundry behaviours of participants. Historically in Brazil, houses, and consequently apartments, have been built with designated laundry spaces – predominately because, before the relatively recent introduction of machines, laundry was an arduous task that needed space to complete both the washing and drying process. In the apartments that were investigated, the laundry room was usually attached to the kitchen with a window on either side so that a through draft could be created to aid with the drying process. The rooms ranged in size from approximately 3m² to 12m² and contained the tools required for laundry (machine, sink and washtub, detergents, and drying facilities), with some of the bigger spaces even being used as spare rooms for guests.

This laundry space is beginning to change however. It was noted that the laundry space decreased with size the more modern the apartment. Indeed the participants noted that modern apartments had laundry spaces that were very small, or not at all – with the washing machine being integrated into the kitchen. Many of the participants suggested that
they had specifically rented out an older apartment simply because of this larger laundry area.

In India the machines were located in different places around the house - sometimes in the kitchen, in the bathroom or in other designated areas around the house such as the small room on the roof terrace. One modern house had specifically located the washing machine on the roof so that gravity could be used to help filter the waste water down to other appliances in the house. In the UK all the washing machines were located in the kitchen under the worktop. It was common practice to dry clothes on radiators and racks throughout the house – a practice that had mixed reviews amongst the participants – with some disliking the aesthetic of wet clothes around the house and some just not bothered – feeling that it was just the norm to have clothes draped around.

5.14.3 House Help

The adoption of house help differed between the regions. In India house help was common with one participant having a permanent member of staff to aid with the household chores (UK01), whilst all the other participants either had house help that came for a few hours each day or at least once a week.

There was also the service as seen in figure 5.12 above whereby an ironing service would be located nearby, either a mobile cart or in the stairwells of apartment blocks which many participants used for their formal wear.
In Brazil all the participants had house help, however they only came either once per week or once every two weeks, usually staying for a few hours to clean the house, do other household chores and, if time, do some aspects of the laundry. In the UK none of the participants had any form of house help.

5.14.4 Why Launder

Exceptions to the laundry routine

The common themes across the 3 regions in relation to participants’ exceptions to their normal laundry routine was either guests (usually in-laws) staying in the house or washing for an occasion (a particular garment for a particular event).

In Brazil a couple of participants mentioned that they washed certain garments by hand, although these were usually shoes or garments of a particular, fragile material.

“*I wash some delicate clothes by hand because sometimes the machine can spoil them*” (BR02).

One participant mentioned that they occasionally set the machine to wash empty to clean it, but only about once every 6 months. When commenting that participants’ occasionally wash something for a particular event they suggested that if this was the case they wouldn’t only wash one thing, but fill the machine.

“*Yesterday that happened. I just asked, so I kind of picked up everything that I had that was dark and asked the girls [flatmates] if they had anything as well and I just put everything in*” (BR07).

In India, the in-laws coming to stay increased the frequency of washing from 2-3 times per week, to almost daily with one participant. Participants also added that there was an exception to their washing machine if they went travelling, either for holiday or for work. Participants argued that if they were away for work they would wash less because either they would get the washing done when they were away (hotel service) or they were on location (engineer) and didn’t require a change of clothes as regularly.

“*I will get everything done outside and then bring it home*” (IN02)

Although this can be counteracted with an extra wash before going away so that all the clothes are ready for the trip.
“If you are going on a tour or travelling and you want clothes with you – then you don’t wait for a full load” (IN01).

One Indian participant had also changed his laundry routine recently because he had decided to cycle to work (IN04). This meant he had more to wash because he changed from his ‘cycling clothes’ to work clothes when he arrived at the office – Although this was now becoming more of a routine.

Similarly in the UK, one participant (UK03) admitted that his laundry routine was often dictated by his running routine – washing clothes after a run. Although he tried to keep this fairly regularly, sometimes his running routine would change and as a result so would his laundry routine.

Similar to the other samples washing would increase if visitors came to stay, and also if there was an occasion or event that a particular piece of clothing would be suited to or preferred but was dirty.

One participant suggested that they would alter the laundry routine if there was a new piece of clothing that was likely to run or ruin other clothes.

“The only exception would be if someone got something new that was bright red. But generally they all go in together” (UK02).

**Time related**

Once again there were common themes between the regions, but also contradictions and differences within each sample.

In Brazil there were noticeably three types of washing technique related to time. Those that always washed on the quickest setting because time was important to them and they wanted it done as soon as possible;

“I know this one [setting] is quick, but the other one is not” (BR03)

Those that put it on the longest cycle because they felt the short cycles did not clean thoroughly enough;

“I always use the longest because it is best to rinse clothes...The shorter takes 30 minutes and this is not long enough to thoroughly clean the clothes” (BR04)
Finally, those who weren’t bothered about time at all – not knowing how long the machine took they would just return in a few hours to collect their washing.

“No I don’t know the time, most of the time it is in the morning because I leave it all day long” (BR01).

In one instance the participant washed clothes by hand when there was not a huge amount to do simply because they felt the cycle time of the washing machine was too long. Although they noted they still used the spin cycle of the machine to help wring out the clothes.

One Brazilian participant (BR06) also looked at buying a front loading machine but noted that the cycle time was too long so she opted for a top loading machine with a shorter cycle time – relating this to time and energy saving.

In India there were fewer types of washing technique, with most participants suggesting they use the quickest cycle because they don’t want to wait a long time for clothes to be washed.

“The minimum used is fast wash...that it takes 40 minutes is good” (IN03)

One participant (IN05) suggested that despite owning a dryer, they never used it because it took ‘far too long’ at nearly 2 hours and they did not feel comfortable using that much energy.

Similarly in the UK, the most common wash was the quick wash, although there were also participants who were not too bothered about the time the wash took. One particular participant (UK03) did not like the idea of leaving his clothes in the washing machine for too much time after it had finished because they would smell mouldy. For this reason he didn’t like the long setting because he felt like he had to hang around whilst the machine was working so he could be there when it finished. Only one participant (UK04) admitted to changing the setting depending on what she was washing – she followed the instructions on the washing machine (figure 5.13).
5.14.5 Consumption

Why buy: machine

In the Brazilian sample the most important factors considered when purchasing a washing machine were price, washing capacity, brand, and energy consumption.

The washing capacity was noted by numerous participants and was unique to the Brazilian sample. The reason cited for the desire to have a larger washing capacity was the convenience associated with doing fewer washes:

“I have many things to do in my week, so to make only one wash per week I need to have a larger washing machine” (BR01).

Energy consumption was also cited as a reason for purchasing a particular washing machine by many of the Brazilian participants. Although they did not possess an in depth knowledge of the energy requirements of the machine, the energy rating scale, or PROCEL, influenced their decision to buy. Most participants opting for an ‘A’ rated machine with no one buying below ‘B’ rated.

“I just check if its like ‘A’ or at most ‘B’ and then its ok, I just turn it on and use it” (BR03).

“before I buy I always see if it’s a product like with the ‘A’.”(BR05)

One participant (BR06) admitted to buying a larger machine because it used the same energy as a smaller machine that could wash fewer clothes.
The key factors that were brought up by nearly all Brazilian participants were the price of the machine and the brand. Often the participants would draw up their own cost-benefit analysis of the machines and then opt to buy the one that was best value to them. Not necessarily the cheapest product, they opted for brands that were familiar or had been recommended to them.

“My flatmates mother has it and she thinks its good because that’s the one they use in their house so….OK that is fine” (BR07).

One Brazilian participant (BR05) noted that they wanted to buy a particular type of machine but their perception was that this type of machine was of poor quality in Brazil. In this case, they wanted to buy a combined washer and dryer but had heard that this type of machine was bad quality in Brazil so had decided not to buy it.

Similarly, the Indian participants bought machines based on the energy rating, price, and brand, with a couple of participants also mentioning noise as a small factor in their decision making when purchasing a machine. However, the Indian sample also possessed knowledge about which machine type to buy – with many opting for front-loading machines for water efficiency.

“The energy star rating is very important because it should be that, but then it should also be the front loading because that is the most water efficient one” (IN01).

There was still a lack of knowledge, and a lack of desire to learn, about the exact energy efficiency of the machine or the energy rating. In some instances the participant (IN04) knew that there was a certain amount of ‘clever marketing’ being done, but as long as the machine was in the top energy rating band, he was fine with that.

“From an electricity point of view also, I mean, it was... I didn’t go into details with the man, it was like a booklet. It was - OK, lets get this done with...but energy consumption, he said it was more efficient and there is no belt involved and its energy consumption was less and all that was part of the marketing thing, and it sounded fine” (IN04).

Like Brazilian participants, the Indian sample tended to do a cost-benefit analysis of which machine was best value to them with brand being equally important. Often the decision was based on recommendations from friends, or previous (bad) experiences with certain manufacturers.
“Because this company, IFP, is a very good machine” (IN03)

Two of the participants (IN04, IN05) also noted that they purchased a certain machine when they learned (through the salesman) that the machine had a new technology, which meant it was much quieter than traditional machines. Although they added that this was not a determining factor in the purchase of the machine.

By contrast, the UK sample offered very few similar factors in determining which machine to buy.

Often those in rented accommodation did not have a choice in the machine as it was there when they moved in. This is not the case in Brazil as often, the machine has to be bought by the tenant rather than the landlord.

One participant (UK02) suggested that they bought the machine as it came as part of a deal with a new kitchen that they purchased. Whilst other participants suggested price was important – buying a second hand washing machine (UK01, UK03). There was also a participant with a hand-me-down washing machine from their parents (UK06).

Brand was much less a determining factor when deciding to purchase a washing machine with the UK participants.

In the UK participants were concerned with the energy use of certain products and this was their first thought when commenting on the washing machine. In contrast, in Brazil and India, whilst the energy was a factor, perhaps more important and more commented on was the water consumption of the washing machine.

This offers an interesting insight into how the two resources are viewed in each context and is likely related to the way households pay for water and energy and the local supply of both.

**Why buy: detergent**

In terms of detergent use, in Brazil the common reasons for purchasing a particular detergent were price and brand. It was very common for Vanish to be used for stain removal – with specific Vanish products used for colours and whites. Powdered washing powder was also common with bleach used for white clothes.

Generally speaking, price was less of an issue with detergent purchasing as it was deemed to only be needed to be replaced fairly infrequently. Participants were happy to pay slightly
extra for a brand they knew or were used to, however there was an upper limit where they would not go beyond.

“Its like 2 Reals difference between the good and a not so good one, so I don’t have problems to buy the better one a little more expensive, because I don’t use so much...There is one vanish that is the best and it is like 20 something Reals but I don’t buy it ‘cos it is too much.” (BR05)

Similarly detergent is also bought through habit as it is the one they have always purchased and it just works fine (figure 5.14)

“The brand is a good brand and it works fine for me, it works quite fine” (BR01)

Participants also noted smell as a determining factor for purchasing a particular brand of washing powder.

In India, two participants were particularly worried about the phosphates in washing powder (IN01, IN04). They were made aware of the issues predominantly due to the nature of their work. One participant, a pro-environmentalist, had combated this by purchasing natural washing powder and re-using the water from the washing machine to water the plants. The other participant tried to purchase phosphate free washing powder where possible, although admitted this was a rarity. He also didn’t believe he could make a huge impact as he was living in an apartment block and didn’t see how changing his washing powder would greatly affect the waste water situation of his building.
Other Indian participants admitted to buying the ‘popular brands’ without any real knowledge of why; “It’s just what we’ve always used” (IN02), “It is the one made for front loading machines” (IN05).

In the UK, detergent purchases were generally made based on price and ease of use. The most common detergent type were tablets as “It’s just easy – just throw them in” (UK05). Participants also bought tablets as they took up less storage space.

Only one participant (UK03) didn’t like the idea of the tablets as he could not control the quantity of detergent used. Whilst one participant (UK02) specified that they bought non-bio as their children suffered from eczema and due to recommendation they stuck with that type.

5.14.6 Aspirations for washing

In Brazil, despite all participants owning a top loading machine (figure 5.15), by far the most common aspiration was to own a front loading machine, with all bar one participant wanting this. The common perception amongst those participants was that a front loading machine cleans the clothes better, is more water efficient and takes up less space. The participant who did not want a front loading machine reasoned that she could not stop the process mid-way through the cycle to add another garment she had forgotten to wash as she could with a top loading machine.

Figure 5.15 - Typical top load washing machine, this example in India
The reasons uptake of the front loading machines were slow was down to the expense

“I think the washing machine that has a front opening cleans better, but is more expensive” (BR02)

“I know the front load is better, but here it is quite expensive so…” (BR03).

There is also a perception that front loading machines are of poor quality in Brazil and the wash cycle is too long.

Similarly, many of the Brazilian participants wanted to wash clothes in warm water. They felt it would clean clothes better, particularly whites and clothes with stains, as some participants already soaked particularly dirty clothes in warm water prior to a wash. The reason cited for not using warm water was the expense of both the outlay of the machine in the first place and the cost of running it.

“I wish I could have laundry with warm water, yes, but I’m not going to buy. Just if one day it is almost the same price as a normal one, then it is OK.” (BR05)

Interestingly, most Indian participants were fairly happy with their washing machine performance with the two Indian participants with top loading machines wanting to change to front-loading machines.

“I would say the front load is more efficient in cleaning, because of the rotation of the drum which is horizontal rather than vertical. I think it cleans clothes better. The next one will not be a top load.” (IN02)

“I would have gone for the front loading and IFB [Indian appliance manufacturer] ones but at that time they didn’t have a model that didn’t have the heating option. That is not needed” (IN04).

The only UK participant who wanted their machine to be different suggested that “if it was simpler it would be better, you know – less buttons.” (UK05).
5.14.7 Energy and Environment

Only one Brazilian participant (BR06) thought that despite having an ‘A’ rated washing machine it still consumes a lot of energy (figure 5.16). The other Brazilian participants showed little concern or association with the energy consumption of the washing machine. Often the participants either had no idea of the consumption rate, or assumed that it was one of the lower energy consuming devices in the household, with other devices such as electric showers and heaters consuming considerably more energy. This is linked again to the energy rating, whereby as long as the device is ‘A’ rated, they believe they have done everything in their power to reduce its consumption; after all ‘I have to do the washing’.

“So it’s more the lights, oh, and I was living with a girl that cooks a lot, the oven [electric] was really expensive. But the laundry machine, I think no” (BR05).

“I just know that when it is cold I use the electric heater more and I use more energy. But for the washing machine – I have no idea about how that is going” (BR03).

“Only ‘A’ [energy rating], all my products, yes. But I never, when I see my bill I never think of the washing machine” (BR05).

When asked about the desire to own a machine that washes with warm water participants generally thought that this would contribute significantly more to the energy consumption of the machine.

“I guess it would be more expensive to get the water heated” (BR03).

However one participant (BR06) did conclude that she thought it shouldn’t make too much of a difference because of the technologies involved, however she couldn’t be sure because she had never used a hot water device. She concluded that if she had a hot water device she would only use it on lights/whites.
There was also some scepticism over some of the functionality of the machine, with one participant suggesting the extra rinse cycle was “bullshit, it washes clothes twice and uses too much water” (BR06).

Like in Brazil, in India the assumption is that buying a machine with a good energy rating is the most that consumers can do to conserve energy, and little is looked at beyond this energy rating.

“The one I have I don’t remember the wattage, but it is lower on energy consumption compared to most other models, and one of the cheaper ones” (IN04)

The common concern regarding the laundry was more to do with water efficiency than energy consumption. As one participant summarized “people usually want a water efficient washing machine, because they think that water is the only thing that is an input into the washing machine. They forget energy comes in too” (IN01).

This could partly be due to the payment of energy and water, which in India is often combined. The price of the water is not just the water bill, but also the energy required to pump the water around the house.

Again the consensus is that the washing machine is not the most energy consuming device in the household, with people more concerned about the geyser (water heater). One participant (IN04) noted that when he needed to use the geyser for the 3-4 months of the year due to the climate, his energy bill nearly doubled. He noted that the price of energy was not prohibitively high but was sufficient to notice the cost each month.

Equally participants admitted to a lack of knowledge about the energy consumption of washing machines generally because they ‘just had them’.

“Maybe I don’t know because I have had a washing machine since the day I moved in [to new apartment] so I really don’t know the difference” (IN06).

In the UK, consumption was much more focused around energy than water. This could largely be due to the heating of the water which is more inherent in the UK than the other regions and therefore offers the user a real chance to alter the energy implications of the washing process. That said, few participants actually consciously changed their washing behaviour to consume less energy. One participant noted that he washed at 30°C to save energy, not for environmental reasons, but just to save money. Whilst another participant
suggested that she tried washing at 30°C but found it did not clean as well, and was less inclined to wash at lower temperatures because she had learned from ‘her biology days’ that enzymes break down around 40°C.

Most energy concern in the UK was based around the use of a tumble dryer. Participants recognized the high-energy consumption and therefore tried to lessen the use of the tumble dryer.

“I try not to use the dryer, I just don’t want to waste energy” (UK03).

“It just seems like a waste of energy...” (UK05).

The negative connotations of high energy use causing high bills could be one reason to reduce energy consumption; however it is also thought that the general perception of tumble dryers to be high energy consumers and the relative ease to dry clothes by other means could also have an effect. This explains why even the participant who did not pay for bills themselves was still reluctant to use the tumble dryer.

One participant directly linked the cost of the drying to be free without the use of the tumble dryer and also added that drying it naturally had greater functionality in terms of aiding the washing process and had a better effect on the overall performance – in this case the sense of smell.

“I would much rather have it on the line. I’m not paying for it to dry when it is out there, it’s free and the sun is the best possible bleach for stains, especially tomato stains. And they smell nice, that ‘line-dry’ smell” (UK02).

As all of the participants in the Brazilian sample owned a top-loading machine the most common environmental behaviour observed or discussed, was regulating the amount of water the machine used, ensuring that only the necessary amount was used. This was generally observed by all participants, although only a few mentioned that they did this for environmental or energy conservation reasons. Ironically this behaviour of regulating the water level cannot be achieved with the front load machines that they aspire to have.

Participants also noted that they try not to separate clothes too carefully so they don’t have to do more washes and thus use more water.

“We separate by white and dark, but try not too separate too much to save water.” (BR06).
Another participant also admitted to only using the machine when full to save water, energy and space.

In the Indian sample there was a self-confessed ‘manic obsessive ecologist’. This participant had adapted the washing process so that the waste water passed through a reed bed system to filter out the impurities and could then be used to water the plants in the garden (Figure 5.17). To achieve this, a natural soap nut detergent was used.

![Figure 5.17 - Reed bed system filtering dirty washing water to water plants, Indian Participant](image)

Another participant also worried about the use of finite phosphates in detergent and tried to buy phosphate free detergent where possible.

Participants who lived in a detached house, rather than an apartment block, also used solar water heaters. Predominantly used for showering with warm water, they would also be used on occasional washes or to soak clothes that were particularly stained or if someone was ill in the household. The participants noticed a substantial increase in prices of the energy bill for the few months of the year when solar water heaters were not in use.

One participant also admitted to using the same setting on the machine because it was the most economical on water consumption, whilst a further participant admitted to buying a machine because it had a dryer but has yet to use it after nearly a year because of the energy implications.

“And the dryer is a very long cycle here. It is I think over an hour and a half or 2, and I wouldn’t want to use that kind of electricity” (IN05).
A UK participant added that they used non-bio detergent for a secondary reason that it is better for the environment when the water drains back into the system.

### 5.14.8 Climate

Climate is one of the key external factors that influences laundry behaviour and is heavily influenced by cultural contexts.

The weather has a major influence on when the washing is done in all three regions. The time it takes the clothes to dry, dictated by the climate, will influence how often something gets washed, the use of the dryer, and where the clothes are dried.

![Figure 5.18 - Typical roof terrace, Bangalore](image)

In general, in all regions more washing is done in summer due to sweating more and changing clothes more often; however, a couple of Brazilian participants thought they washed more in winter due to wearing more clothes and clothes being more bulky.

The increase of sweating due to seasonal change had different effects on the participants with BR04 suggesting she scrubs and soaps clothes by hand in summer before putting in the machine to make sure all signs of sweat are gone, whereas participant IN03 only rinses clothes briefly by hand in the summer as they don’t consider them to be overly dirty.

Seasonal change also influences the external environment with Indian participants suggesting they wash more in summer due to the prevalence of dirt and dust on the street whilst UK02 washes bedding on the first nice day of spring.
Climate can also affect the technologies involved in the washing process, for example many Indian participants have solar water heaters on the roof of their property which get used occasionally if hot water is required (figure 5.18).

5.14.9 Experience and Knowledge

Two of the Indian participants compared their experience in other countries as influences on their current laundry behaviour. One participant admitted that, from his experience in other countries he realised that he could wear clothes longer, but that this just wasn’t possible in India due to the climate (increasing sweat) and the outside environment (dust and dirt). The participant indicated that if he were to live in another area, he would wash his clothes less.

The other participant had spent a considerable amount of time living in the United States. When they returned to India they immediately went and bought a high end washing machine with built in dryer because that is what they had been used to using in the USA, although they admitted that they hadn’t used the dryer once since returning to India, as it just wasn’t needed. They also admitted to indulging in expensive brands because of the perceived benefits that had been marketed to them in the different cultural context, even though they knew some of these benefits may have been exaggerated.

“I’m so corrupted by the United States that I need a certain kind of clean, so I have to use the expensive one” (IN05).

Consumption is heavily linked to previous experience within the Indian sample. One participant purchased their current top-loading machine because their previous machine was a top-load and therefore they were comfortable with how to use it and what to look for. Interestingly, this participant now desires a front load machine because of the perceived benefits of a front load and disadvantages of a top-load. A further participant also purchased their current machine based on their previous experience. They used to own a top-loading machine at their last house, but didn’t like it so purchased a front-loading machine when they moved to their current house.

Interestingly, when asked if they desired hot water, once again experience, or lack of, contributed to their answer. One participant admitted that cleaning might be better with hot water but they had never had the experience of a hot water machine therefore couldn’t be sure.
“it could be better with hot water, but neither do we have the facility to heat the water nor we have the experience of how much more cleaner it can be so...we never tried that” (IN02).

On the other hand another participant admitted to having a machine with a hot water facility, but hadn’t used this function once since owning the machine; a clear indication that the context and people around play a huge role in the everyday behaviours of people.

In Brazil past experiences with the laundry was a determinant in their behaviour, however the knowledge of how to correctly use the appliance was equally important. One participant suggested that she would never use a tumble dryer because of her past experience when she shrunk her clothes (BR05). The only participant with a dryer decided to finally learn about how to use the dryer and the different dryer settings after she shrunk an item of clothing that she particularly liked.

“Especially since I had a really, really nice jumper that I loved and one day it just became baby sized, because of the drying, and then I found out that there were different dryer settings and now I’m kind of learning how to use it after about a year and a half” (BR07).

Other participants (BR03, BR01, BR06, UK03) admitted that they were often confused about how much detergent to use because the design of the machine didn’t make it clear whether the detergent indicator was for dry clothes (bulkier) or wet clothes (more condensed) (Figure 5.19). Equally there was confusion over the desire for hot water with participants desiring it for its better cleaning ability, but not really understanding why. It was more that they had heard from others it was a better cleaning agent rather than that they understood the technicalities involved.

“Probably, yeah. The chemistry – like the molecules...I guess. I don’t know how but yeah I think so” (BR03).
Figure 5.19 - Confusion over how much detergent to use

In the UK previous experience accounts for current opinions on machines as well as current laundry behaviours. A number of participants suggested they have altered their behaviour because of previous experiences or because of a lack of knowledge about alternative practices.

“I try not to shove too much in, ‘cos then it doesn’t spin very well” (UK02).

“I don’t know how long the other ones [machine settings] will last. There’s nothing more annoying than picking an appropriate programme and spending an hour and a half waiting for it before you can nip out” (UK03).

There was a split in the participants as to those that initially tried different programs to see which one washed best for them, and those participants who just stuck it on one setting and always stuck with that one setting. Generally most participants based their behaviour on an experiential level – either sticking with a certain behaviour because the performance and outcome was ‘just fine’ or changing their behaviour because a previous action or change hadn’t gone well so they resorted to a known behaviour or tried a different technique.

5.14.10 Perceptions

Which type of machine is better?

As previously discussed, the perception by all participants from India and Brazil apart from one, is that the front load machine (Figure 5.20) is better than the top load machine. However, the Brazilian participants admit the front load machine is better in terms of cleaning ability and efficiency, they also concede that it is more expensive, both to buy outright and to run.
“Front load is better, but here is quite expensive so...” (BR03).

Interestingly, although there is almost universal agreement that the front loading machine is better, there is little understanding as to why it is better, often either a recommendation or something the participant ‘has just heard’. Occasionally the participant would try to relate the better cleaning ability of a front load to the orientation of the axis of the drum, although not fully explaining why this helps.

“I didn’t think about that, I just think it is better....I have also heard that is better” (BR03).

“I don’t know if it is something different with the process, but the cleaning is better” (BR04).

“I would say the front load is more efficient in cleaning, because of the rotation of the drum which is horizontal rather than vertical. I think it cleans clothes better” (IN02).

“Front load is more energy saving and water saving, that's why I invested in this one” (IN05).

Perception of dirtiness

People’s perceptions of dirtiness varied between the samples and was linked to the frequency of wash and why they washed.

One Brazilian participant always used the longest setting on the machine because she believed the shortest setting, which took 30 minutes, was not sufficient time to clean
clothes. She also often scrubbed clothes, particularly those with visible stains, by hand as she did not believe the machine could get these clothes clean enough.

Another Brazilian participant also directly linked their everyday routine to the dirtiness of their clothes and thus the frequency of their wash.

“I use the bus a lot so I kind of get grossed out by using the same things [clothes] a lot” (BR07).

Interestingly, in contrast to the Brazilian participants, a couple of the Indian participants admitted to using the shortest settings on the machine or just rinsing the clothes because they believed the machine cleaned the clothes to an unnecessary degree.

“One more setting is there for detail washing. No I don’t want that – that much cleaning is not required” (IN03).

One Indian participant put her perception of what is dirty down to previous experience and knowledge. She joked that she subconsciously knew what and when to wash because that was her ‘job’ within the household and she had been doing it for years.

“I kind of ‘know’. I’ve been married for years now” (IN05).

One Indian participant directly linked the perception of hot water to the perception of cleanliness, suggesting that clothes that have been worn a long time or are particularly dirty should go for a wash in hot water because it just ‘feels cleaner’.

“It is also a perception thing. You think that when the jeans go in, and they normally go in once every 2 months, 3 months, that kind of stuff, so you think they need to be cleaned much more and that you think that it needs to be hot water also for it. It’s more a perception thing” (IN01).

In the UK sample there was a direct contradiction and debate around the dirtiness of towels. Some participants felt that towels were dirty as they smelt damp and there was the negative connotation of dead skin, whilst other participants felt that towels were used on clean bodies and thus didn’t need washing as often and weren’t that dirty.

Perceptions of hot water

Nearly all Brazilian participants would like to wash in hot water because of the perceived benefits and cleaning performance.
“I would like to have hot water because I think the clothes would be cleaner” (BR02).

“I like the idea of hot water mainly for light and white clothes” (BR04).

“I think it would be great because they would be more clean, especially for light coloured clothes, the clothes would look better” (BR06).

Interestingly though most participants agreed that hot water would, fairly dramatically, increase the cost of the laundry.

“I don’t know if I would pay if it’s too expensive to have hot water” (BR04).

“Because of power consumption I would only wash light and white clothes in hot water” (BR06).

One participant directly linked hot water to hygiene and desired hot water for this reason.

“I would like to clean the laundry; linens and towels, underwear in hot water because of hygiene” (BR06).

In India there was more of a mix regarding the perception of hot water, with a couple of participants suggesting the cleaning ability would be much better, but a couple of participants disagreeing saying there was no real need for hot water.

“It’s OK. I mean it could be better with hot water but....” (IN02).

“That’s not necessary, you know, I don’t need it – the heating option” (IN04).

One participant didn’t want to wash clothes in warm water because she believed it ruined the clothes.

“And it will harm the clothes also. Everyday washing with hot water – so even the colour will go very fast and even the quality of the clothes will go bad” (IN03).

A few participants did however suggest that they washed in hot water if there was someone ill in the house or if there was a baby – making a direct link between the influence of hot water on hygiene.

Perception of aesthetics

The aesthetics of the washing machine are not really discussed by many of the participants. There were only a couple of people in the Brazilian sample who discussed the aesthetics of
the washing machine or the machine they would like within the Indian and UK samples the
washing machine seemed more ingrained and thus the aesthetics were less important to
them.

One participant in Brazil admitted that front load machines “were more beautiful” but she
was the only participant that did not want one because she could not stop the washing
process half way through (BR05). Another participant felt the washing machine got grimy
and old fairly quickly and they were not happy with this.

Interestingly the only Brazilian participant to use a tumble dryer did so because they did not
have a separate laundry room and they did not want to have clothes drying constantly
around the house.

“But we really think that it is not very aesthetic to keep clothes in the living room and our
apartment is pretty small so we try to avoid it” (BR07).

This was equally noted by another Brazilian participant who expressed shock at the fact that
other countries did not have a specific space for laundry – saying that the clothes would
have to be washed again because of all of the smells from the smoke and the cooking of the
kitchen.

Perception of Self

One Indian participant had strong opinions of herself and her washing technique, often in a
negative way. She explained the reason she didn’t do the washing everyday was because
she was “bloody lazy” and that she often “screwed up” – either ruining clothes or changing
their colour – pointing to the example of a cushion she had changed from white to green.
Interestingly she noted that she is normally the type of person to find out how things work
and how to use them correctly, but that the washing machine just wasn’t on her list of
priorities.

One UK participant described himself as ‘tight’ for the reason for not using a tumble dryer
because it “probably wastes a lot of energy”.

Influence of others

Perception of other people was a key factor in influencing participants’ laundry behaviour.
The key factors were what people’s mothers did, what other people e.g. friends did, and
what the perception of a larger region e.g. the country did.
In Brazil many participants pointed to the influence of their mother as a major factor in their washing technique. This influenced participants’ view on hot water, perceptions of cleanliness and reason for purchase.

“‘Cos my parents use cold water, I didn’t think about using hot water” (BR03).

“I think I do the process of soaking clothes, because I learnt that from my mother” (BR02).

“It’s the one that everybody uses [detergent]...but mostly because of my mum” (BR03).

Brazilian habits are also influenced by friends and flatmates. One noted that her friend used a dryer and it shrunk her clothes, so because of that she wouldn’t use one. Equally, another decided to buy their particular washing machine based on the recommendation of her flatmate and her flatmate’s mother.

A couple of Brazilian participants also suggested their behaviour was because ‘that’s just the way it is in Brazil’. For example buying a top load machine because those are the most common, adding that it might be a cultural thing to do with the layout of the house.

In the Indian sample participants mentioned their spouse as a common reason for their laundry behaviour.

“Generally my wife comes and checks my wardrobe, and if it’s too stinky...!” (IN02).

Recommendations from friends and the perception of what other people are doing was also common in India, with one participant suggesting he would buy a front load machine based on the recommendation of a friend, and another participant buying a certain detergent because it is what their friend uses.

One Indian participant added that there is confusion in the household with the laundry because all of the different members have differing views and needs of the laundry. She has to check her husband’s clothes for dirtiness, her son throws in everything that he has had that day, and her daughter doesn’t put anything in so she has to go round her room and collect it (IN05).

Similarly in the UK the main influence for the current laundry behaviour is mothers.

“That’s what my mum used to say” (UK02).
Although a couple of participants took behaviours from their mum and changed them to fit their own personal context.

“I probably get a lot from my Mum, but she would use the proper programmes, not the time” (UK03).

“I don’t do whites, colours and darks like my Mum does, I just do lights and darks; and colours can go where they may!” (UK04).

One participant suggests he can never get the smell as good as his mum does back home, whilst also admits that his energy saving habits of not using the tumble dryer come from his parents (UK05).

Similarly to the Indian participant, one participant in the UK struggles with the differing techniques of the household members, with laundry getting muddled and not correctly dealt with by differing members of the household.

Interestingly one participant has observed that her neighbour must use a tumble dryer because she never sees her hang washing up on the line (UK02).

**It’s just a thing**

In all the regions the washing machine was seen as ‘just a thing that cleans clothes’. Beyond the initial purchase of the machine, where some thought took place into the energy label and the brand and price, there was no real thought into the device, how it worked or how it could be improved. The only time people established an interest was when the device started to go wrong or make funny noises, or if they saw better performing machines at their friends/families or in society.

Generally, laundry was a deeply habitual behaviour, with people just doing it because they felt they had to, and it just working fine. Participants across the regions would only change their behaviour if they were forced into it, for example buying a new detergent;

“I mean probably if it is once out of stock or something for some reason we will use another one and start using it to see how it is” (IN02).

Or reasoning why they use a particular setting on the machine;

“The first setting I came across and it works alright” (UK05).
5.15 Conclusions

The findings from the intensive study give a very in-depth and detailed understanding of the laundry behaviours of the participants across the three sites. There is an enormous amount of insights that can be drawn out of the data; however the following main conclusions can be made:

- In India and Brazil, clothes are predominantly dried in the sun as there is fairly predictable weather. Participants find it hard to dry clothes when it is wet or cold and occasionally use the tumble dryer when it is hard to naturally dry clothes. In the UK, naturally drying clothes outside is often overlooked because of the changeable weather.

- In Brazil, the most common time to do the laundry is on the weekend, whilst in India it is throughout the week depending on when the house-help is available. House help is common to all the Indian participants. Brazilian participants also used house-help, however less often than in India. None of the UK participants employed anyone to help with household chores.

- Across the three sample sites participants either washed clothes based on their sensory perceptions of dirtiness (look/smell dirty) or time related (worn for two days). This was independent of the sample context.

- In Brazil the use of a ‘laundry room’ or designated area for the laundry process was common. The only participant without this room used the tumble dryer because she didn’t like to have wet clothes draped around the house.

- In Brazil and India the participants bought washing machines based on the price, brand, energy consumption or size. In the UK the participants either didn’t have a say in which machine was purchased (rented accommodation) or bought whichever machine was cheapest. Detergent was typically purchased based on habit of what had previously been used.

- In Brazil the most common washing machine was a vertical axis machine that used cold water, however nearly all participants aspired to own horizontal axis machines and wash in warm water for the perceived better cleaning ability. In India there was a mix of machine types with participants agreeing that horizontal axis machines were better. All participants in the UK had horizontal axis machines.

- Participants in all three sites were not well informed on the energy consumption of their washing machine or laundry behaviours beyond purchasing the machine based on the energy rating scheme (A rated).
- Consumption and use behaviours were heavily linked to good/bad past experiences and the influence of other people (friends and family).

- In India the use of hot water is linked to hygiene (washing when someone is ill) rather than cleanliness. In the UK, hot water is more associated with cleanliness. Most participants in Brazil wanted to wash in warm water for the perceived benefits but admitted they were worried about price.

- In all sites the laundry process was a deeply habitual behaviour usually carried out without significant conscious thought.

The qualitative, user-centred nature of the study, specifically investigating laundry behaviours, completes objective 2b presented at the beginning of the research (Chapter 1.3). Understanding how these findings affect the overarching research area and developing resources that designers can use in different cultural contexts are established in the next chapter.
6 DEVELOPING THE RESEARCH

6.1 Introduction
The previous phases of research have revealed some insightful and detailed findings into the everyday behaviours of people from different cultures. However for this information to be relevant to designers it needs to be disseminated to provide resources that can be used to innovate in unfamiliar contexts. In this chapter, the findings from the intensive study are discussed in relation to the previous phases of research and the opportunities that have been revealed for designers looking to moderate sustainable behaviour in new cultural contexts are outlined.

6.2 Cultural Significance vs. Cultural Independence
The analysis of the washing process in the three regions has highlighted elements of the process that are ‘culturally significant’ and elements that are ‘culturally independent’. Cultural significance refers to the elements of the washing process that were common amongst the samples in their respective regions; often contextual factors at a macro level. Culturally independent elements refer to the differences between the individuals throughout the samples; often influenced by perceptions of particular individuals. Table 6.1 shows the main culturally significant and independent factors that were identified, which are explained in more detail below.
Table 6.1 Culturally significant and independent factors

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Culturally Significant Elements

Culturally significant elements identified included; the external environment, the influence of other people, consumption, tools, and inputs.

One key element that affected each sample group as a whole was the external environment. This typically can be divided further into physical elements; the climate, and human elements; the built environment.

The climate is one of the main culturally significant factors that influenced the laundry behaviours in all three regions. Climate is a factor beyond human control that differs significantly from region to region. As a result it influences people to behave in different ways as they interact and overcome the challenges it may throw at them at either end of the scale. In the samples, participants’ altered their laundry behaviour based on the climate. Laundry was often delayed on days where it would be difficult to dry outside, or on occasion the tumble dryer would be used. In the UK this behaviour had turned to habit as many of the participants felt they couldn’t rely on the weather and thus didn’t dry clothes outside at all. In Brazil and India, where the weather was less sporadic, the incidence of a rainy day would only alter the laundry behaviour temporarily. As a result the participants in Bangalore, which receives ‘300 days of sun per year’ all dry their clothes outside, compared to in the UK where drying is only done outside sporadically by a few participants because of the unreliability of the weather. In this way, climate is culturally significant.

The other main influence of the external environment is the built environment. This refers to the area where a user lives and the affect that it can have on behaviours. In the laundry example, the sample shows us that it is common place for Brazilian households to have a ‘laundry room’. This is often a designated room off to the side of the kitchen which contains the laundry machine, a sink and washboard, a cupboard with all the washing tools and
utensils, and drying facilities. These rooms varied in size within the sample from a small area just enough for a sink and machine (approx. 3m²) to much larger rooms that had spare beds (approx. 12m²). In the UK none of the sample had utility or laundry rooms, and in India there was a mix. These rooms have an historic significance and will be discussed later in the analysis, however these differences in the architecture and layout of buildings influence the user’s behaviours and thus are culturally significant.

In India, whilst the architecture and layout of buildings also differed and thus altered behaviours, so too did the surrounding area. Participants altered their laundry behaviour due to the dust and dirt on the street, and this changed seasonally.

The **Influence of other people** also has a bearing on the particular process being examined. In the case of laundry, the prevalence of home-help is something that varies in each region and affects the laundry procedure. In India and Brazil having home-help either daily or weekly is common, with the maid often asked to wash clothes, whilst in the UK this is not common.

Another important culturally significant element is **consumption** in the macro sense. Consumption encompasses the price, marketing and costs (e.g. energy payments) within a region and is closely linked to average income. We can assume that the price of energy or water within a particular region will have an effect on the end user behaviour and thus the consumption of utilities is culturally significant. In the same way the marketing of a particular brand of detergent or machine will be different between regions, we can also look at average income and price of goods as factors that will differ culturally. Another area that will affect consumption is the implementation of any incentives or feedback schemes such as energy rating scales on washing machines.

Closely linked to consumption are the **tools** involved in the process. These are the instruments and artefacts used by the people in a selected group or region. Whilst the specific tool, for example brand of washing machine, may vary between individuals within a region, the overarching type or technology may be culturally significant. In this case we can look at the top loading machine being by far the most common type of machine in Brazil compared to the front loading machine in the UK, as well as the use of heated water in the UK compared to cold water in India and Brazil.

As a sub category of the tools of laundering we can also look at the **inputs** into the tool; in this case, the clothes that are being laundered. These differ from region to region in terms
of the materials and dyes used and the fashion of particular areas affect how and when the 
laundry is done.

**Culturally Independent Elements**

Culturally independent elements identified included; perceptions, aspirations, senses, views, 
and income.

Culturally independent elements are those factors that are not representative of a region; 
they are based on an individual’s perceptions and behaviours and may be shared by people 
from different regions or groups. Interestingly the previous significant factors (external 
environment, other people, consumption, tools and inputs) may all have had an input in 
shaping the independent elements of an individual, but with greatly different results in each 
case. This is explained in more detail below.

A large part of the independent elements is made up by people’s **perceptions**. These may be 
a perception of cleanliness or dirtiness, brand, effectiveness or the washing process. An 
example would be the increased frequency of a wash between two participants because 
one perceived a garment to be dirtier than the other participant. The two participants might 
be from the same region, or from completely different areas or cultural contexts. These 
perceptions are predominantly built up by a wide variety of influences, namely; past 
experiences, upbringing, recommendations/observations of others, income; as well as the 
significant elements above; external environment, other people, consumption, tools and 
inputs. Ultimately these perceptions will change the way users behave, but will differ 
according to the individual.

Closely linked to perceptions and another independent factor influencing behaviour is 
**aspirations**. Similar to perceptions, aspirations are influenced by all the same factors, 
however they deal with what the participant would rather have or aspire to 
do/have/behave. As an example we could look at the Brazilian participants who owned a 
top loading machine but aspired to own a front loading machine because of the perceived 
benefits it would bring.

**Senses** are also a major factor that makes up culturally independent elements. Participant’s 
sense of smell, touch and sight, and the meanings they attributed to them, differed vastly 
from participant to participant. Equally participant’s **views**, such as their environmental 
views, played a huge factor in their behaviour and interaction with artefacts, which largely
could not be attributed to a culture, context or region. Income was also an independent factor as this differs between households.

By identifying the elements that are common amongst a group of people and those which are independent we can start to understand how best to influence users’ behaviour. We can begin to group individuals based on their washing technique and the factors that have influenced this technique, whilst we can also look at the significant elements of a region that can help us to design more appropriate products for an area.

This can be linked back to the original definition of culture, defined in Chapter 2 as:

“The shared patterns of behaviours, interactions and understanding learned by a collective group of people”

The culturally significant elements offer us insights as to what we understand are the shared beliefs and behaviours of a group of people, whilst the culturally independent elements are beyond those boundaries; beliefs and behaviours that are independent of cultural context. Understanding this link between the two entities governs how culture can really affect design. The factors introduced above give designers tangible elements to take into account when designing that tie into the cultural dimensions outlined by Hofstede (1980) and the social and individual choice models of behavioural theory.

Defining these culturally significant and culturally independent factors can also aid in redeveloping current thinking around a particular process or product. In the example of laundry we can look at Shove’s Whirlpools of Laundering (2003). In her model Shove defines the five whirlpools of the laundry process as: How to launder, the tools of laundry, when to launder, what to launder and why launder (Chapter 5.3: Laundry as a system).

In reality this could be broken down and simplified further. In an updated model the tools of laundering would remain the same (the specific physical things used in the process) and are culturally significant; Why launder could be summarised better by a new category of ‘perceptions’ (the views and aspirations of the consumer) and would be culturally independent; and the categories what to launder, how to launder, and when to launder
could all be merged into one category – the laundry routine, which is ultimately influenced by both culturally significant and culturally independent factors (figure 6.1).

![Diagram of Shove's Whirlpools](image)

**Figure 6.1 - Redefining Shove’s Whirlpools of Laundry**

### 6.3 Consumption

Consumption habits are generally focussed around factors that are to be expected. The price and the brand of the product are important; these are influenced by recommendations by other people and past experiences. Having a large machine for a bigger washing capacity was unique to the Brazilian sample and correlates with the belief that washing is a chore and they want to do it as infrequently as possible. Within the Indian sample there was very much a perceived belief that the front-loading machines were more water efficient and better at cleaning. It is not exactly clear why this was thought, although could be down to front-loading machines being seen as a ‘new’ technology as the literature suggested the traditional washing machine type in India is the top load.

The Brazilian and Indian samples had similar factors determining the purchase of a washing machine; namely price, brand and energy rating. In contrast the UK sample were less affected by brand and generally bought based on what was cheapest (either second hand or just what came with the deal). There was often very little thought process into buying the machine with many participants not the original purchasers of the machine.

This could be interpreted that brand is less important in the purchase of a washing machine in the UK. This could be due to the fact that washing machines are now so ingrained into the UK culture, having been used for many decades, that there is a certain amount of scepticism by the UK consumer about the various marketing claims of new machines, and in reality consumers see the machine as just a thing that cleans clothes. In Brazil and India washing machines are still not the norm across society and people have only started to see washing machines appearing in houses in the last decade or so. It would be an exaggeration to argue
that the washing machine is a status symbol in either location, however the amount of money spent and the relative novelty of buying a new machine might suggest one reason why brand is an important factor in the Indian and Brazilian samples. That coupled with the huge marketing drive by companies looking to explore new markets.

The consumers of Brazil and India fit into the social theorist’s model of consumption. In this sense, they purchase goods based on the perception of themselves and the others around them, changing consumption patterns to fit into a social order. Consumers in the UK fit more into the individual choice theorist’s models; basing their consumption decisions on obtaining the greatest benefit from the lowest cost. Interestingly these theories of consumption correlate with the cultural dimensions outlined by Hofstede (1980), with India and Brazil being marked as ‘collectivist’ societies (belonging to a larger social group is the norm); whilst the UK is a more ‘individualist’ society (looking after oneself is the norm).

Across all three regions many of the participants admitted to not knowing why they bought a particular detergent, suggesting it was just the one they bought. This can largely be put down to habit, with consumers sticking to a brand that they know works well especially if there is no specific reason to change ("I suppose if they were out of stock we might try something different but it works just fine" (IN02)). Other factors influencing the purchase of detergent were smell, price and ease of use.

Generally speaking purchasing decisions were made based on previous experience, with a particular product getting re-purchased if it was available at a reasonable price and had performed its function to a satisfactory degree. A change in purchasing decision would occur when the consumer was unhappy with the performance or believed an alternative was better based on their perceptions e.g. changing machine from top load to front load.

Two participants were worried about the effect of phosphates – these were both pro-environmental participants with an interest in their field of work. One had radically changed his washing behaviour whilst the other didn’t feel he could have any great impact; an interesting aside for the debate regarding knowledge and ability to change behaviour.

Overall in Brazil there were mixed opinions about the utilities bill and the general price of energy. A couple of participants found it expensive and felt energy could be cheaper, whilst other participants did not feel it was particularly expensive, particularly comparing to other regions. The extensive research suggests that Brazilians pay the highest price for electricity as a percentage of their income. Whilst to some extent the intensive research reflects this, it
is clear that participants compare the price of energy with other regions to determine a ‘fair price’.

6.4 Cultural Norms

Many of the cultural elements discussed previously correlate with more quantitative country-wide data picked up on in the literature and discovered in the extensive survey. Participant data was as expected, with income, housing type, technology of washing machine and gender roles correlating with those of the extensive survey and literature.

In the extensive survey a high rate of geyser use was mentioned by Indian participants and this was also picked up on by the participants in the intensive study. Participants noted that the predominant energy consuming device in Indian households was the geyser and there is a considerable increase in household energy bills for the few months of the year when water cannot be heated by solar power. This may be one of the reasons why washing at higher temperatures is only done when someone in the household is ill.

Similarly the extensive survey pointed to a higher frequency of wash by Indian participants and this was represented in the intensive survey with the majority of participants doing 2 to 3 washes per week compared with just 1-2 for Brazil and the UK. Equally, as expected from the extensive survey, washing temperatures in Brazil were much lower than those in the UK with India in-between – only using hot water sporadically.

6.5 A simple change….A big difference

One of the interesting insights that came out from the analysis was the difference between the regions in front loading or top loading machines. The UK sample all had front loading machines, by far the most common type of machine in the UK, whilst in Brazil all the participants had a top-load, again – in keeping with the typical machine type of the country. Interestingly nearly all participants with a top-loading machine desired a front loading machine due to their perceived better cleaning ability and water efficiency. There has been a small growth in sales in front loading machines in Brazil in recent years (Electrolux, 2011) and this is expected to rise rapidly in the future. India is further ahead in this transition with a large growth in the sales of frontloading machines – replacing top-loaders, represented in the sample with a 60/40 split of front loaders to top loaders. This small change in washing technology, however, can have considerable consequences.
Firstly, the benefits of the front-loading machine, as well as the water efficiency, are the space saving ability as it can be more integrated into the household, often under counters in the kitchen or bathroom. However, the benefit of saving space often comes at the cost of more complicated installation. Due to the tight spaces the machine is squeezed into, it often has to be more integrated into the plumbing and electrical system of the house. A front-loading machine will often have two water inputs (hot and cold), directly from the plumbing system of the house and a drainage facility again linked to the plumbing system. By contrast, the top-loading machines, particularly those seen in Brazil, are much simpler. One input which attaches to a standard tap (found in Brazilian laundry rooms), and one output (drainage) which hooks over the laundry sink and pours down the standard plug hole (Figure 6.2). The front-loading machine requires someone very competent at DIY or a professional plumber to install, whilst the top loading machine can quite easily be explained and installed by most users – straight from the shop.

Figure 6.2 - The plumbing of a top load machine, Brazil

This has implications on the users’ knowledge of the relevant inputs and outputs of the machine. With a top load machine, they have installed it themselves and understand the link between the input from the tap (often having to turn the tap on and off before and after use) and the output in terms of drainage. In a front load system, installed by a professional, this link between inputs and outputs is lost – and the machine becomes a ubiquitous white box that washes clothes. This may be part of the reason why water and energy efficiency is more prominent in Brazil and India than in the UK sample.
The lack of cognitive thought process about the inputs and outputs of the device paves the way for more unsustainable behaviours to creep in. It doesn’t take long before the user clicks the ‘better’, ‘harder’, or ‘tougher’ button on the generic white box with longer cycle times and higher temperature washes as the user is detached from the cause and consequence of the action. A user that has installed the machine themselves, as in the case of top-loads, will have more of an understanding of the inputs and outputs; in this case, having to turn the tap on to fill the machine with water and seeing the dirty water drain out via the sink.

This also can be seen with the water efficiency of the machine. Whilst a front loading machine is more water efficient, once again, the efficiency gain is taken out of the hands (and thought process) of the user, instead using technology to remove any control from the user. Although the top load machine technology may use more water – the act of filling the machine is in the complete control of the user and is more visually understandable (similar to filling up a bucket). Users understand an efficient level of water to wash at and can see when they have filled it too high and wasted water – a visual stimulus that is lost in front load machines.

Furthermore, the simple change from a top load to a front load has interesting consequences on the responsibility of purchasing the machine. As previously stated, the front loading machine becomes more integrated into the house, often under the sink in the kitchen, and plumbed into the central household plumbing system. As a consequence, the washing machine becomes an integral part of the kitchen rather than a standalone appliance. In the samples, all the UK participants who were living in rented accommodation stated that the washing machine was already there when they moved in. In contrast, the Brazilian sample that lived in rented accommodation all purchased the washing machine as their own appliance after moving in.

The shift from having a stand-alone appliance to an integrated one changes the responsibility of the purchaser in rented accommodation. With a top-load, the end user is usually the one purchasing the machine and therefore has control over the type, style, brand, and functionality of the machine they buy. A front loading machine on the other hand, integrated into the house, is bought by the landlord of the premises, with the end user of the machine often not around to decide which would be most suitable to buy. Once again control is taken away from the end user.
Although seemingly a simple change, it is clear there are far reaching consequences between a top-loading and a front loading machine. In a front-loading machine the control and understanding of the system is taken away from the user and replaced by technological efficiencies. In reality, a user with understanding and control of a system is more likely and able to behave in a desired way. Taking heed of this will be important in future designs of front loading machines, combining technological efficiencies with user understanding and control, as they continue to grow rapidly and replace top-loading models.

6.6 The Potential for Leapfrogging

The findings have raised some interesting issues regarding the potential of leapfrogging in certain developing regions towards more sustainable consumption and behaviour. In relation to laundry practice there are examples that can be highlighted as possible starting points for this development.

![Graph showing leapfrogging impact of using hot water](image)

The graph (figure 6.3) shows the leapfrogging potential of the hot water process in laundry behaviours by comparing the UK and Brazil. In the UK, developments in technology and a change in perception based on washing temperatures has meant the temperature has decreased incrementally over time (from approximately 90°C, to 60°C, then 30°C). It can be projected that this may drop even further with new technologies and advertising campaigns suggesting washing at even lower temperatures. In the UK the trend has been reducing temperatures over time because washing machine performance has increased or plateaued with lower temperatures. In Brazil on the other hand, washing temperatures have always
been fairly low and there is little experience of washing at higher temperatures. From the sample it is fairly clear that participants’ aspire to wash at higher temperatures because of the perceived increase in performance and resulting cleanliness. As the UK’s washing temperatures are going down, Brazilian temperatures show the potential to increase. The projection made here is that, much like in the UK, Brazilian washing temperatures will increase and stabilise at a point until energy costs become prohibitively high and consumers start demanding cheaper machines – at which point the temperatures may start to fall again. The leapfrogging potential will be to avoid the rise and stabilisation of higher temperatures, and instead jump straight to the point of decreasing temperatures.

Achieving this will be particularly difficult; however the redesign of the washing process to be more effective whilst at lower temperatures will certainly help. It will also be important to change the perception of the benefits of washing in hot water. As the samples have shown, people obtain a large amount of their information from other people, both close to home and in completely different contexts. The Indian sample showed that people directly acknowledged a change in their behaviour as a result of living in, or visiting, foreign places. The aspirations for hot water may be seen as a natural progression in the growth of the middle income consumer group, because this is what has been observed in other more developed nations. The move to hot water is just seen as the natural ‘next step’. In reality, if the more developed nations collectively adopted the cool water washing process and the benefits were portrayed and broadcast, this ultimately might change the course of the natural ‘next step’, avoiding the leap to hot water in emerging consumer classes.

Looking at individual household behaviours such as laundry negates some of the problems of leapfrogging identified in the literature. Focussing on individual behaviours such as lowering the temperature of washes is a defined objective with a clear understanding of the behaviours and contexts involved, avoiding the criticism of current ambiguous theories for leapfrogging by Perry (2003). However, as discussed the challenge will be reacting quickly to new technologies, as it may already be too late to ‘sell’ lower temperatures to Brazilian consumers who are already ‘locked in’ to increasing temperature washes through purchasing new washing machines (Perry, 2003; Schäfer et al., 2011).

6.7 The Importance of Information

The participants showed that information is key in their decision making and behaviour. Nowhere was this more clear than in the decision to purchase the machine based on the
energy rating scale. In both Brazil and India participants only bought machines based on the highest energy rating as they thought this was all they could do to save energy.

This draws out some interesting insights. Firstly, participants are generally happy to purchase efficient technologies, especially if the benefits are made clear to them in an easy to understand system. A simple rating scale puts one technology or product above another and participants can easily see the benefits, especially if both products have very similar functionality.

By doing this however, the user has already consciously made the effort to be more resource efficient. They have put their trust into the product based on the information that they have been given, and thus believe that by buying an efficient machine they have done all they can to be more resource efficient. When questioned what they do to be more resource efficient, they all pointed towards the energy rating scale of the appliance, but rarely questioned their own behaviour or interaction with the appliance as a means of being efficient. Part of the reason for this is that it is hard to market a product based on the potential efficiencies of using it in a certain way, where as a new technology or technical process in the machine can easily be marketed (e.g. Now uses 30% less water!). Companies will struggle to advertise potential energy savings to consumers based on projections of expected behaviour.

Similarly the energy rating scale could also be a potential source of confusion by informing consumers they are making an energy efficient decision when all of the alternatives may not be accounted for. As an example, a consumer may buy a tumble dryer with an ‘A’ rating and assume they have ‘done their bit’ to be more resource efficient, without fully considering the alternatives such as reorganising their routine to dry clothes naturally.

In this way the information that consumers are fed is of the upmost importance. Energy rating scales are a great way of easily portraying the technological efficiencies of an appliance, and have, as the samples show, had an enormous impact in driving sales of efficient machines. However, an over-reliance on such a system should be viewed with caution. Just because the appliance has been labelled as the most efficient does not mean it will be the most suitable product for everyone or in every context. As an example we can look at the Indian participant who had purchased a washing machine based on the advertised efficiencies, but noted he would prefer it if it had a shorter spin cycle, as clothes can easily be dried just as well outside, and this would take up less cycle time and energy.
Similarly the only participant in Brazil to use a dryer did so because they did not have a big enough laundry space to dry clothes and didn’t like the aesthetic of clothes drying around the home. Although they purchased an efficient model, surely a more efficient behaviour is that of the other Brazilian participants with a natural drying space.

6.8 The Built Environment

The space in which an individual operates has a substantial importance in shaping activities around the home. All too often the design of an artefact is centred on precisely that; the artefact. In reality, the spaces around all the ‘touch-points’ of a system will shape a behaviour. In the laundry example, designing an efficient machine is one part of the challenge, but the factors that will greatly impact the behaviour are the other spaces in the process; where the clean clothes are kept, where the dirty clothes are collected, where the washing machine is located, and where the clothes are dried. Each of these spaces are part of the subtleties of everyday life that affect behaviours in a huge way.

The close relationship between the design of household products and the architectural layout of the living environment is often stretched and at times unclear. Correlating two design processes with vastly different timescales, such as product design and architectural design, will always be a challenge. In some instances people will be living in houses that are century’s old using modern appliances and processes; in this case the industrial designer has to ensure that appliances can be used in such situations. On the other hand, in modern houses, the architect has the ability to integrate appliances into the design of the house and shape the user’s engagement with the different spaces in their environment.

In Brazil the downsizing of the laundry area within property has been a direct result of the increasing consumer class; being able to afford automatic washing machines, the need for house-help has decreased and the price of labour has increased. As a result modern properties have been designed with much smaller spaces for laundry, and with the move to front loading machines, this area may be abandoned altogether. This clearly shows a direct link between how the design of a product directly influences the space around it; and underlines the importance of the relationship between industrial design and architecture. By reducing the laundry space and moving the machine into the kitchen the type of machine changes – with front loading machines being more favoured to top loading machines for their space saving ability. The drying process will also change as people have to find new places to dry their clothes where once they would have had their own separate room. This was shown particularly in the one Brazilian participant who did not have a designated

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laundry space, but a front loading machine in the kitchen, she used the tumble dryer to dry all her clothes because she did not like the aesthetic of having wet clothes draped around her apartment.

The above point highlights the interconnectedness of design with all aspects of our everyday lives. In the example, the change in societal structure (increased disposable income) together with the design of new technologies (front loading washing machines) has begun to change the architectural layout of modern buildings. If we are to move to more sustainable household behaviour we have to integrate the design of spaces with the design of products. The links between architecture and product design have to be strengthened so that the interaction by the user with the appliance, and its correlating ‘touch points’ in the given environment, promotes sustainable behaviours. This will be especially important as we are facing a ‘housing crisis’ and the need for new houses to be built in all locations is increasing dramatically.

6.9 A Sense of Time

As well as identifying culturally significant aspects of the laundry routine, the study also helped to highlight the differences in washing technique irrespective of context. Across all the regions there were two types of ‘washers’; those that washed in relation to time; and those that washed through a sense of smell, sight or touch.

In general, those who washed by time had strict ‘policies’ about when an item should be washed; usually a ‘one wear, one wash’ policy for shirts and t-shirts and similar 2 – 5 wear policy for trousers.

Those who washed by sense would only wash a garment if it was visibly dirty; i.e. with a stain, or if it smelt dirty; i.e. from sweat. Interestingly these two types of ‘washers’ were interchangeable depending on their personal circumstance, with some participants sticking to a ‘time related wash’ for their work clothes, but a ‘sense related wash’ for their casual clothes. In this way the role of laundry is strongly linked to routine and habit.

The interesting point here is that the technique used for establishing whether something is dirty, ultimately the users’ perception of cleanliness, is a culturally independent factor, with participants in different contexts having very different views; yet this perception is created by the culturally significant factors such as their upbringing, other people around them and their views. One Indian participant noted that they wash jeans and ‘harder items’ every 2 or
3 months (IN01), a substantial difference to other participants both in India and in the UK and Brazil.

This insight is key to developing laundry products that are more relevant to consumers and shows a good example of how the previous studies were aided by further more detailed enquiry. The scoping study identified differences of frequency of washing between the regions but further more detailed user centred research has shown exactly why those differences exist.

6.10 The Role of Design

One of the important considerations when looking at the redesign of any laundry system will be the relatively long replacement cycle of laundry appliances. As the sample shows, the washing machine is not something that people change regularly, and it usually requires a large life change, such as moving house, a new kitchen, or the current machine malfunctioning to decide to go and buy a new one. In this sense, any behaviour that is adopted by the introduction of a new technology or design will remain with the user for a long time and will almost certainly alter their habits of washing. This is a particularly important consideration when looking at the leapfrogging potential in emerging markets, as any behaviour adopted early will stay with the person for many years to come.

This will not only have a dramatic effect on the original user, but also a knock on effect over generations. As the samples have shown, a great deal of household behaviours are influenced by upbringing, with the behaviour of the mother being the strongest influence in the laundry example. With this in mind, a significant change in the design of a process to promote more sustainable behaviours will have far reaching consequences, not just in the present, but for future generations too.

As an aside, the designer will also have to come to terms with the washing machine not garnering much of an emotional response from the user. As one might expect, the participants did not view the washing machine with a great deal of excitement as they might with other consumer goods. In general the machine was seen as ‘a white box that cleans things’ and any emotional response was generally only negative, when the machine performed badly or malfunctioned. In this sense the design of a successful washing machine will be one that goes almost unnoticed by the user, with little thought needed for satisfactory use.
More thought in the design process with the environment in which the appliance is located is also required as well as a degree of control being established by the user. If we take the example of tumble dryers, people in the sample generally use them rarely because there are other alternatives to drying which are more practical and less energy intensive. Users make the conscious decision not to use the energy inefficient process if there are other alternatives available, and this could be a vital lesson in giving control back to the user.
6.11 Conclusions

There are a number of insightful conclusions that can be drawn out from the findings of the intensive study to inform design practice. One of the clear conclusions is the identification of the culturally independent and culturally significant factors and the complex relationship between them. The identification of these factors represents both a challenge and an opportunity for designers as there is clearly a role design can play in shaping behaviours using these factors as influences in the design process, however there are also external factors either beyond human control or requiring more interaction with other groups in society.

A new way of thinking about design to link it more closely to other creative areas in society would be a step forward. The design of appliances within homes needs to be incorporated in the design of the homes themselves, rather than a retrofit perspective that does not account for the various ‘touch-points’ or spaces within an environment. Similarly, new ways of thinking about the marketing of new products are needed to avoid adding unnecessary features which detract from the use of the product and ultimately confuse the user just to try and generate new sales through hyperbole. In this way design needs to be incorporated closely with the business decisions of corporations to improve the lives of the user as well as the growth of the company.

One key conclusion is the removal of control from the user for more technological efficiencies. Removing the user from understanding the processes involved when using a product and not giving them control to change the situation results in the homogenisation of products where the user feels restrained and unengaged. This is where looking at other cultures can draw inspiration for new designs as, despite peoples’ perceptions; their actions and influence over the products are often very different. This will be of increasing importance in new emerging markets; giving the user control will allow them to customise the process to suit their exact needs in their exact environment, and could greatly aid the leapfrogging process.

The development of the culturally independent and culturally significant factors into a framework that designers can use for designing in different cultural contexts is the obvious next step to the research. Developing guidelines that can be used by designers to help empathise with the user in different cultural contexts will ultimately aid in designing products that are more sustainable in their use and more relevant to the user. The results have helped to draw out correlations between cultural and consumption theory and their
design implications. India and Brazil fall in the collectivist category and therefore designing products with a heavy influence on social motivations such as the perceptions of the user and those around them will be more accepted than products designed for individualist societies with an emphasis on cost/benefit.

The methods used in the data collection process have helped understand the effect that culture has in the laundry process across the three regions. A huge array of insights have been drawn out that can help in the design of a new washing process and help to create a more suitable standard for using culture as a source of inspiration for designing for sustainable behaviour.

6.11.1 Development of Design Guidelines

The cultural factors identified above can help designers to build empathy within a particular context and therefore better identify behaviours that can be designed for. This, however, is only the first part of the challenge. Identifying sustainable behaviours within a procedure and understanding the process to guide behaviours have to be integrated with empathy building. By comparing the behaviours identified in the three regions, a list of sustainable laundry behaviours (Table 6.2) has been identified as well as seven guidelines which may help moderate more sustainable behaviour.

<table>
<thead>
<tr>
<th>Sustainable Laundry Behaviours:</th>
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</thead>
<tbody>
<tr>
<td>• Wash in cooler water</td>
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<tr>
<td>• Wash less frequently</td>
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<tr>
<td>• Use less detergent</td>
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<tr>
<td>• Use natural detergent</td>
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<tr>
<td>• Control the water and energy levels to suit a particular wash</td>
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<tr>
<td>• Re-use waste water</td>
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<tr>
<td>• Line-dry clothes</td>
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<tr>
<td>• Fill the machine to the optimum level</td>
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</tbody>
</table>

The seven guidelines are a direct consequence of the research in the three contexts. Some of the guidelines may be familiar from other aspects of design or behaviour research. Due to their origins, the guidelines relate specifically to the laundry process, however, with further research the concepts can be transferred to other resource intensive household behaviours. Below the guidelines are listed with examples in each case.
1) Understand the flow of the procedure from start to finish. Understand the various ‘touch points’ in the system.

(How does the laundry make its way around the house? Who, what, where & when?)

Figure 6.4 shows the simplified journey of clothing for one user around a typical home in the UK. The journey is simplified as, in reality; individual users will have very different routines. Dirty clothes may be left on the floor before making their way to the washing machine, whilst the drying stage may never happen if the user has a tumble dryer. Timescales are also erratic, as dirty clothes may be left in the linen basket for a number of days before being transferred to the washing machine, where they may remain for a day before being transferred to the clothes dryer where they may stay for several days – in some cases never making it back to the wardrobe.

In Brazil, most apartments have an ‘area do serviço’ (service area) specifically for the laundry where clothes are washed & dried (and ironed if needed). The journey of the laundry takes a simplified route (Figure 6.5).
2) Integrate the design of the procedure with the design of the spaces where the procedure occurs

(Can the process be linked with other processes (killing 2 birds with one stone)? Can there be a better use of space in the household?)

In India, some modern houses are designed to accommodate the washing machine on the roof terrace so that waste water can be filtered down through the house to other appliances or to water the plants in the garden (figure 6.6).

Figure 6.5 - Typical Brazilian apartment with service area
3) Adapt the design to suit the needs of the user

(Is the user a ‘time related’ washer or a ‘sense related’ washer? Do they use the different programs or not?)

In all three contexts, users fell into one of 2 categories; those that chose the cycle based on the time it took, and those that chose the cycle based on the most appropriate setting and senses such as smell. Understanding the user in their context is critical and is an area where the cultural factors can help in establishing empathy with the user in a given context.

4) Give the user control to influence the resource use of a process

(Is the user in control of the amount of energy and water used? Can the user add garments half-way through? Can the user choose the exact programs they desire?)

In Brazil it was noted that the advantage of a vertical axis machine was to be able to add garments that had been forgotten half way through the wash. Vertical axis machines also give the user control by letting them manage the amount of water in the machine. Whilst the common aspiration was to have a horizontal axis machine, some of the control elements in a vertical axis machine could be transferred.
5) **Create a new emotional attachment between the user and the process**

(Does the user enjoy the process or hate the process? What would make them enjoy it more?)

Laundry will always be a chore; however, importance should be given to making the process more enjoyable (not necessarily just easier!). Are there other connotations and stimuli that can be evoked by doing the laundry e.g. the ‘freshness’ smell being circulated around the house?

6) **Let the user know and understand the various resource inputs and outputs of the process**

(Can the user see the various inputs/outputs? – Make the user aware of the resource use)

In Brazil, free standing washing machines have to be installed by the user. Water is added in a visible way by the user where they have to attach the machine to the tap and turn it on, whilst watching the machine fill up to the desired level. Waste water from the machine then passes through a pipe that is placed in the sink. Users understand the inputs and outputs to the system and can see the waste (figure 6.7).

*Figure 6.7 - Understanding the resource use, Brazil*
7) Be clear about the operation of the process. Give the correct and relevant information at the right time, in the right place.

(Is there a clear indication of how much detergent or water or energy to put in?)

In Brazil and the UK users complained that they weren’t sure if the detergent mark on the machine was for liquid detergent or powder detergent. Giving irrelevant or incomparable information also adds confusion. Labelling products as ‘A energy rated’ implies to the user that they have done everything in their power to lower their resource impact, when in reality it might not be best suited for their needs or identified behaviours.

Figure 6.8 shows how the identified guidelines can be used along with the DfSB strategies identified in the literature and the cultural factors identified in the intensive study to guide change towards more desired behaviours.

Both the cultural factors and the design guidelines have been identified based on the current study area of laundry behaviours within the household in three contexts; Curitiba, Brazil; Bangalore, India; and Loughborough, UK. Neither is therefore an exhaustive list that can be used in all contexts for all behaviours; however both can be used as a platform to develop and further understand other aspects of cross cultural behaviour in wider contexts.

The idea behind the above guidelines is not to give designers a rigid framework to adhere to, as by its definition, design is a fluid and flexible creative process; however, the guidelines can assist in designing in cross cultural contexts by providing themes to better identify with the user in a given context and guidelines to aid changes to predetermined desirable behaviours.

The development of the theory based on the previous phases of research and the creation of design guidelines complete objectives 3 and 4 identified earlier in the research (Chapter 1.3). In the next chapter, the findings from the intensive study, in the form of the cultural factors and the design guidelines, are tested in a design context. An international design competition is introduced to designers from around the world to answer a laundry related brief to understand how the cultural factors and guidelines can be used by designers.
7 DESIGN STUDY

7.1 Introduction
The final design study took the form of an international design competition. The competition ran for an eight week period from Monday 22\textsuperscript{nd} of April 2013 until Friday 14\textsuperscript{th} June 2013. The competition was open and promoted to entrants from all over the world with teams and individuals, students and professionals allowed to enter. It was actively promoted to participants with a design background to provide the most relevant results.

The competition had two main aims:

- To test the cultural factors and design guidelines by generating numerous different designs from different contexts;
- To understand the implications of the resources on designers looking to promote sustainable behaviours.

7.2 Data Collection
Design competitions or innovation contests have been a fundamental part of the creative process for centuries with a growing popularity in the last couple of decades aided by the facilitation of potentially global reach to entrants. Innovation contests have been used in diverse scenarios over the years from the creation of margarine in 1869 following a brief from Napoleon III (Khan, 2005), to the design of the Jeep in 1941 following a call from the US government for an all-terrain vehicle (Slavin, 1997), with breakthroughs in aviation, medicine, energy, agriculture and many other fields all having their roots in competitions.
In modern business, competitions are used as an innovation and conceptualisation tool as well as a way for large corporations to better engage with their customers. Despite this there is little published material available on running innovation contests for data collection purposes, particularly in design research in the modern era of instant global communication.

Following their extensive literature review Adamczyk et al. (2012) define innovation contests as:

“IT-based and time-limited competitions arranged by an organization or individual calling on the general public or a specific target group to make use of their expertise, skills or creativity in order to submit a solution for a particular task previously defined by the organizer who strives for an innovative solution.”

Design competitions can be useful to organisations to help explore new concepts, understand the market better, and generate considerable publicity. Participants in design competitions have a number of motivations including; expanding their portfolio of work with ‘real’ projects, potential high level publicity of their work in established design channels, possible realisation of designs, prestige, prizes, and recognition and contacts that might further their design career.

Despite their extensive use in creative disciplines, innovation contests as a tool for data collection in design research are a relatively under-explored methodological approach. Cobanli (2011) introduces six types of competition commonly used to integrate the end user into the design process. These are:

- Participatory Artefact Design Competition (Designers are the end-users of the product).
- Artefact Pre-Configuration Design Competition (End users design or ‘configure’ products).
- Crowd Sourcing Design Competition (All stakeholders are involved in the designing).
- Complimentary Artefact Design Competition (End users are asked to design complimentary products for use with a main product).
- Co-Branding with End-Users Design Competition (Participants are asked to design for their particular niche market).
- Futuristic Innovation Design Competitions (Concepts and out-of-the-box ideas unlikely to be realised using existing technologies).
Details of the factors to consider when designing an innovation contest are detailed by Hallerstede and Bullinger (2010) in figure 7.1 attributes identified for use in the design competition have been highlighted.

<table>
<thead>
<tr>
<th>Design element (synonym): definition</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Media (-): environment of IC</td>
<td>Online  Mixed  Offline</td>
</tr>
<tr>
<td>2 Organizer (-): entity initiating IC</td>
<td>Company  Public organization  Non-profit  Individual</td>
</tr>
<tr>
<td>3 Task/ Topic specificity (problem specification): solution space of IC</td>
<td>Low (Open Task)  Defined  High (Specific task)</td>
</tr>
<tr>
<td>4 Degree of elaboration (elaborateness, eligibility, degree of idea elaboration): required level of detail for submission to IC</td>
<td>Idea  Sketch  Concept  Prototype  Solution  Evolving</td>
</tr>
<tr>
<td>5 Target group (target audience, target participants, composition of group): description of participants of IC</td>
<td>Specified  Unspecified</td>
</tr>
<tr>
<td>6 Participation as (eligibility): number of persons forming one entity of participant</td>
<td>Individual  Team  Both</td>
</tr>
<tr>
<td>7 Contest period (timeline): runtime of IC</td>
<td>Very short term  Short term  Long term  Very long term</td>
</tr>
<tr>
<td>8 Reward/ motivation (-): incentives used to encourage participation</td>
<td>Monetary  Non-monetary  Mixed</td>
</tr>
<tr>
<td>9 Community functionality (community application, communication possibility, tools): functionalities for interaction within participants</td>
<td>Given  Not given</td>
</tr>
<tr>
<td>10 Evaluation (ranking): method to determine ranking of submissions to IC</td>
<td>Jury evaluation  Peer review  Self assessment  Mixed</td>
</tr>
</tbody>
</table>

Innovation contests tend to be ‘community based’ (construction of a community to comment and judge designs), ‘expert-based’ (submissions for specific tasks evaluated by a panel of experts), or ‘mob-based’ (evaluated by peers and experts). Expert-based innovation contests tend to run for a few weeks to a few months and require a degree of elaboration to the solution of a specified task usually from a targeted audience with a monetary or valued reward for successful entries (Hallerstede & Bullinger, 2010). The competition is therefore ‘expert-based’ with experts from both academia and industry.

The brief for the competition was to use the cultural factors and design guidelines available on the website to design a new laundry concept that promoted more sustainable user behaviour in the participant’s chosen context. Participants were asked to submit their
designs via an online submission portal. There were three elements required for the submission (An example of a submission can be found in Appendix G):

1. **Context Board:** This was to identify the context the designer had chosen to design for. It included details of the user and the context of use based on advise available on the website. The requirement was an A3 sized presentation board as either an image or pdf file with links to video or audio files where appropriate.

2. **Solutions Board:** This was the solution to the brief. Participants could use the form of a storyboard, concept sketching, CAD rendering, or other design output. Again submissions were A3 sized presentation board as either an image or pdf file with links to video or audio files where appropriate.

3. **Designer Reflection:** This was where designers had the opportunity to reflect and better explain their design by answering the following questions:
   - Briefly explain the design.
   - Briefly explain which of the Design for Sustainable Behaviour principals and Design Guidelines you have used in your design.
   - Explain how you feel these factors help to fulfil the brief.
   - Do you feel the Design for Sustainable Behaviour principals and Design Guidelines helped in inspiring your design?

![Figure 7.2 – Competition Website Homepage](image-url)
The central hub for the competition was the website (designwithculture.co.uk) which contained all of the resources and information required to take part in the competition (figure 7.2). The resources on the website included a small amount of theory on design for sustainable behaviour, the cultural factors and the design guidelines (full resources and a completed entry can be found in appendices F and G). The website address was sent out in all communication and promotion of the competition and was also where the participants could register and submit their entries. Visitors to the website were invited to register their information (contact details, occupation & area of expertise) if they were interested in taking part in the competition, which helped build a database of interested parties who could be reminded to enter closer to the deadline.

The competition was supported by Forum for the Future (forumforthefuture.org) a non-profit sustainability consultancy working globally with business and governments for solutions to environmental issues. The Innovation Team at Forum for the Future helped with promotion, judging and meeting the eventual winner and provided invaluable industry expert assistance.

7.2.1 Sampling Strategy

The competition was specifically targeted towards participants from a design background; however there was no limitation on whether the participants should be students or professionals, individuals or groups. A website acted as the centre for all promotional materials. The most effective way to attract participants, particularly for a global audience, was therefore through online channels.

The most obvious promotion was internally within the Loughborough Design School. Firstly undergraduate and master’s students were emailed together and invited to take part in the competition. Secondly staff and researchers were asked to forward the competition on to any design networks they felt it would be appropriate for (or take part in the competition themselves).

Further to this, a list of partner organisations were targeted and emailed the relevant details for them to promote within their institutions. These included other universities, design schools, design consultancies and NGOs that were known to the researcher or introduced through a mutual contact.

Further to this, expert groups such as the PHD_DESIGN JISC mailing list, the O2 Sustainability Network and other expert mailing lists were be targeted to help promote the competition.
Press releases from Loughborough University and promotional material such as guest blogs with the competition partners also helped with the marketing, as well as the multitude of design competition websites (contestwatchers.com, designcalls.com) on which the competition was placed.

Finally social media such as Facebook and Twitter were utilised to help the competition gain momentum via a snowball-like methodology.

7.2.2 Incentive for participating

The prize for the eventual winner of the competition was two-fold. The first was a Nexus 7 Tablet. This was chosen as a prize as it is a desirable piece of consumer technology particularly for aspiring designers. Another prize in the form of a ‘design experience’ was chosen. The winning designer would get the opportunity, either face-to-face or via online video chat, to present their design to the innovation team at Forum for the Future, supporters of the competition.

The prizes were chosen for a variety of reasons. The Nexus 7 tablet was chosen to offer a physical reward to the winning participant. Studies have shown that monetary incentives are important to participants in innovation contests (Antikainen & Vääätäjä, 2010). The design experience was offered to also encourage designers who were not motivated by physical prizes and in this way could help build up contacts in the design world and publicise their design work across a number of design related media. In this way the prizes were chosen to accommodate the many motivations designers have in entering competitions and therefore receive as many targeted entries as possible. Choosing both monetary and non-monetary rewards, such as recognition in the community, is an important factor for participants of innovation contests (Antikainen & Vääätäjä, 2010).

7.2.3 Analysis

Analysis of the design competition entries was based around preselected criteria used in the creation of the competition. The designs were evaluated in numerous different ways to add depth and breadth to the analysis.

There were 3 main factors considered when analysing the data:

- The participant’s own reflections on their design.
- The judges’ comments.
- The participant’s work and the relevance to the design brief.
Responses to the designer’s reflections were divided into analytically relevant codes (Coffey and Atkinson, 1996) and placed under appropriate a-priori categories. Further review of the data added more codes and eliminated some, thus helping to refine the analysis procedure.

Furthermore, the designs were evaluated by a panel of design experts (figure 7.3). These included academic experts in the relevant design field (design for sustainable behaviour), Dr Debra Lilley and Dr Garrath Wilson and experts from industry in the supporting organisation, Rodrigo Bautista, Anna Warrington, & Gemma Adams from the innovation team at Forum For The Future.

All entries were assessed using the assessment criteria devised at the beginning of the competition and thus informed a large part of the judges’ comments and evaluations. The assessment criteria can be found in Table 7.1.

Table 7.1 - Design Competition Assessment Criteria

<table>
<thead>
<tr>
<th>Assessment Stage</th>
<th>Assessment Criteria</th>
</tr>
</thead>
</table>
| Defining the Context | How well is the context portrayed?  
|                     | Is the context relevant?  
|                     | Do they use contextual factors provided in the brief?                                                                                               |
| Design Process      | What design process has been used?  
|                     | Do they use DfSB principles?  
|                     | Have the Design Guidelines been applied?                                                                                                           |
| Solution            | Is the solution relevant to the context they have portrayed?  
|                     | Is it effective in changing behaviour (and would this change be sustainable)?  
|                     | Do they understand the principles where they have used them?  
|                     | Clarity of design solution.                                                                                                                                 
The participant’s work was also evaluated using a matrix (Table 7.5) to classify which guidelines were used in their design and where their design was located along the axis of influence. In this way it was easy to see common guidelines that featured throughout the entries and whether there was an association between the DfSB principles and any particular guideline.

7.3 Participant Information

Over the 8 weeks that the competition ran the competition website received 3,731 visits from 2,461 unique visitors based in 83 countries in six continents (figure 7.4).

Figure 7.4 – Country visits
The 10 most common countries by visit can be found in table 7.2:

<table>
<thead>
<tr>
<th>Country</th>
<th>Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>981</td>
</tr>
<tr>
<td>India</td>
<td>553</td>
</tr>
<tr>
<td>United States</td>
<td>305</td>
</tr>
<tr>
<td>Mexico</td>
<td>227</td>
</tr>
<tr>
<td>Canada</td>
<td>124</td>
</tr>
<tr>
<td>Netherlands</td>
<td>115</td>
</tr>
<tr>
<td>Sweden</td>
<td>115</td>
</tr>
<tr>
<td>Greece</td>
<td>107</td>
</tr>
<tr>
<td>Belgium</td>
<td>97</td>
</tr>
<tr>
<td>Brazil</td>
<td>93</td>
</tr>
</tbody>
</table>

In total 45 people from 10 countries registered their interest in taking part in the competition with a total of 17 final entries from 7 different countries. Out of the 17 final entries there were 2 professional entrants and 15 student entries, with 2 groups entering and the rest individuals. There was a mix of entrants from product design, industrial design, mechanical engineering, design ergonomics, and design innovation backgrounds.

Table 7.3 categorises the different designs according to whether the design was part of a group, individual, student or professional, which country the designer is based, and what their area of expertise is. The theme of the design relates to the themes discussed in more detail later in the chapter, whilst the success of the design relates to how successful the concept was according to the assessment criteria.
Table 7.3 - Competition participant information

<table>
<thead>
<tr>
<th>Designer Code</th>
<th>Country</th>
<th>Area of Expertise</th>
<th>Theme</th>
<th>Success of Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST_IN_01</td>
<td>UK</td>
<td>Sustainable design</td>
<td>Misc.</td>
<td>High</td>
</tr>
<tr>
<td>ST_IN_02</td>
<td>Netherlands</td>
<td>Design Engineering</td>
<td>Acupuncture</td>
<td>High</td>
</tr>
<tr>
<td>ST_IN_03</td>
<td>UK</td>
<td>Design Engineering</td>
<td>Mentors</td>
<td>High</td>
</tr>
<tr>
<td>ST_IN_04</td>
<td>India</td>
<td>Mechanical Engineering</td>
<td>Macro Context</td>
<td>Low</td>
</tr>
<tr>
<td>ST_IN_05</td>
<td>India</td>
<td>Product Design</td>
<td>Individual Use</td>
<td>Medium</td>
</tr>
<tr>
<td>PR_GR_06</td>
<td>USA</td>
<td>Design Innovation</td>
<td>Mentors</td>
<td>High</td>
</tr>
<tr>
<td>ST_IN_07</td>
<td>UK</td>
<td>Product Design</td>
<td>Acupuncture</td>
<td>Low</td>
</tr>
<tr>
<td>ST_IN_08</td>
<td>UK</td>
<td>Product Design</td>
<td>Acupuncture</td>
<td>Low</td>
</tr>
<tr>
<td>ST_IN_09</td>
<td>UK</td>
<td>Design Ergonomics</td>
<td>Misc.</td>
<td>Low</td>
</tr>
<tr>
<td>ST_IN_10</td>
<td>UK</td>
<td>Product Design</td>
<td>Misc.</td>
<td>Low</td>
</tr>
<tr>
<td>ST_IN_11</td>
<td>India</td>
<td>Industrial Design</td>
<td>Community</td>
<td>High</td>
</tr>
<tr>
<td>ST_IN_12</td>
<td>UK</td>
<td>Industrial Design</td>
<td>Community</td>
<td>Medium</td>
</tr>
<tr>
<td>ST_IN_13</td>
<td>Ireland</td>
<td>Product Design</td>
<td>Community</td>
<td>Low</td>
</tr>
<tr>
<td>ST_IN_14</td>
<td>India</td>
<td>Product Design</td>
<td>Acupuncture</td>
<td>Low</td>
</tr>
<tr>
<td>ST_IN_15</td>
<td>India</td>
<td>Product Design</td>
<td>Community</td>
<td>Low</td>
</tr>
<tr>
<td>PR_IN_16</td>
<td>Greece</td>
<td>Mechanical Engineer</td>
<td>Macro Context</td>
<td>Low</td>
</tr>
<tr>
<td>ST_GR_17</td>
<td>Canada</td>
<td>Design</td>
<td>Individual Use</td>
<td>Medium</td>
</tr>
</tbody>
</table>

7.4 Results of the Design Competition

In this section the results of the design competition are be discussed in detail relating to the assessment criteria. Design outcomes are then portrayed according to themes and more detailed case studies are discussed.

7.4.1 The portrayal of context

The context board gave the opportunity for designers to portray the particular context that they had decided to design for. In most cases users divided this into the particular user
group they had identified and the context or physical environment in which the user group were operating in. In certain cases the participants took this back a level further and looked nationally or globally at the context creating context boards relating to a ‘Western’ (ST_IN_02) washing style or portraying the context as the top of the ‘global wealth pyramid’ (ST_IN_03) (figure 7.5 & 7.6).

![Figure 7.5 - Entry displaying the user group and context](image)

**THE USER GROUP**
**YOUNG AND UNEXPERIENCED**

- LACK OF KNOWLEDGE AND INSECURITY
- CONFUSION ABOUT PRODUCTS PURPOSE

---

**THE CONTEXT**
**STAIN REMOVAL PRODUCTS**

- LEADS TO
- IMPROVE:
- APPLICATION OF PRODUCT
- OVERDOSAGE PROBLEM
- CLEANING EXPERIENCE FOR YOUNGER USERS

---

**Figure 7.6 - Context board from a broader perspective – the ‘Western’ environment**

**Washing clothes in a western environment**

Westerners are currently the leading consumers in the clothes production market, however the unsustainable practice of these consumers are becoming increasingly visible in developing markets.

Typically, most western households have their own washing machine, dryer and cleaning equipment. This provides accessibility with the means to abuse the product, but it also means that laundry tends to happen “when people fancy doing it”.

![Graph showing environmental impact of washing clothes](image)

Of all the products used in laundry processes, dryers and washing machines themselves have the highest impact on the environment. Additionally much of the impact is due to their energy phase as shown adjacent. The life phase of a washing machine studied at ETH Zürich comprised 80% of its environmental impact.

However, this also means that we, the users have a great potential to make the laundry process more or less environmentally friendly depending on their usage.

---

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It was common to find information relating to the cultural factors to portray the relevant context showing that participants had used the information available on the website to help portray the context (table 7.4).

“We recognize the potential need for dryers in the NE US [north-east United States] based on climate” (PR_GR_06).

Table 7.4 - Design that used the Cultural Factors

<table>
<thead>
<tr>
<th>Cultural Factors</th>
<th>Designs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptions</td>
<td>ST_IN_10, PR_GR_06, ST_IN_03, ST_IN_07, ST_IN_11, ST_IN_14</td>
</tr>
<tr>
<td>Aspirations</td>
<td>ST_GR_17, ST_IN_03, ST_IN_13, ST_IN_11</td>
</tr>
<tr>
<td>Views &amp; Opinions</td>
<td>ST_IN_10, ST_GR_17</td>
</tr>
<tr>
<td>Income</td>
<td>ST_IN_10, ST_GR_17, ST_IN_03, ST_IN_13</td>
</tr>
<tr>
<td>Climate</td>
<td>ST_IN_10, PR_GR_06, ST_GR_17</td>
</tr>
<tr>
<td>Built Environment</td>
<td>PR_GR_06, ST_GR_17, ST_IN_13, ST_IN_09, ST_IN_14</td>
</tr>
<tr>
<td>Influence of Others</td>
<td>PR_GR_06, ST_IN_13</td>
</tr>
<tr>
<td>Consumption</td>
<td>PR_GR_06, ST_GR_17</td>
</tr>
<tr>
<td>Tools &amp; Inputs</td>
<td>ST_IN_10, PR_GR_06, ST_IN_07, ST_IN_13, ST_IN_09</td>
</tr>
</tbody>
</table>

In the more successful designs, participants had carried out their own primary research usually in the form of interviews and observations with their target user group, often using the cultural factors as guidelines for collecting data (PR_GR_06, ST_IN_13, ST_IN_03).

“After speaking to a number of students about their laundry expenses many of them complained about how much it can cost. As a result many of the students I spoke to were very open to the idea of a variable price range” (ST_IN_13).

“91% of respondents from survey have laundry on a different floor to storage” (PR_GR_06).

Judges commented that solutions were easier to understand if there was a clear context board behind them. Participants who had not used the cultural factors to help portray the context generally showed the problems to the specific aspect of the laundry they were tackling, used persona boards, or misunderstood and started to explain their own design in more detail without linking it to a user group or context.
In the participants own reflection they admitted to discovering new insights by focussing on a particular context

“By focussing on a young and unexperienced user group, I identified two key insights that led to my final design” (ST_IN_07).

In the most part, the context boards were often visual displays portraying a specific area of focus. Whilst it was clear some participants had collected primary data, the specific methodology for this was not presented and it was often enough to understand the context with a few good visuals (diagrams or photos) and some key phrases or quotes.

### 7.4.2 Designers own Reflections

The designers own reflections were an opportunity for designers to explain in more detail the context and solution they had designed. However the reflections also offered interesting insights into the application of the design guidelines and how design for sustainable behaviour was perceived by the designers themselves.

Many of the participants used this section to identify the resource reductions their design would create (ST_IN_13, ST_IN_07, ST_IN_12, ST_IN_03, ST_IN_02, ST_IN_05, ST_IN_01, PR_GR_06). However, participants often commented on reductions without going into the specific details of exactly how or how much their design would reduce resource consumption, possibly because the competition was for concept designs rather than ready to produce solutions.

“It is both a user-centred new way to experience your laundry process, and a design that helps you keep track and improve your carbon footprint after every wash” ST_IN_03.

“In the aim of encouraging community based living which in itself sets the basis for a sustainable way of living” ST_IN_07.

Perhaps the most useful reflections, in terms of the research, were how and when the designers used the different guidelines and behaviour theory. By far and away the most common use of the guidelines was in the research and ideation process; in the initial stages of idea and concept generation. They provided a basis for designers to think ‘outside-the-box’ or develop different concepts that would not have initially been conceived.

“Initially they helped provoke ideas that would not have been generated had I not had the guidelines to provide a direction” ST_IN_13.
“I found the guidelines to be very helpful at the initial research stage, as they already provided me with a lot of information and also the possibility to focus on certain issues from the start” ST_IN_07.

They were also used by some designers to conceptualise the complexities of the process and help understand the resource implications.

“They reminded us to think about the complexity and systems surrounding a product and process” ST_GR_17.

“They helped me to understand the different factors which could contribute to sustainable design” ST_IN_09.

Whilst using the guidelines for ideation, designers also continued using the guidelines throughout the design process to maintain the direction of the design.

“During the design process I also regularly read over the guidelines again which helped to stay focused on the requirements of the task” ST_IN_07.

Finally many of the participants used the guidelines as a structure to evaluate their designs with. After using the guidelines in the initial idea generation stage the participant’s commented that they were further used as evaluation criteria for which concept to take forward as they “served as sensible parameters to judge my concepts against” (ST_IN_11).

The design for sustainable behaviour strategies were typically used to understand the potential impact of changing behaviour and were also used during the ideation phase to help generate concepts.

“The behavioural principals were very supportive and inspiring when it came to pushing my concept to be more sustainable. However I did not deliberately choose from the beginning to locate my project at a specific point along the ‘axis of influence’, as I was afraid this could limit my design” ST_IN_07.

7.4.3 Use of DfSB and Guidelines

Most of the participants commented on the individual guidelines that they had attempted to use, however it was common for participants to either overstate or understate the significance of any particular guideline. Some participants tried to explain how their design involved nearly every guideline, whilst other participants designed using one or two guidelines as major influences.
A matrix (table 7.5) was used as an analysis tool to firstly plot which guidelines had been used along with which design for sustainable behaviour strategies and secondly to plot the understanding of this from the individual designers. In the Matrix below the red dots signify the guidelines and behavioural influences that the designers believe they have used, whilst the black dots signify the actual guidelines and behavioural influences that the designer’s have used based on analysis of the final designs with experts.

It is possible to see that some designers (ST_IN_01, ST_IN_11 & ST_IN_15) clearly understood the guidelines and behavioural influences and acknowledged which guidelines and behavioural principles they had used in their designs. Their explanation of their design matched the actual analysis of the design.

Other participants (ST_IN_02, ST_IN_04, ST_IN_07, ST_GR_17, ST_IN_14, ST_IN_10, & ST_IN_09) understood there to be other guidelines or behavioural principles present in their design that were not apparent under analysis. For example Kahlfeldt and Wardell believed to have used guideline 5, create a new emotional attachment with the user, by changing the colour or aesthetic of aspects of their designs. Under analysis it is not believed that solely changing the aesthetic slightly would create a new emotional attachment or indeed change behaviour otherwise all new designs would fit into guideline 5.

This could also be seen with confusion distinguishing one behavioural approach from another (e.g. ST_IN_10 & ST_IN_14. ST_IN_10). One participant suggests her design uses clever technology by “enabling the user to compare how much energy they have produced with other family members, this should help create a competition” (ST_IN_10). In reality this approach is related more to behaviour steering and feedback than clever use of technology or automation in design. This correlates with findings by Lilley (2007) that designers find it hard to distinguish between the behaviour change strategies, particularly behaviour steering, in their designs.

It was also common for participants not to mention certain guidelines that were present in their designs. For example ST_IN_07 doesn’t mention guideline 4, the user has control to influence the resource use of a process, when clearly in her design, a dosage system for stain removal, there is the ability for the user to effect the amount of stain removal product. However it must be noted that some participants did not state all of the guidelines they used in their designs as they might have felt use of a particular guideline was obvious, did
not need any explanation, or only concentrated on explaining the main guideline they used in their design.

It can also be seen from the matrix that some participants decided not to explain specifically which guidelines or behavioural influences they used. This may be because they misunderstood the brief or could not identify any specific guidelines that matched their design.
Table 7.5 - Evaluation Criteria Matrix

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>PR_GR 06</th>
<th>ST_IN_02</th>
<th>ST_IN_04</th>
<th>ST_IN_05</th>
<th>ST_IN_06</th>
<th>ST_IN_07</th>
<th>ST_IN_08</th>
<th>ST_IN_10</th>
<th>ST_IN_11</th>
<th>ST_IN_12</th>
<th>ST_IN_13</th>
<th>ST_IN_14</th>
<th>ST_IN_15</th>
<th>ST_IN_16</th>
<th>ST_IN_17</th>
<th>ST_IN_09</th>
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<tbody>
<tr>
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</tr>
</tbody>
</table>

Key: • = Designer's belief they have used; = Designers have actually used.
### 7.4.4 Which behaviour to which guideline?

One of the ideas behind the matrix was to see if there is any relationship between specific guidelines and the behavioural strategies on the axis. The hypothesis is that certain guidelines would be more aligned to certain behavioural strategies, for example guideline 6; let the user know and understand the various resource inputs and outputs of the process, would be suited to feedback.

**Table 7.6 - Where the guidelines featured on the Axis of Influence**

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Feedback</th>
<th>Steering</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
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</tr>
<tr>
<td>4</td>
<td>1</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7.6 above plots how many times a guideline has been used in correlation with where the design featured on the axis of influence.

As the table describes, there is in some cases, no correlation between the guideline used in the design and where that design sits along the axis of influence, for example guidelines 1, 2 & 6. In other cases there is a strong link between the guideline used in the design and the type of behavioural strategy attributed to it, for example in guidelines 3, 4, 5 & 7.

In some cases this is understandable. Guideline 3, adapt the design to suit the needs of the user, is more aligned to behaviour steering than feedback to allow changes to occur based on the behaviour of the user. Interestingly the design could also be changed to suit the user through use of technology, yet this is not common in the findings. Similarly guideline 4, give the user control to influence the resource use of a process, is suited to steering as this is where the user has most control to change the process.

Interestingly creating an emotional attachment with a process is more aligned to feedback and steering than technology. This is obvious in designs such as Ask Nana (figure 7.17) which
provides feedback through an emotional connection with familial ties. Designs that use technology with moderate degrees of success such as ST_IN_05 do not create an emotional attachment with the user.

Understanding the correlation of the guidelines to the design for sustainable behaviour strategies allows us to plot which guidelines can be used in a design to increase the effectiveness of changing behaviour. If a designer looks to implement feedback into their design, then creating an emotional attachment is important, where as if we want to steer the users behaviour, giving them an increased level of control is more important.

### 7.5 Specific design outcomes:

Analysis of all the designs entered into the competition revealed a vast array of approaches undertaken with influences from a range of different behavioural aspects as well as use of different design processes such as user-centred design, interaction design and engineering design amongst others. The following section briefly outlines the different themes that were tackled by the designers. These include:

- Community Solutions; designs that incorporate a social element within either a developed context or a developing context.
- Individual Use Solutions; designs intended to individualise the laundry procedure.
- Acupuncture Points; the designer recognises there is a varied process but tackles one point within the process on the basis that small changes to single points will change the process as a whole.
- Macro-Context Solutions; designs that used the wider context to look holistically at the process.
- Mentors; designs that incorporated learning through providing relevant information.

#### 7.5.1 Community based solutions:

ST_IN_15; ST_IN_13, UK; ST_IN_12, UK; ST_IN_11.

Four entries tackled the brief using community based solutions, but for very different contexts. Two entries used community solutions in developing areas where prevalence of mechanical washing machines and clean water is low and laundry is typically done by hand; whilst the other two entries used community solutions in different contexts (India and UK) but in more developed regions, using the shared aspect of laundry to lower resource use.
The common themes for solutions in the developing context were to create a centralised hub for washing which acted as a social area.

Figure 7.7 - Community based central laundry hub

The idea behind both designs is low-tech solutions with materials that would be widely available in the respective contexts. Users reduce the resource consumption by pooling the laundry tasks. One design talks of reducing water input from 25 litres per family per week to 10 litres due to centralising and mechanising the normally labour intensive process. In an innovative twist, rather than ask for payment like a laundrette-style community washing centre, users are just asked to bring the resource with them, i.e. the 10 litres of water and detergent needed for the wash (figure 7.7). This does however bring about some issues, not least the logistical issues of carrying the laundry and resources to a centralised location, but also issues regarding ownership, installation and maintenance of the central hub and therefore the design would probably not be as effective as the designer anticipates.

The other solution maintained the social element of the laundry observed in the context but tried to reduce water inputs and increase efficiency by combining the workload of two people in a semi-mechanised concept (figure 7.8).
The common thread with the solutions for a more developed context was laundrette style washing centres that reduced resource consumption through sharing the resource load across machines.

Laundromat 2.0 is a community based washing system for use in large campus offices or universities (figure 7.9). It incorporates an app to be able to plan and book the time in the laundry and also allows the user to engage in other social activities by linking the activity with friends. The design of the linen basket acts as the washing machine drum and the university or work campus maintains the system (figure 7.11). The user can see the cleaning process and the resource use due to the transparent nature of the design and can see the waste water and potential clogging (figure 7.10).
The design shows clear use and understanding of the design guidelines and behaviour strategies. Various aspects of the design include feedback, steering, and technology. Emotional attachment is built in by social engagement with friends whilst doing the process whilst the user can also clearly see the resource inputs and outputs. Although there are some logistical issues that need to be ironed out, as a concept it shows innovative thinking combining interesting elements of behavioural thinking and the system as a whole.
7.5.2 Individual use solutions:

ST_IN_05; ST_GR_17.

A couple of solutions were directed towards individualising the laundry procedure with the premise being that the resource reductions would reduce per wash as much fewer garments were involved (figure 7.12). Although the potential resource implications are unclear, this act to individualise laundry is very interesting from a behavioural point of view. Whilst the actual act of doing the laundry is very habitual, the findings from the intensive study show that the laundry routine is often not as habitual or routinised. Unlike taking a shower or brushing one’s teeth which are performed without conscious thought as part of an everyday ritual, laundry is generally completed ‘when the basket is full and I have free time’. The designs that reduce the size of the washing load and individualise the process attempt to introduce the laundry process into the everyday routine of the user (figure 7.13).
The reality of these designs would in all probability effect an increase in overall detergent, water and energy use through daily washes and therefore, were considered unsuccessful in meeting the brief. Users would most likely use a ‘daily wash’ solution as well as a ‘normal’ washing machine for larger washes and bed sheets / towels etc. There could therefore have been more careful consideration of the context and aspirations of the users, perhaps combining a daily wash design with a social or community based design for larger items washed less frequently.

Although the designs were unsuccessful in their implementation, attempting to change the routine of the laundry offers interesting behavioural insights. The findings from the intensive study suggested that for some people laundry is very routinised; either everyday or every week at the same time, whilst for other people it is less time dependent, just when there is free time and the basket is full. In this way, laundry sits in between being an automatic behaviour performed on autopilot and needing some degree of cognitive deliberation to decide when to wash (Hanratty et al., 2012). By introducing daily washes the behaviour becomes more routinised and requires less cognitive deliberation.

One of the clear distinctions observed in the designers work is the relation to Hofstede’s Cultural Dimensions, particularly the Individualism vs Collectivism dimensions which can be predominantly seen in the community and individual use themes. The design solutions under the community theme relate to Hofstede’s Collectivist Dimension whereby individuals are integrated into strong, cohesive groups with a strong focus on shared community goals (Hofstede, 1980). Individual use solutions relate to Hofstede’s Individualism whereby emphasis is put on independence and self-reliance (Hofstede, 1980).

What is interesting is the mix in designs based on the context that the designer was designing for. The two community based designs for developing contexts are from UK and Indian designers. Their designs focus on a community hub for socialising whilst doing the laundry in poor rural areas of developing countries. In these conditions a community based washing centre would correlate with the high collectivist nature of poor rural communities in India and Africa (Hofstede Centre, 2013). Thus theoretically a community based design solution would be appropriate in these conditions.

Interestingly the two designs for more developed contexts are also from designers in India and the UK. India is considered a highly collectivist society with an individualism score of 48, compared to the UK with a score of 89 – a very individualistic society.
The two individual use solutions were for a Canadian (individualist society) and an Indian context. This opens an interesting debate that some design entries were individual use designs for a collectivist context, whilst some were community based designs for an individualism context.

7.5.3  Acupuncture points:
ST_IN_08, UK; ST_IN_02; ST_IN_07, UK; ST_IN_14.

Various designs tackled a singular issue in the process which has been coined an ‘acupuncture’ point. This is where the designer has recognised there is a wide array of factors influencing the process and has decided to tackle one specific point in the process with the idea that small changes to single points will create a big change to the process as a whole.

The designers attempted to solve issues relating to using ecological washing powder, stain removal dosage, efficient machine filling, and helping other family members get involved with the laundry. Once again there was a wide spread in terms of potential success of the design.

Solutions such as ‘Feed Wash’, which tried to engage other family members in the laundry by making a noise when laundry was placed in the drum, and ‘Staintape’, a stain removal dosage system, both offered relatively novel designs that attempted to change user behaviour through feedback or steering (figure 7.14). Clear use of guidelines was also shown, with ‘Feedwash’ clearly provoking a new emotional connotation with the laundry and ‘Staintape’ allowing the users to see and change the amount of resource use, however it
was not clear how either design would reduce resource consumption from the current method or whether there would be a positive change in behaviour.

Figure 7.15 - Soapnut shell grinder

A further concept the ‘Soapnut Shell Grinder’ (figure 7.15) tried to make the user more aware of their detergent use by engaging them in preparing the ecological detergent (soapnuts). In reality this showed very limited use of the guidelines and would not particularly change user behaviour other than at the point of purchase. It is also unclear what the advantage of freshly grinding the soapnut shells would be over buying ‘pre-ground’ shells. It is a poor design with a low success as ultimately the product would be redundant, with users opting to buy pre-ground soapnut shells if they were going to buy ecological washing powder.

THE LAUNDRY SPRING

Figure 7.16 - Highly Commended - The Laundry Spring

The laundry spring aims to show users exactly when they should do their laundry to maximise efficiency (figure 7.16). It prevents under or over filling the machine by visually
showing users when the correct time to do the washing is. It falls into the acupuncture points theme as it is solely designed to improve the loading of the washing machine.

The design predominantly uses feedback to visually and ‘playfully’ inform the user of the correct time to do the washing by changing form when there is an input. In some sense it also steers behaviour, as it can only be filled to a certain level before the user must engage and do the laundry.

The design is successful due to its playful and simple solution to a very real problem. The design guidelines and behaviour change strategies have clearly been used to good effect. The design engages the user and subtly adds emotional attachment to the process. The solution also gives the user information to lower impact without the user having to ‘go out of their way’ to change behaviour. It shows the possibility for very targeted behaviour change which portrays very useful information as a spur to action.

Despite this is does not allow for separation of colours or materials and doesn’t negate all the behavioural issues or take into account the complexity of whole process. In this way it only partially solves the problem.

As suggested, this design shows the potential possibilities for solutions under the acupuncture point theme. The design tackles a very specific problem, however small changes across the whole system can lead to a big overall change.

7.5.4 **Macro-context Interventions:**

ST_IN_04, India; PR_IN_16, Greece.

A couple of solutions looked at wider context, macro level interventions for changing the laundry process. These typically involved the use of renewable technologies such as solar energy and water heating as well as changes in infrastructure. These were very poor designs and were a fairly literal re-wording of the guidelines, with little behaviour change theory applied or novel innovative solutions. Often the designs muddled resource reduction concepts with resource increasing concepts, such as using solar energy to heat water, but then an electric pulley system to move laundry between floors.

In these cases the designers were obviously confused by the nature of the brief and did not apply the behaviour strategies in their final designs. The two participants had a background in mechanical engineering and this may highlight the differences between designers and engineers in their approach to problem solving.
7.5.5 Mentors:

ST_IN_03; PR_GR_06.

Two designs had strong elements of learning through providing relevant information, but from very different angles. ‘Ask Nana’ (figure 7.17) evoked an emotional engagement with the user by introducing ‘Nana’ as a source of expert knowledge on the laundry process. ‘Nana’ is the inbuilt computer in the washing machine but it evoked a strong reminiscent connotation to grandmothers, who are considered ‘experts’ in domestic chores according to the designer’s own research and backed up by the findings of the intensive study. At each stage of the laundry process the user was guided to the most effective and efficient course of action.

Figure 7.17 - Ask Nana ‘Mentor’ System

‘Ask Nana’ uses an emotional attachment to grandmothers as experts on domestic activity. The design has tried to change user behaviour through feedback and used many of the design guidelines in the process. There is a strong emotional connection made between the user and their nostalgic familial memories backed up by research. The designers have also thought about the flow of the procedure and the space where it occurs by condensing it so the washing machine is closer to the process. Some of the guidelines they have implemented are very literal whilst other aspects, such as having to constantly speak and listen when trying to do the laundry, needs further thought. It is also not precisely clear as to exactly how the ideas implemented in the design would directly reduce resource consumption.
Trax on the other hand uses feedback through technology to inform the user of the most effective and efficient behaviour (figure 7.18). Instead of using mothers or grandmothers to act as ‘mentors’ in the process, Trax used an app to inform users of the most efficient behaviour whilst also using aspects of gamefication to encourage the adoption of low resource impact behaviours.

The app is designed to link and control appliances in the home. The user can schedule and get updates on their wash whilst also receiving real-time information about the status and resource use of their washing. In this way Trax heavily uses feedback to encourage users to change their behaviour but also uses some degree of behaviour steering by using gameification to see other user’s data in the linked network.

It gives intuitive feedback related to energy performance with remote control to change use patterns. It also lets users see the resource inputs and outputs in electronic form, but not necessarily to immediately change them. However there is a concern about building momentum to engage the user. Why would the user download the app and would they stop using it after its novelty wore off?

The two designs once again can be related to Hofstede’s cultural dimensions, this time in the form of Masculinity vs Femininity. The literature along with intensive study findings suggests that the laundry is focussed in familial norms predominantly as a woman’s role in the household. Masculinity refers to values that are competitive, materialistic, ambitious and powerful; whilst femininity refers to emotions, relationships and quality of life.
Within the competition entries we may therefore distinguish between the behavioural influences and the relationship to Hofstede’s dimensions. Entries such as Trax which use strong features of gameification to lower resource use may be more appropriate in masculine contexts (USA, UK) where competition and winning are high influences. Whereas designs such as Ask Nana may be more appropriate in feminine contexts (Scandinavia) where there is a higher influence on the emotional and familial bond.

7.6 Design for Sustainable Behaviour

It is possible to see visually as well as in the reflections of the designers themselves that the design guidelines and design for sustainable behaviour strategies were used as effective measures to change behaviour. What is unclear however, in some of the less successful designs, is how that behaviour change resulted in a reduction in resource consumption.

In some of these cases, such as the individual use solutions (ST_GR_17 & ST_IN_05), this is a technical consideration that is unclear whether the design would actually reduce resource consumption. As concepts, the designs are very different to what is currently used and therefore it is not clear whether they would use more or less resource. The only real way to understand this would be through rigorous user testing with appropriate prototypes, and therefore as concept designs we can only hypothetically analyse the resource implications. Using a daily wash system compared to an ordinary washing machine cannot be fully evaluated until tested by users in their everyday environment.

In other cases, the designs showed signs of significantly changing user behaviour, but with little or no resource impact. Solutions such as Feedwash clearly use the guidelines and axis of influence in the design, and it is believed that to some extent, particularly in the short term, other family members would be engaged with the laundry process, however the design would clearly not reduce resource consumption.

This helps us to greater understand the usefulness of the guidelines and behaviour change strategies when trying to reduce resource consumption. With Feedwash an emotional attachment is attempted through giving users feedback when washing thus trying to engage family members. In reality, just creating the emotional attachment to the process doesn’t reduce resource impacts.

The more successful designs used multiple guidelines and behaviour change strategies to obviously show resource reductions. In solutions such as Trax, the user is given feedback
and an incentive to reduce resource intensive behaviours and therefore it is possible to see how the reductions would occur.

Relating this to the behaviour theory with Trax as a solution, the user can understand the resource consumption through visually seeing the impact through the app, they have the ability to change their behaviour with the app providing relevant information for change, and they have the motivation for change through gameification – comparing their use to friends, family & neighbours etc. With Feedwash as a solution there is little understanding of a change in behaviour, little ability to affect the resource use and only a small amount of motivation in the form of an audible noise when the action is complete.

7.7 The Value of Research

The findings showed that designers that had completed their own research into the user group and context, or were experienced in it themselves, generally had designs that were considered to be more successful. This is particularly noteworthy from a design methodology point of view considering the earlier critique of using personas to build empathy in design compared to first hand primary research.

One key finding was that the research conducted by the designers generally related to the literature and previous study findings. This was particularly the case with laundry as a domestic household process with emotional connotations steeped in cultural and familial norms. Research by one participant (PR_GR_06) suggests:

“People are typically taught how to do laundry by their mother, older sister, house keeper, first girlfriend. Truths and fallacies are passed down from person to person and there is a lack of knowledge about the ‘Chemistry of Clean’”.

This correlates with the intensive study findings that typically people are taught how to launder by mothers, grandmothers and househelp and, much like what was concluded in the intensive study, behaviours are passed down from generation to generation typically through the women in the family acting as ‘teachers’ of domestic behaviours.

This acknowledgement is crucial for designers looking to change behaviours, but also shows how difficult it is. Domestic behaviours of ‘the right’ way to do something are often very ingrained into the emotional bond between generations of family members despite ‘the right’ way potentially being out dated, superseded by new technologies, contexts, or values. A person in their early twenties may be washing their shirt based on grandmother’s advice
which may not take into account modern machine technologies, detergent advancements, or changes to material or fashions.

On the other hand, it could be argued that grandmothers (or mothers) have adapted their behaviour when new technologies have been introduced and therefore they have the experience and the knowledge of the most effective cleaning technique to hand down.

Either way, what is certainly clear is the very apparent bond between domestic behaviours and generations of (typically) women in the family. Introducing a new technology will need the approval of family elders if it is to truly adopted and this highlights the difficulties for designers looking to change behaviours, but the potentially huge rewards in seeing that behaviour transferred for many generations to come.

7.8 Methodology Evaluation

As established earlier in the chapter, the competition was promoted via a wide range of online channels. The graph below (figure 7.19) shows the visitor data for the period the competition ran.

![Figure 7.19 - Competition visitor data](image)

46% of visitors from the website were from referral sources whilst 53.1% were direct traffic with no attributed referral source (the other 0.9% were from campaign sources).

As the graph shows, visits to the website fluctuated dramatically depending on the publicising of the website. Visitor numbers increased dramatically on days in which the website was promoted via certain media, with the highest peak of 259 visits on Monday 3rd of June when the competition was emailed to the design lists PHD_JISCMAIL and the O2 sustainability network.

Typically these spikes in traffic correlate with either emails sent out to relevant mailing lists, activity and snowballing on Facebook and Twitter, the day of a press release by Loughborough University, the days of the guest blogs on Forum for the Future’s website, the design competitions websites (particularly near the deadline), and a general increase in
traffic close to deadline day. The 10 biggest referral sources by visit can be seen in table 7.7 below:

Table 7.7 - Referral sources by visit

<table>
<thead>
<tr>
<th>Source</th>
<th>Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook</td>
<td>692</td>
</tr>
<tr>
<td>Twitter</td>
<td>193</td>
</tr>
<tr>
<td>Designcalls.Wordpress.com</td>
<td>148</td>
</tr>
<tr>
<td>Direct Email</td>
<td>142*</td>
</tr>
<tr>
<td>Loughborough University (lboro.ac.uk)</td>
<td>141</td>
</tr>
<tr>
<td>Contestwatchers.com</td>
<td>104</td>
</tr>
<tr>
<td>Designcompetition.com</td>
<td>102</td>
</tr>
<tr>
<td>Productdesignforums.com</td>
<td>85</td>
</tr>
<tr>
<td>Forumforthefuture.org</td>
<td>24</td>
</tr>
<tr>
<td>Loughboroughecho.net</td>
<td>24</td>
</tr>
</tbody>
</table>

*This figure is from the referral source data, however it is expected that a large part of the 53.1 % of direct traffic is from direct email without a referral source attributed to it.

Overall the competition received considerable interest from a global design audience. The number of visitors to the website from such a varied and wide reaching group was better than expected. There was a quick uptake as design institutions and organisations promoted it through their networks and the competition continued to snowball as time passed.

Looking back, one of the positive features of the competition was the ‘register your interest’ section, which allowed participants who were interested in taking part to register with no obligation. This allowed the researcher to gauge the potential participants and send out reminder emails to ensure continued interest and a successful entry.

The competition also benefited from having an industry partner on board, and although they were not providing any financial backing, the time and expertise of the team of industry experts was invaluable. The benefit of having the partner on board helped in:

- Awarding a prize that would appeal to all designers in the form of a non-monetary design experience, appealing to the motivations of designers seeking industry feedback on their work
- Adding prestige to the competition by showing industry support from a highly regarded institution.
- Evaluating participant’s work; giving an industry viewpoint to an otherwise academic judging panel thus building in rigour to the data analysis.
Promoting the competition through their extensive and exclusive network of design contacts and social media streams.

Despite the large exposure of over 2400 unique visitors, there were 17 entries to the competition. Although this might seem like a low number of final entries, the design brief was a very involved one with many aspects for the designers to consider. The competition also ran at the end of the student year and was therefore too late for any educational institutes to add the competition into their modules or syllabuses.

7.9 Conclusions

Phase 4 of the research consisted of an international design competition that focussed on applying a set of design guidelines, created in phase 3, with the design for behaviour change strategies to design a less resource intensive laundry process. In this way the competition helped to complete the objective of creating concepts to test the guidelines in different contexts to reduce resource intensive behaviours.

Participants from all over the world with design backgrounds undertook the competition. The brief was set to utilise the insights and conclusions established from phase 3 of the research and therefore explore the concept of using different cultures to design for sustainable behaviour.

On analysis of the entries it is evident that combining the design guidelines along with the design for sustainable behaviour strategies with additional information on context building helped enhance the depth and breadth of sustainable concepts. The themes discussed above show the varied nature of the entries; using many of the guidelines and behaviour change strategies, or just using one guideline and one strategy. The guidelines allowed the designers to think out of the box to come up with novel and insightful concepts despite the relatively defined nature of the brief.

Giving the participants the cultural factors allowed them to question their own ways of doing the laundry and try to understand the impact that different contexts and different behaviours can have on everyday household tasks. The guidelines helped the designers in ideation, reflection and evaluation of their designs.

The competition itself proved to be a very useful tool for data collection in a design research enquiry. It generated substantial publicity for the research, linking it to industry, and
provided a novel way to gain international design-specific participation in the research. However, the following recommendations are made for future design competitions:

- **Create an open brief.** Having a very defined brief is good for specific design tasks, but involves considerable investment from the participant and therefore may put some designers off. Opening the brief will encourage higher participation rates.

- **Offer early-bird incentives.** One of the issues with the competition was that the majority of the entries were submitted in the last few hours of the deadline. This made for a nervous last few days to see the participation rate. Offering an earlier prize draw for a smaller prize may have incentivised designers to get their designs in earlier and therefore calculate participation rates better.

- **Get organisations involved.** Having Forum for the Future involved in the competition aided with promotion, prestige and evaluation of the entries.

- **Run the competition at an appropriate time.** Although the competition was not specifically for students, they are generally the most attracted to design competitions. The competition ran at the end of the academic year, meaning students were busy with their main projects or already on holiday and the competition could not be integrated with modules or syllabuses on design courses.

- **Organise the marketing strategy.** One of the unexpected outcomes of the competition was the interest from global organisations and websites. Despite having a rough plan for marketing channels of the competition, there was not a rigorous marketing strategy in place, which could have been used to increase participation rates.

### 7.9.1 Development of the guidelines

One key finding evidenced in the competition entries was the potential for re-aligning some of the guidelines. Guideline number 6, let the user know and understand the various resource inputs and outputs of the process, is a form of feedback; giving the user visual, tangible information of the resource use. Guideline 4, give the user control to influence the resource use of a process, could be combined so that the two guidelines allow the user to understand and affect the resource use of the process. Being able to understand and affect the resource use of a process links back to the model in the literature of motivation, ability and understanding of users to change their behaviours (Abrahamse, 2005; Steg, 2008).

Table 7.8 below links each guideline with the behavioural influence, as well as where the designs were placed along the axis of influence. As discussed in the literature and observed
in the competition results, the most successful designs attempt to give the user the understanding, ability and motivation to adapt their behaviour. This table therefore gives us an insight into the necessary steps to take to implement a successful change.

Table 7.8 - Guidelines linked to behavioural influence

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Behaviour</th>
<th>Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understanding</td>
<td>All</td>
</tr>
<tr>
<td>2</td>
<td>Ability</td>
<td>All</td>
</tr>
<tr>
<td>3</td>
<td>Ability</td>
<td>Steering</td>
</tr>
<tr>
<td>4</td>
<td>Ability</td>
<td>Steering</td>
</tr>
<tr>
<td>5</td>
<td>Motivation</td>
<td>Feedback/Steering</td>
</tr>
<tr>
<td>6</td>
<td>Understanding</td>
<td>All</td>
</tr>
<tr>
<td>7</td>
<td>Understanding</td>
<td>Feedback/Steering</td>
</tr>
</tbody>
</table>

Furthermore, the various themes observed in the concept designs can be mapped to Hofstede’s Cultural Dimensions to identify themes that would be more successful in areas with a higher score in some of the cultural dimensions. In this way we can start to understand how Hofstede’s dimensions can help designers looking to introduce designs into different markets. Introducing a very communal, collectivist solution into an Individualist context may not have the same results as when it is introduced into a collectivist context (table 7.9).

Table 7.9 - Themes identified correlated to Hofstede’s dimensions

<table>
<thead>
<tr>
<th>Theme</th>
<th>Hofstede’s Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Solutions</td>
<td>Collectivism</td>
</tr>
<tr>
<td>Individual Use Solutions</td>
<td>Individualism</td>
</tr>
<tr>
<td>Acupuncture Points</td>
<td>Dependent on Solution</td>
</tr>
<tr>
<td>Macro-Context Solutions</td>
<td>Long Term Orientation</td>
</tr>
<tr>
<td>Mentors</td>
<td>Femininity/Masculinity</td>
</tr>
</tbody>
</table>

The designs acted as a suitable test bed for using the guidelines with the behaviour change strategies in different cultural contexts. The competition acted as an evaluation of the
resources developed in the previous phases of research and in this way completed objective 5 identified at the beginning of the research (Chapter 1.3). The development of the guidelines, cultural factors and behavioural strategies and how they relate to the findings from the previous three phases are discussed in the following chapter.
8 DISCUSSION

8.1 Introduction
This research has built upon previous theories of culture, behaviour and development to understand the impact that different cultural contexts can have on designing products that are less resource intensive during use. Although heavily in the realm of the design for sustainable behaviour (DfSB) research field, this research is not an advancement of the current DfSB theory (as is the case in Wilson (2013), Daae (2013) and Renström et al. (2013)); rather it is a separate, parallel strand of theory concerned with developing resources to target the application of DfSB strategies in different cultural contexts. This is a very new study area with few previous studies, but one that is vitally important as development and consumption, particularly in emerging markets, increases rapidly.

In each of the preceding chapters relevant discussions and conclusions have been presented relating to the research aim and objectives at that point. This chapter however, presents a wider understanding of the research findings to the study area and the broader design implications of the research as a whole. This chapter therefore discusses the development of theory; the transfer of behaviours and implications for leapfrogging; the specific differences in laundry behaviours between countries; the application and limitations of the findings; design and empathy in different contexts; the relevance and importance of design methodologies; and a broader discussion of the role of design in changing society.

8.2 The Development of Theory
This research has drawn considerably on theories of culture, behaviour and design to explore and advance the relatively new field of designing for sustainable behaviour in
different cultural contexts. Within the research, three strands of theory have been developed; the integration of Hofstede’s model into design; linking the cultural factors to the behavioural models in the literature; and linking the design for sustainable behaviour strategies to the design guidelines developed in phase 3. The implications of these developments are discussed below.

Hofstede’s cultural dimensions were first developed in the 1970s and 80s to understand behaviours in different cultures and use this to simplify and clarify cross-cultural communication in global corporations. Whilst Hofstede’s research is still used to inform business strategy and innovation decisions, the research is typically limited to organisational and corporate culture (Bredillet et al., 2010).

Within this research, the scoping study drew out clear differences in household behaviours between the chosen regions which were compounded further in the intensive study. These phases of research gave clear indications of the utility of Hofstede’s cultural dimensions for designers looking for opportunities in unfamiliar contexts, and this was substantiated by the findings of the design competition.

Whilst the designs from each theme were submitted from designers in different contexts, the designs clearly fell into distinct themes, which, upon analysis, drew distinct similarities with Hofstede’s cultural dimensions. One of the clear insights is that Hofstede’s dimensions can be tracked against the design and behaviour theory previously discussed in the literature. Design concepts such as gameification are clearly a masculine cultural dimension, whilst creating an emotional attachment fall into Hofstede’s feminine cultural dimension. Solutions focusing on community are a collectivist dimension, whilst solutions that deal with a macro-scale topic are generally long-term orientated dimensions.

Moving Hofstede’s cultural dimensions from business communication to the design process is one way to engage with new markets. The implementation of Hofstede’s dimensions, along with the resources developed in this research can assist in the ideation and evaluation of a design in a particular context. Designing solutions, such as community based washing systems, will not have the same impact in individualistic societies as in collectivist societies, and the results of the competition help to demonstrate this.

A further strand of theory that this research advances is to break down the antecedents of behaviour to understand if they are culturally independent or significant, and what the possibilities are to change them. As the literature on behavioural models suggests, there are
numerous factors that make up an individual’s behaviour, not least their intention to act and their contextual circumstances. The development of the cultural factors breaks down the antecedents of behaviour into internal and external influences that can be examined within the relevant context to understand the parameters for change and implement designs more likely to succeed in changing behaviour.

Models, such as Triandis’ Theory of Interpersonal Behaviour (1977), suggest ‘facilitating conditions’ as the contextual factors that affect behaviour. The cultural factors developed in this research aggregate this further into elements that are representative of a group based on their cultural identity, and elements that are independent of culture. Each of the significant factors can be found in a context and, to some extent, shape the culturally independent factors, which are not confined to a particular context. In this way, there is a grey area between how the individual interprets the significant factors to constitute the independent factors (figure 8.1).

<table>
<thead>
<tr>
<th>Significant Factors:</th>
<th>Grey Area</th>
<th>Independent Factors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Environment, Tools, Inputs, Consumption Patterns, Influence of Others</td>
<td>The same significant factors are interpreted into different independent factors</td>
<td>Perceptions, Aspirations, Views, Senses, Income</td>
</tr>
</tbody>
</table>

![Figure 8.1 - Relationship between Significant and Independent Factors](image)

One final strand of theoretical contribution from the research is the development of the design guidelines and their links to the design for sustainable behaviour strategies. The results from the competition provide an insight into how the guidelines relate to behavioural theory. As table 7.8 shows us, each guideline relates to a user’s understanding, motivation and ability to change behaviour. Guideline number 1 for example (Understand the flow of the procedure from start to finish), relates to the ‘understanding’ of users to be able to act. Guideline 3 (adapt the design to suit the needs of the user) is related to behavioural theory that suggests users need the ‘ability’ to act, and is suited to the behaviour steering strategy. Guideline 5 (Create an emotional attachment between the user
and the process), affects the ‘motivation’ of the user and is suited to either feedback or steering strategies (table 7.8).

This breakdown of the DfSB strategies allows designers to develop products pinpointing a particular behaviour they are looking to change. If they are looking to change a user’s behaviour through steering, then the research suggests changing the user’s ability to act will be most successful and guideline 4 (giving the user control) would be a good source for inspiration. Similarly if the designer was looking to change behaviour through their design using feedback, then this will affect the user’s understanding, and guideline 7 (Be clear about the operation of the process) might be a good way forward.

Prior research and other studies of the design for sustainable behaviour strategies and theory greatly contribute to the subject area. Despite this, the research tends to focus on the theoretical progression of the model rather than a tangible output for use in design research. The resources developed in this research therefore support the DfSB theory by offering guidelines for suitable strategy selection. The resources can be used to understand which DfSB strategy would be most suitable in which cultural context, a current gap in previous research.

### 8.3 Differences in Laundry Behaviours: UK, Brazil and India

It should also be noted that the findings, particularly from the intensive study, offer new insights into laundry behaviours in Brazil, India and the UK. Whilst in this research, the findings have been used to develop an overarching theory using cultural differences to develop less resource intensive products; the findings themselves are useful to researchers and industries looking specifically at the laundry process in the three regions. In their own right, they are a novel and valuable contribution to household behaviour research.

The literature on laundry suggested that users’ behaviours and their associated resource intensity varied greatly between countries, however the studies reported in the literature were typically quantitative or used data from the few previous studies, predominantly in Europe and Japan (Laitala et al., 2011; Uitdenbogerd, 2007). Previous research has concluded that cultural background has a social influence on the formation of routine (Elizondo, 2011). Shove (2003) points to the ‘whirlpools of laundering’, with cultural context affecting each aspect, or ‘whirlpool’, of the model.

The findings from the intensive study generally align with the literature and scoping study to validate the results. In Brazil, it was noted that participants washed clothes in cold water in
vertical axis machines, correlating with data from Greendex (2010) and the scoping study. Typically Brazilian participants have a separate ‘laundry room’ which is a designated space specifically for washing clothes. In India the washing machine was located in many different rooms in the house, whilst in the UK it was typically under the work surface in the kitchen. In Brazil and India the price, capacity, brand and energy consumption were important factors when purchasing a machine, whilst in the UK, participants were concerned primarily with price. Despite predominately owning top-loading washing machines, Brazilian participants aspired to own front loading machines and wash in hot water for the perceived better cleaning ability.

The findings helped to develop Shove’s whirlpool model and also divided the cultural factors of the laundry process into groups for greater comprehension by designers. The results offer insights for designers and potential opportunities. Identifying the laundry room in Brazil as a factor for decreased tumble dryer use, for example, opens up a debate on the design of spaces within modern buildings in all locations. Additionally the results provide a specific knowledge of the aspirations of consumers in the emerging markets of Brazil and India which can be used to better understand and implement solutions to other theories, such as leapfrogging (Schäfer et al., 2011).

8.4 Transferring Behaviours and the Implications of Leapfrogging

The cultural factors developed in this research give designers a heightened understanding of the complexities of transferring behaviours from one cultural context to the other. At the beginning of this research, in Chapter 1.2 (Gap in knowledge) previous studies alluded to the need to understand resource intensive behaviours in different cultures and form a method for more successful transfer of sustainable behaviours with the implementation of new technologies. As was noted, transferring a new technology to a new cultural context does not mean the technology or desired behaviours will be adopted successfully. Transferring behaviours between cultural contexts requires a deep-rooted understanding of the social, cultural and personal norms of the region. Findings, such as the ironing service identified in India, could offer an innovative solution to a household chore in a more modern service based economy; however for the successful transfer of behaviours the cultural, societal and personal norms need to be identified and matched – something the cultural factors were developed for.

The cultural factors therefore enable designers to break down the reasons behind certain behaviours in one context and then innovate to recreate the conditions behind the desired
behaviours in another context. For example in a Brazilian context there is a dedicated space for the washing machine and drying the clothes (the built environment), and this concept was used in the design competition to attempt to recreate this condition and the resulting behaviour in a Canadian context – as in the case of The Flusher Washer (ST_GR_17).

Understanding the cultural factors therefore not only allows the designer to build empathy with users in unfamiliar contexts, but also allows the designer to understand the causes of a desired behaviour and transfer this to a new context. This significantly improves the prospects of the adoption of a new product in an unfamiliar cultural context.

This understanding of transferring behaviours assists designers when trying to implement new technologies to leapfrog to sustainable consumption. Traditionally leapfrogging has been used by economists and politicians to describe, on a macro-level, the potential for skipping dirty technologies in favour of cleaner more modern technologies. The findings of this research have shown that there is merit in designers looking at the everyday behaviours of individuals to skip from the perceived benefits of resource intensive behaviours to new behaviours that are less resource intensive – as long as the facilitating conditions, perceptions of new behaviours, and aspirations of the consumer are aligned.

Whilst on a macro scale, leapfrogging is used to describe a change to clean and renewable energy technologies, the research has shown that a simple change in behaviour could avoid a switch to increasing washing temperatures in emerging economies such as Brazil. Not only would that cause a significant resource reduction in households across Brazil, but the behaviours could then be studied using the factors identified in this research to transfer and implement the new behaviour in other contexts, thus having further resource reduction benefits.

Indeed leapfrogging is another example of a more-macro, organisational theory that could be used to a greater benefit by designers looking at the everyday lives of individuals. It plays to the arguments identified earlier and by Stevenson (2013) that designers, with their skill of looking at the everyday behaviours of everyday people, should be used more often higher up in business and policy making decisions. Designers can present insights from a micro level of the consequences macro decisions can have on the lives of everyday people.

8.5 Discussion of Methodology

One of the key contributions of this research is an understanding of the use of design methodologies in different contexts as part of a wider development of methods for
designers investigating user behaviour. Translating raw data from real users into information designers can use to innovate is of paramount importance and has been tackled by one of the few previous studies in this field by using personas (Elizondo, 2011). In her work on dishwashing behaviours in the UK and Mexico, Elizondo (2011) concluded that personas “allowed a mechanism to be created, that provides designers with an organized set of data about functionality, emotional, aesthetic and contextual information...promoting empathy, creativity and innovation throughout the design process” (Elizondo, 2011; p138).

Whilst personas can aid in boosting creativity and empathy to an extent, there are also several limitations; not least, as Elizondo points out, “designers tend to mistrust any sort of information that has been somehow interpreted into something else” (Elizondo, 2011; p.140). Personas help designers get an idea for a particular user in a given situation, but are in no way a substitute for actual primary research with real users in real contexts. For this reason, this research does not attempt to provide a quick fix for designers looking to translate raw data into actionable insights. The culturally significant and independent factors that have been identified in Chapter 6 provide a means for designers to understand elements of a behaviour in a given situation and how they can affect them. The factors are there to guide the designer or researcher as to what elements need to be investigated and how certain behaviours can be affected. In this research, laundry behaviours in Brazil, India and the UK are investigated, however the cultural factors could be used for other behaviours in other contexts. In this way, the designer understands the user and context they are designing for, unlike using other empathy tools, such as personas, which are often considered ‘fake’ and distance the designer from the reality being studied (Elizondo, 2011).

Creating empathy with the user will always be easier if the designer investigates the problem first hand; however this is not always a practical or cost-effective option. Using the cultural factors helps to break down the user behaviour and contextual factors further and can help to substantiate other empathy building tools, such as personas.

An additional method that this research has further developed is the use of competitions as a data collection technique in design research. Design competitions are a common method employed by companies to help engage with their customers, understand the latest trends, and innovate within their product range, yet in academic design research their application is typically limited to the field of computer science (Hallerstede and Bullinger, 2010). This research has shown that by having a strong, underpinning theoretical model, design competitions can be designed to obtain and extract clear data through specifying a
structured submission type. Design competitions therefore, offer a valuable method to obtain a wide array of concepts from a global, design-related, sample.

One of the interesting aspects from the competition was the variability in the ways the designers tackled the brief. The designs embodied concepts such as feedback, gameification, automation, and emotional attachment amongst others, from the fields of service design, product design, interaction design, user-centred design, and mechanical engineering. The design competition methodology is fairly unique in drawing in such a wide array of designs from a multitude of different disciplines in different locations, and hopefully this study can be used by researchers as a basis to develop further competitions to investigate designers in different contexts.

Although there are considerable advantages to the design competition methodology, one question could be raised regarding the final response rate of designers. Despite a large number of visitors to the website, from all around the globe, the final number of completed entries remained at 17. Whilst 17 specific concept designs was considered acceptable for the purposes of this research, given the high number of visitors to the website, it could be perceived as a little low. The reasons for this and potential recommendations for increasing the design rate are given in Chapter 7.9 (create an open brief, offer early-bird incentives, get organisations involved, run it at a good time). The competition was conceived, developed and published in a very short space of time, conforming to the short time-scales of this research project. Researchers wanting to use design competitions in future should allow plenty of time to prototype the competition, get companies and sponsors on board, and properly plan their marketing strategy, as well as heeding to the other recommendations in Chapter 7.9 to make full use of this potentially powerful data collection method.

The other data collection techniques used for the scoping study and intensive study were based on the available literature of previous cross-cultural studies. The online survey was not designed to draw out indicative behaviours of an entire nation. However the results highlighted some interesting insights which supported the literature and opened further avenues for exploration. The online nature of the survey allowed access to participants typically hard to reach because of time and cost constraints and because of this there was a good response rate over a widespread area (Wright, 2005).

Contextual interview and observation were used in the intensive study as they are the most suitable methods for investigating people’s behaviours in real world settings (McClelland &
Suri, 2005). The informal nature of the interview whilst the participant was doing the laundry gave the researcher the opportunity to guide the interview based on aspects that were interesting to the topic. It also provided a means of reflection for the participant as they had rarely questioned or consciously thought about their behaviours whilst doing such a ‘menial’ chore as the laundry. This data collection, coupled with the household tour gave a contextual perspective of the participant and their everyday life – something which really helped with the insight generation and analysis of the data.

Conducting a cross-cultural study of this kind, with such a limited budget and time-scale, meant prolonged in-context immersion with each participant in each location was not possible. Combining the interview, observation and tour was in-part, a way of combatting the relatively short time spent with each participant.

One recommendation for future studies of this kind is the importance of pilot studies. Within the extensive study the pilot allowed for changes to be made based on language whilst with the intensive study the pilot highlighted aspects to change the routine of the data collection and also other tools to bring along which were ultimately of paramount importance to the research i.e. video research.

8.6 Using the Guidelines and Cultural Factors: Applications and Limitations

The development of the cultural factors and design guidelines open an interesting research field with significant implications for designers. As touched upon briefly earlier in the discussion, there are various ways the cultural factors can be useful to designers. The factors help to identify antecedents of behaviour which can aid designers to both build empathy with users in new contexts and provide an understanding of factors to investigate when researching users in different contexts. In this way, the cultural factors can significantly aid data collection for designers looking for new insights to solve a problem.

The cultural factors can also be used by designers to understand how changes in their design will affect certain changes in behaviour, and whether it is possible to implement a change in behaviour within a given context. For example a designer might look to encourage a more natural line-drying technique for drying clothes to discourage the use of tumble dryers; however in a context that receives sporadic and plentiful rainfall (such as the UK), a direct translation of behaviour from a warmer, more predictable region (such as India), may not be possible. The use of cultural factors in this way was observed in the design competition. In one example, the ‘Flusher Washer’ (ST_GR_17), the designer drew
significant inspiration from researching the built environment (a culturally significant factor) to produce a solution for small apartments in Canada (figure 8.2). In another example, the influence of other people (a culturally significant factor) was used to develop a solution based around the advice of other family members (PR_GR_06).

Like the cultural factors, the design guidelines can be applied in various situations to inspire behaviour change. One of the key elements for the creative industries is to inspire ‘out-of-the-box’ creative thinking, and the guidelines can help to achieve this. By their very nature they guide the designer to think differently about creating innovative solutions for new or unfamiliar environments. The guidelines are by no means hard-and-fast rules for designing, but as the participants from the competition asserted, they can be used in the ideation process for innovation, for reflection during the design process, and for evaluation of concepts and designs against the original brief.

Both the cultural factors and the design guidelines are useful to designers looking to explore new markets and make products more relevant to the market and less resource intensive during use.

Despite the potentially varied application of these methods, there are also several limitations which should not be ignored. Firstly, despite the fact that the guidelines and cultural factors have been developed from first-hand primary research and validated
through research from prior studies, they are a new concept that are otherwise untested other than within the realms of this PhD. Further development of this research and the study area in general, with new design challenges and in different contexts will help to substantiate the findings and progress this embryonic research field.

Secondly, whilst the guidelines and cultural factors aim to help designers looking to create low resource intensive products for unfamiliar markets, there is no procedure in place for their misuse. As previously discussed no empathy-building tool is as good as the designer experiencing the everyday behaviours of the user in question in their given environment. Whilst the cultural factors can help the designer ‘ask the right questions’ and the guidelines can help them ‘think about the problem differently’, they are not a ‘silver-bullet’ for the problem of creating low impact products in unfamiliar contexts. They are also untested with other forms of methodologies typically used in design research.

Finally, due to the short timescales and academic nature of the project, the research is untested in industry. Only time will tell if the theory or research developed within this PhD will filter across to industry, however there are several suggestions for transitioning the theory to the real world identified in Chapter 9.6.

### 8.7 Design and Empathy in Different Cultural Contexts

Having clear and precise user information is critical in the design process. A design brief cannot be successfully fulfilled without the designer interacting and engaging with the user to some degree. Nowhere is this more important than when designing for different cultural contexts.

One of the key insights that this research has highlighted is the importance of control for designers in the early stages of the project. Whilst traditionally, a designer will not be involved with setting the brief, allowing the designer to understand and build empathy with the user to the best of their ability is critical for successful designs. Building walls around the designer takes away their control of the creative process, leading to a potentially less innovative solution.

Of course, the amount of control the designer is afforded completely depends on the brief as set by the client. This relates to a long-standing debate about at what stage the designer should be involved in the setting of the brief. As the design competition showed, allowing the designer to use the information however they desired led to some very creative and diverse concepts, however more concrete, realistic designs may be more appropriate for
most design briefs in the real world. Of course, successful businesses understand the importance of putting designers at the heart of business decisions, rather than using them as a ‘bolt on feature’ to generate novel ideas for new sales. Using designers throughout the hierarchy of a business utilises their ability to spot opportunities and implement solutions to new problems. Previous research has shown that giving the designer more responsibility and allowing them access to the strategic business decisions has a greater social and environmental impact on the product and more compelling and innovative design solutions (Stevenson, 2013). The resources presented in this research are particularly important for businesses looking to explore unfamiliar markets.

8.8 Changing Roles: Demographics and Society

The design of everyday products and services is one of the key factors that shapes the evolving nature of societal change. It is a complex issue whereby new innovations may spark social structural change, or social change sparks new innovations. The invention of the washing machine, for example, dramatically changed society by radically reducing the manual, time-consuming task of doing the laundry, allowing women the opportunity for education (Rosling, 2010).

The literature, scoping study, and intensive study findings all conclude that generally women are the ‘teachers’ of household chores, particularly the laundry. Many of the participants from the intensive study suggested their use of the washing machine and laundry habits were solely based on advice and experience from their mothers or grandmothers. This role of women as ‘teachers’ of everyday household behaviours has far reaching societal consequences that represent both a challenge and an opportunity for designers.

These energy intensive behaviours get passed down from generation to generation, with users unlikely to alter their habitual behaviours unless there is a significant or disruptive change in their environment or the tools they use (for example the invention of the washing machine). Incremental changes to household behaviour may be slow and costly because the advice from the mother will have a greater impact than advice from corporations.

Having said that, the cultural factors identified in this research can change perceptions and behaviours by implementing a more relevant technology or artefact in a given context. The aspirations of some of the Brazilian participants was to own front loading washing machines with hot wash cycles. Changing this aspiration away from hot washes to a more general perception of cleanliness through using the cultural factors and guidelines will not only have
far reaching consequences on that individual, but also on their children and grandchildren. In certain circumstances it may also be possible for the ‘teaching’ to go the other way – with the younger generation showing the older generation a new possible behaviour or routine. This is, however, more likely to be the case with the introduction of a completely new technology.

In some part, this alleviates the ‘burden’ of the mother as the ‘teacher’ of household behaviours, coinciding with a shift in social structure. As discussed in Chapter 6.7, there is a housing crisis because of the changing structure of society; people living longer, more single occupancy homes, higher divorce rates, etc. In this way, more people are exposed to household chores and that could change the dynamic of family life.

Designers have a responsibility to monitor shifts in social structures and innovate accordingly. Single occupancy, smaller living, urbanisation, and an ageing population are just a few of the major social changes that affect energy intensive household behaviours and designers need to be integrated into the structural and social decisions that affect these changes. Will smaller family size and urban living affect the use patterns of the washing machine? How will the gender imbalance around laundry be affected by more single occupancy homes? These are questions that designers need to be aware of when looking to innovate in new markets where the social and cultural norms of family life may be unfamiliar to the environment the designer is used to.

The exploratory nature of the research has led to the generation of many insights and the development of existing theories within design and its associated fields. The points of discussion above are the start of a potentially large research area that will, hopefully, be built upon further in the coming years. The final concluding remarks from the research are presented in the next chapter.
9 CONCLUSIONS

9.1 Introduction
In this final chapter of the thesis the overall findings of the PhD are concluded. The first section describes how the research aim and objectives were achieved, before general conclusions derived from the previous seven chapters of research are presented. The explorative nature of the study into a relatively new field of research ensures there is a considerable contribution to the formation of new knowledge in the research area, however, as with all explorative research; there are also limitations to the findings which have been highlighted. Finally the chapter culminates in suggesting future work that can build on the present research and advance the study area even further.

9.2 Meeting the Aims and Objectives
In table 9.1 the fulfilment of the objectives, as outlined in Chapter 1, are described in relation to the research activities carried out as part of this PhD. The completion of these objectives fulfilled the overall aim of the research to develop resources to aid design for sustainable behaviour in different cultural contexts.
**Table 9.1 - Meeting the Objectives**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Method</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) To draw on cross-disciplinary literature to outline theories relating to design and behaviour, define the terms culture and development, and identify factors that influence resource intensive behaviours.</td>
<td>Previous relevant work, drawn from several fields helped define the terms of this research project and contribute a body of work to understand and direct the various overarching theories of this research. Relevant resource intensive household behaviours were also identified in various different countries.</td>
<td>2</td>
</tr>
<tr>
<td>2) To explore resource intensive household behaviours in the UK, Brazil and India through: a) An extensive online survey gauging perceptions and behaviours around several household themes</td>
<td>An online survey was devised and promoted to a global audience to understand and compare different household behaviours around the themes of food, water, energy, materials and government schemes. In total there were 158 participants from the UK, Brazil and India. The results aligned with many of the findings from the literature review and helped define a more specific avenue for enquiry in further studies.</td>
<td>4</td>
</tr>
<tr>
<td>b) In-depth, user-centred research on one particularly resource intensive behaviour identified in the previous phases of research.</td>
<td>In-context interviews, observation and household tours were used to understand laundry behaviours from 19 participants across three sites: Bangalore, India; Loughborough, UK; and Curitiba, Brazil.</td>
<td>5</td>
</tr>
<tr>
<td>3) To develop a theoretical understanding of the complex cultural factors that influence people’s behaviour.</td>
<td>The research findings of the previous chapters, combined with an in-depth knowledge of the literature led to the development of a set of culturally significant and independent factors which give a greater understanding of the complexities of behaviour.</td>
<td>6</td>
</tr>
<tr>
<td>4) To develop resources to enable designers to understand and affect behaviours in different cultural contexts.</td>
<td>The insights from the in-depth laundry study were used to create a set of guidelines to assist designers in creating products that are less resource intensive during use in different cultures.</td>
<td>6</td>
</tr>
<tr>
<td>5) To evaluate the application in design of the resources developed with international designers.</td>
<td>The guidelines and cultural factors were used by 17 designers from around the globe to fulfill a laundry related brief, providing many insightful designs using different aspects of the theory presented.</td>
<td>7</td>
</tr>
</tbody>
</table>
9.3 General Conclusions

From the outset, this project has addressed a gap in knowledge relating to exploring the impact that different cultural contexts have on designing products that are less resource intensive during use. The underlying principle was that breaking down behaviours of users in different cultural contexts would help designers create products that are less resource intensive during use. Whilst the conclusions from each phase of research have been outlined in the respective chapter, this section details the final conclusions that they encompass.

This research integrates the complex themes of measuring and defining behaviour, development and culture within a design context. Despite the complexity of the terms, by defining them clearly within the research area, there is a clear demonstration that the inter-relationship between the themes can be adopted by designers for creative and innovative purposes.

The Scoping Study (Chapter 4) highlighted the differences in behaviours between the regions studied. A couple of areas where this was particularly clear were in bathing behaviours and laundry behaviours, and this was further investigated in the intensive study (Chapter 5). The findings, whilst providing insights in their own right, are linked to the larger aim of this research, to provide opportunities for designing in different cultural contexts. This culminated in the resources developed in Chapter 6 which were validated using the design competition in Chapter 7, with insightful and novel designs from a wide range of different design disciplines.

One clear opportunity for designers is the rapid growth in emerging markets, however as highlighted in the literature, growth typically follows the Western model of over consumption of finite resources. By promoting this consumption in emerging markets consumers get ‘locked-in’ to unsustainable behaviours, being unable to convert to less resource intensive technologies once the infrastructure and base technology has been purchased. ‘Leapfrogging’ to sustainable consumption has been touted as a possible solution to sustainable development, however it is currently used as a macro, over-arching concept mainly by economists. Designers can use the concept of leapfrogging to change individual behaviours to promote more sustainable actions. In this way, designers have the ability to connect with individuals on a micro level and apply changes that are often theorised by economists and policy makers. Designers and their creations are the interface between individual’s everyday behaviours and larger macro shifts in society.
A further area where the research can be connected to the theory is the development of Hofstede’s cultural dimensions for use by designers – again allowing designers to explore opportunities typically afforded to economists and business strategists. The results of the competition in Chapter 7 clearly show a strong affinity between designing in different cultural contexts and the dimensions outlined by Hofstede (1980). Using the design guidelines created in Chapter 6 and the design for sustainable behaviour strategies along with Hofstede’s cultural dimensions gives designers the opportunity to be more precise about the behaviour they wish to change and a method to be able to change that behaviour. Themes from the competition, such as community based, individual use designs, mentors, and macro-use solutions all correlate with Hofstede’s cultural dimensions.

In addition to linking Hofstede’s dimensions with the DfSB strategies and design guidelines, the culturally significant and independent factors, created in Chapter 6 give designers the basis for understanding behaviours within a context, building empathy with the user, and understanding the possibilities and implications for changing a particular behaviour. Designers are in control of the information they receive and can understand how to affect behaviour, rather than being asked to design based on ‘fake’ or ‘average’ information.

The research also helped to advance the literature surrounding competitions as a data collection technique. The designs came from a wide array of design disciplines with varied and insightful solutions to the brief, which provided an alternative and engaging validation study. The competition and concluding recommendations can be used as a vital case study for design researchers looking for new techniques to collect data from designers and advance future research projects.

One final note should also consider the incredibly fast moving nature of this young research field. Some recent theoretical developments such as those by Wilson (2013), Daae (2013) and Renström et al. (2013) have significantly advanced the field of design for sustainable behaviour, however their publication was after the main data collection and analysis periods of this research. Nevertheless the research is testament to the rapid growth and necessary interest in designing for sustainable behaviour and this research adds a further strand of investigation into different cultural contexts to the theory.

9.4 Contribution to Knowledge

Design for sustainable behaviour has emerged over the last decade or so as a vital research area for sustainable design. Whilst the research area is continually growing, with theoretical
and practical studies adding to the knowledge base, parallel research strands, such as the implications of cultural context, remain very emergent, with few research studies and little published material available (Elizondo, 2011; Matsuhashi, 2012). The lack of any substantial prior work in this field emphasises the contribution to knowledge of this research, specifically:

- **The advancement of previous research**: Studies by Elizondo (2011) into washing-up practices in Mexico and the UK attempt to understand the implications of cultural context on DfSB, however the results focus on empathy building between the user and designer by developing a methodological approach for converting cultural probes into personas. In this research the importance of empathy has been built upon by identifying cultural factors that the designer can use to understand an unfamiliar context, whilst the guidelines enable the designer to affect changes. In this way, the research provides a selection strategy for DfSB theory by developing which DfSB strategy affects which behavioural antecedent. The research has also contributed to an understanding of laundry behaviours of users in the UK, Brazil and India; a field typically dominated by quantitative technical testing in Europe and Japan.

- **Developing a theory**: The resources developed within this research are linked to theories of behaviour and culture typically used in organisational or business theory. Using a novel approach of a design competition, the research has shown that with the right resources, designers can make use of Hofstede’s cultural dimensions to innovate and create products for different cultural contexts. It is also clear that theoretical concepts such as Leapfrogging, typically used on a macro-level by economists and politicians, can be used by designers looking at creating less resource intensive everyday products. Indeed the research has shown that designers, with their ability to understand everyday people on a micro-level, should be used at a higher level in business and policy decisions. Recommendations are also made for running design competitions as a feasible methodology in design research.
9.5 Limitations of the Research

The research has uncovered some insightful findings, discussions and conclusions in a new field of enquiry, however, as with any long-term research project, there are several limitations which have been encountered along the journey. The section below highlights some of the limitations of the current research as it stands.

9.5.1 Time Limitations

As is the case with any fixed-term research project, time will always dictate the final completion. The themes involved within this PhD, particularly culture, development, design and behaviour, are all huge areas of research within their own right, and therefore there will always be constraints on what can be achieved in a relatively short time frame.

The data collection is one area which had a significant time constraint. Trying to schedule three global primary research studies within the course of a three year PhD is a substantial undertaking. Whilst the extensive study received a good number of participants, prolonging the study would have not only helped to gather more participants, but potentially other areas could be studied too. Whilst currently the results from the study cannot be used to describe the behaviours of a whole country, with a greater time-frame allowing for more participants over a wider area, the results could be increased to be indicative of an entire population.

Within the intensive study, time was limited to discussions and observations for one visit with each participant. Whilst combining data collection techniques attempted to prolong the enquiry, ideally the researcher would visit the participant multiple times. Within different cultural settings a longer time period for in-context immersion would allow the researcher to become more integrated with the participants and help create a more relaxed, ‘normal’ environment to research.

Finally, the design competition was organised and distributed on a tight timescale, adhering to the length of the PhD. As discussed in the recommendations for the competition (Chapter 7.9), a longer timescale would have increased participation rates and running it with the foresight of the academic calendar would have further increased the insights discovered.

9.5.2 Logistical Limitations

Similar to the time limitations of the research mentioned above, the global nature of the research also meant there were logistical limitations. Generous grants from Santander and the Design Research Society allowed the research trips to be conducted in Brazil and India,
however these were one-time only trips, and therefore data collection had to be curtailed to fit within the single visit.

Whilst some of the research (scoping study and design competition) could be completed online, the intensive study needed actual researcher observation and discussions with real users. This meant data collection was more costly and time-consuming than if it had just been UK based. Time also had to be spent on building contacts and enabling the researcher to gain familiarity within the study areas, although thanks to the help of the country contacts, this was smooth and fairly time-efficient.

9.5.3 Educational Direction
One further limitation of the research is the educational direction, particularly of the design competition. Whilst the scoping study and intensive study were completed with the general public and a representative number of students, the design competition was predominately (although not exclusively) completed by design students. One of the main reasons for this is the methodological approach typically attracts early career designers looking for projects for their portfolios.

Although this was slightly counteracted by the close links with industry for judging, the lack of application in industry limits how the findings of the research could affect a practicing designer to a theoretical model; a common problem in design research.

Due to these limitations the designs created were concepts rather than working prototypes or actual products. Whilst the research is obviously limited based on the themes in this section, these are not seen to be overly negative as the research has opened up the study area, and the limitations will lead to further empirical enquiry.

9.6 Recommendations for Future Work
This research project has advanced the knowledge around an embryonic research field with an exciting future. The research has developed a theory with the possibility of reducing the environmental impact of products during use by exploring behaviours in different cultural contexts, however there are many more questions to ask and opportunities to research.

One obvious follow up study that would help to validate the findings of the research would be to take the design guidelines and cultural factors and use them to target a different household behaviour in a different context. This would help to understand if the factors identified in this research are relevant to all household behaviours and in all contexts. This
could be further developed by evaluating the design outcomes at a prototype stage rather than just at concept level and might be more achievable through a research project with direct links to industry.

This would help to refine the guidelines and cultural factors and a greater online resource containing examples and case studies from the research could be created for use by practicing designers taking on international projects. Further integration of the resources into industry could be achieved through workshops and seminars with designers, whilst teaching the method to design students would promote the use of resources in industry, after the students graduate.

Another interesting area that further studies could research would be a greater understanding of the implications of the resources developed in this research with the DfSB strategies. Developing a model that integrates the culturally significant and culturally independent factors with the other behavioural antecedents from models such as Triandi’s Theory of Interpersonal Behaviour (1977) introduced in the literature, would be a particularly valuable resource that would progress the DfSB research field. A further study could identify the implications of integrating the cultural resources with the DfSB strategies, with particular reference to the selection and evaluation of interventions. This would draw on the research of others (such as Wilson (2013), Daae (2013) and Renström et al. (2013)) which develop DfSB theory, but add a practical reality of implementing an intervention in a different cultural context.

Finally, if the resources developed in this research are to be adopted by designers, they will need to see successful examples of the resources being used. The further development of research proposals outlined above will help with this; however there are also other opportunities for promotion of the resources. One clear opportunity is to run an annual design competition based on the one in this research, which could grow steadily each year and continue to promote the resources with students and designers alike.


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Appendix A: Online Scoping Study

Welcome

Thank you for agreeing to take part in this short Household Survey. This survey is being run as part of a doctoral research project at Loughborough University, UK.

The survey should not take any longer than 10 minutes. Your answers will be used as part of a global study into household behaviours to increase cultural awareness.

All of the information provided will be treated in strict confidence and will be kept anonymous and confidential.

[Continue >]
Household Survey

Basic Information

1. Where do you currently live (region & country)?

2. What is your nationality?

   Select an answer

3. Age:
   - 18 - 30
   - 31 - 50
   - 51 - 65
   - 65 or over

4. Sex:
   - Male
   - Female

5. Occupation:

6. Yearly Income:
   - $0 - $2000 (£1300)
   - $2001 - $3000 (£1301 - £3300)
   - $3001 - $10,000 (£3301 - £6500)
   - $10,001 - $20,000 (£13,000 - £12,000)
   - $20,001 - $40,000 (£13,000 - £26,000)
   - $40,001 - $60,000 (£26,001 - £39,000)
   - over $60,000 (£39,000)
   - I’d rather not say

7. Level of education:
   - No formal education
   - High school level
Environmental Views

11. Which of these statements do you agree with the most?

- I think environmental issues are critical. I try to live as environmentally friendly as possible but believe I could do more.
- I feel guilty about our impact on the environment. I try to consume less environmentally damaging products where possible.
- I try to avoid waste as much as possible but I'm not too worried about the environment.
- I want to be more environmentally friendly but don't think there is much I can do in my current circumstance.
- I think the environmental crisis has been exaggerated. I don't think I need to change to be more environmentally friendly.
- I don't know much about the environment - I have more important things to worry about.
- I have no interest in the environment or the impact it has on my life.
- None of the above

[Continue >]

Survey testing only

[Check Answers & Continue >]
Household Survey

Food

12. How often do you eat meat?
   - More than once a day
   - Once a day
   - A few times every week
   - Once a week
   - Less than once a week
   - I'm a vegetarian - I never eat meat

13. How much do you spend per week on meat?
   - $0
   - Less than $5 (£3)
   - $5-$10 (£3 - £6.50)
   - $10-$20 (£6.50 - £13)
   - $20-$30 (£13 - £20)
   - $30-$40 (£20 - £25)
   - More than $40 (£25)
   - I'd rather not say

14. How often do you eat imported foods?
   - Every day
   - A few times a week
   - Once a week
   - Less than once a week
   - Never
   - Don't know

15. How often do you eat locally grown food?
   - Every day
   - A few times a week
   - Once a week
   - Less than once a week
   - Never
   - Don't know

16. Where do you buy your meat from?
20. How do you normally wash?
- Bath
- Shower
- Reservoir (bucket)
- Other (please specify):

21. Do you have a fully fitted shower?
- Yes
- No

22. How often do you wash your hair?
- Once a day
- Every other day
- Twice a week
- Once a week
- Less than once a week

23. How is the water for the shower heated?

24. Where does the water for the shower, toilet and tap come from?

25. Is it drinkable?
- Yes
- No

26. Do you own a washing machine?
- Yes
- No
  
  If No, How do you wash your clothes?
Household Survey

Goods

29. Which of the following electrical items do you use? (select all that apply)
- Kettle
- Toaster
- Computer/Laptop
- Tumble Dryer
- Blender
- Microwave
- Iron
- Portable devices (MP3, ebook etc)
- Dishwasher
- Fridge/Freezer
- TV
- Washing machine
- Vacuum cleaner
- Other (please specify):

30. Where does the electricity for your home come from?

31. Do you purchase bio-fuel or ‘green energy’?
- Yes
- No

32. How much is your average monthly electricity bill?
- Less than $5 (£3)
- $5-$10 (£3 - £6.50)
- $10-$20 (£6.50 - £13)
- $20-$30 (£13 - £20)
- $30 - $50 (£20 - £32)
- $50 - $80 (£32 - £50)
- More than $80 (£50)
- I’d rather not say

33. What is the primary source of heating in your home?
- Coal
- Oil
- Gas
- Electric
- Don’t Know
- Other (please specify):
Materials

34. Is there anything you own which you have made (e.g. furniture, garden equipment etc.)?
   - Yes
   - No
   If yes, what?

35. What do you do with products that have stopped functioning (e.g. re-purpose, dispose of, recycle, try to repair, get someone else to repair it, give-away, sell etc.)?

36. Do you buy any used or pre-owned items, rather than brand new?
   - Yes
   - No
Household Survey

Government Schemes

37. Are you aware of any government schemes that could help you reduce your environmental footprint?
   - Yes
   - No
   Details

38. Do you recycle?
   - Yes
   - No
   If yes, what?

Continue >

Survey testing only

Check Answers & Continue >
Household Survey

Contact Details

If you would like to be contacted regarding the results of the survey or the outcome of the data, or to help out more with the research - then please leave your contact details below (all information kept completely confidential).

If you would like to remain anonymous just press continue...

39. Name:
   
   ____________________________

40. Email:
   
   ____________________________

41. Comments:
   
   ____________________________

   Continue >

Survey testing only

Check Answers & Continue >

Thank You

Thank you for completing the survey. Your answers are much appreciated and will go towards furthering the body of knowledge of cultural awareness.
Appendix B: Intensive Study Question Themes

Pre-Treatment

How do you gather dirty laundry?

How do you know when laundry is dirty? Smell, looks dirty, day worn, needs refreshing etc.

How and why do you sort laundry? By colour, by textile material?

Do you turn clothes inside out or apply any pre-treatment chemicals?

Washing

Is there a specific way you load the machine?

How full do you load the machine? Does this ever change?

What programme do you use for each wash?
  - Why do you choose that programme?
  - Do you change the program regularly? If so to what? And why?

Do you know what temperature you are washing at?
  - Do you consciously change the temperature?
  - Why do you wash at that temperature?
  - Would you consider changing the temperature?

What detergent do you use?
  - Why do you use this detergent?
  - How do you know how much to put in? Dependant on load, soiling etc?

How often do you wash each week/month?
  - Does this change seasonally?
  - Has it changed in the last year?

Drying

How do you usually dry clothes?
  - What determines where you dry clothes? Type of clothing, weather, season, time, freshness, smell etc.
  - What are the timeframes of drying involved? E.g. during the day, what time do you put it out, what time do you collect it in?
- Do you do anything else to ensure drying? E.g. turn the central heating on?

If you have a tumble dryer, why do you use it?
- How often?
- On what settings?
- For how long?

**Post Treatment**

When do you repair items?

Do you iron straight after washing?

When do you fold and put away?

**General**

What is the washing machine type and placement in the home?

How old is it?

What is the general plan for laundry over the week/month? Why?

What do you consider to be the use time in days of t-shirts, jeans, jumpers?

What about other items e.g. bedding/towels?

What are the stocks of clothing? Many clothes?

What influences your purchase of clothing?
- How do you decide that you need a new one?

How are clothes discarded of?

Do you wash because of other factors? E.g. sunny day so you can dry outside. Convenience, speed etc?

Is there a change in laundry techniques between family members?

What is the climate of the region?

Usual machines of the region?
Appendix C: Codes from Intensive Study Analysis
Appendix D: Participant Information Sheet

Household study on laundry practices

Participant Information Sheet

Jak Spencer, Design School, Loughborough University, Leicestershire, LE11 3TU
j.a.spencer@lboro.ac.uk
+44 (0)7958594260

What is the purpose of the study?
The study is being carried out to compare the differences in laundry practices in different parts of the world. The main aim of the study is to look at everyday household habits and product interactions from middle-income consumers, to aid in the design of new products that are more suitable for consumers.

Who is doing this research and why?
The study is being carried out as part of a research project at the Loughborough Design School in the UK. The main investigator in the project is Jak Spencer under the supervision of Debra Lilley. The research is being carried out as part of a doctoral thesis into household behaviours.

Once I take part, can I change my mind?
After you have read this information and asked any questions you may have I will ask you to complete an Informed Consent Form, however if at any time, before, during or after the sessions you wish to withdraw from the study please let me know. You can withdraw at any time, for any reason and you will not be asked to explain your reasons for withdrawing.

What is involved?
The study will involve discussing and demonstrating your laundry habits. You will be asked various questions regarding the clothes washing cycle. With your permission, we would like to record these questions and demonstrations on audio recorders and by taking pictures and video. Your voice will not be presented to anyone else or used in documents; it is purely an aid to help with analysing the data. The images may be used in further documentation; however all identifying features will be removed. The study is being taken during one laundry cycle. It is not expected to last for more than 2 hours. You may also be asked to record your laundry cycles over the course of a week, again this data will be kept in strict confidence.

Will my taking part in this study be kept confidential?
The data used will be kept strictly confidential at all times – and no names or personal information will be used. Only data relating to the laundry process will be collected. The audio files and any paperwork will be kept in a secure cabinet in a locked room at Loughborough University and destroyed, once analysed (in approximately 6 months).

What will happen to the results of the study?
The results from the study will help to compare laundry habits in different regions of the world. This will ultimately culminate in writing a thesis and subsequent papers on the subject, however data from the study will be coded so that participants are not identifiable in any publications.
Appendix E: Consent Form

Household study on laundry practices

INFORMED CONSENT FORM

(to be completed after Participant Information Sheet has been read)

The purpose and details of this study have been explained to me. I understand that this study is designed to further scientific knowledge and that all procedures have been approved by the Loughborough University Ethical Advisory Committee.

I have read and understood the information sheet and this consent form.

I have had an opportunity to ask questions about my participation.

I understand that I am under no obligation to take part in the study.

I understand that I have the right to withdraw from this study at any stage for any reason, and that I will not be required to explain my reasons for withdrawing.

I understand that the information I provide will be anonymous and confidential. I agree to photos being used for research purposes (e.g. written reports) and understand that no personally identifiable features (e.g. anything with your name and address on it) will be included in these images.

I agree to the processing of my personal information for the purposes explained to me. I understand that this information will be treated in accordance with the terms of the Data Protection Act 1998.

I agree to participate in the study, as outlined in the Information Sheet.

Your name
__________________________________________

Your signature
__________________________________________

Signature of investigator
__________________________________________

Date
__________________________________________
Appendix F: Design Competition Resources

Design for sustainable behaviour information provided to participants
Above: Cultural factors explained to participants. Below: Guidelines presented to participants

GUIDELINE 1)
Understand the flow of the procedure from start to finish. Understand the various 'touch points' in the system.
How does laundry make its way around the house? Who, what, where and when?

EXPLANATION:
The figure to the right shows the simplified journey of clothing for one year around a typical home in the UK. The journey is simplified as, in reality, individual users will have very different routines. Dirty clothes may be left on the floor before making their way to the washing machine, whilst the drying stage may never happen if the user has a tumble dryer. Timescales are also erratic, as dirty clothes may be left in the bin for a number of days before being transferred to the washing machine, where they may remain for a day before being transferred to the clothes dryer where they may stay for several days – in some cases never making it back to the wardrobe.

EXAMPLE:
In Brazil, most apartments have an "area do serviço" (service area) specifically for the laundry where clothes are washed & dried (and ironed if needed). The journey of the laundry takes a simplified route.
GUIDELINE 2)
Integrate the design of the procedure with the design of the spaces where the procedure occurs. Can the process be linked with other processes? Can there be a better use of space?

EXAMPLE:
The photo above is of a roof terrace in India. The water tank is on top of the shed on the left of the picture. The washing machine is in the shed and the clothes are put to dry on a line leading from the building. Everything is located in a convenient place without the process simplified to one location. In some of the houses, the water water from the washing machine is stored and filtered down through the house (using gravity) to other appliances such as toilets, before being drained into the garden to water the plants.

GUIDELINE 3)
Adapt the use to suit the needs of the user.
Is the user a 'time related' washer or a 'sense related' washer? What washing setting do they use?

EXPLANATION:
Product interactions involve some form of users changing the use to better suit their needs, however can we understand the user more to design products that better suit their needs without bombarding them with irrelevant information.

We identified users who chose their washing program solely on the amount of time it took to complete the cycle, whilst other users chose the program based on their sensory perception (how it smell and felt). Understanding the users and their interactions, in detail is key to designing a suitable solution.
GUIDELINE 4)
Give the user control to influence the resource use of a process.
Is the user in control of the amount of energy and water used? Can the user add garments halfway through the wash? Can they choose the exact setting they desire?

EXAMPLE:
It was noted in Brazil that despite aspiring to own horizontal load washing machines, most participants still owned vertical loading washing machines because of the control benefits they offered. Users could control the amount of water used in the machine and could also to some extent control the cycle - being able to add garments that they had forgotten halfway through a cycle.

GUIDELINE 5)
Create a new emotional attachment between the user and the process.
Does the user enjoy the process? What would make them enjoy it more?

EXPLANATION:
Laundry will always be a chore and it is unlikely anyone will particularly enjoy doing it, however is it possible to create more positive connotations when doing the laundry?

Continue to Guideline 6 >>
GUIDELINE 6)
Let the user know and understand the various resource inputs and outputs of the process. Can the user see the various inputs/outputs? Make them aware of the resource use.

EXAMPLE:
The picture shows a typical laundry room in Brazil. Under the pile of clothes on the right of the picture is the washing machine. The machine is attached to the tap and to fill the machine with water the user must turn the tap on and then turn it off again when the machine is filled to the desired level. The waste water is then also emptied into the sink via the hose that is hooked over the sink.

EXPLANATION:
Make the resource inputs and outputs visible or tangible to the user. In this example, not only does the user have to physically turn the tap on to fill the machine with water - they also have to gauge when to turn it off by seeing how full the machine is. In this way they are connected with the resource input. They can also see the amount of water used via the waste water pipe, whilst also getting an idea that the process is working as they see clean water going in and dirty water going out. A similar example where this philosophy of seeing the waste has worked well is in the Dyson vacuum cleaner.

GUIDELINE 7)
Be clear about the operation of the process. Give the correct and relevant information at the right time, in the right place. Is there a clear indication of how much detergent or water to put in? Are the settings understandable?

EXAMPLE:
A common problem was the confusion over where and how much detergent to put in. Users were often unsure if the levels indicated were for powder or liquid detergent or which compartment to put it in.

Go back to the resources >>
Example of a Solutions Board

The Laundry Spring

- Friendly and more environmentally effective, less time consuming
- Making washing more sustainable, less water and energy required

- Machine operation: when to do laundry to get maximum washing efficiency and how to wash multiple loads efficiently

- Overwashing a machine can mean more clothes are not cleaned properly, more environmentally impacted, time and energy for user.

- Undertaking a machine fewer times reduces costs and expenditure

- So when should users do the laundry?

- Using less detergent and other cleaning materials

- With good reduction in the number of clothes, waste, and water

- One of the ways to make the laundry process more sustainable is to minimise the number of cycles.
Example of participant reflection on their design:

**Explain your design:**

A laundry basket concept, designed to optimise the laundry process. The product shows users exactly when they have a complete load for laundry and therefore promotes using the washing machine only when needed.

**Which guidelines did you use?**

Understanding and optimising the flow procedure of the laundry process - by attempting to minimise the time and effort individuals have to spend on the laundry process, whilst being more environmentally friendly.

Providing the user with more optimum information, by showing them the exact quantity of clothing that makes their washing process most efficient.

Developing an emotional attachment, by using a visually stimulating design that physically indicates that an optimum load size has been reached.

**Did the guidelines help?**

Although I was not able to apply all the principles in my designs, I feel they were very interesting starting points from which to consider the problem posed.