FACULTY OF SOCIAL SCIENCE AND HUMANITIES

DEPARTMENT OF DESIGN AND TECHNOLOGY

DESIGNING FOR BEHAVIOURAL CHANGE: REDUCING THE SOCIAL IMPACTS OF PRODUCT USE THROUGH DESIGN

By

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

ABSTRACT

This thesis investigates the feasibility of applying design-led approaches to influence user behaviour to reduce the negative social impacts of products during use.

A review of the literature revealed a distinct lack of design-led research in this area. Three promising approaches from other disciplines, however, were found; eco-feedback, behaviour steering and intelligence. The majority of product examples identified did not use a singular approach, but combined two or more approaches. Most of the examples were concepts and focused on the end result. Few commented on the research and development processes undertaken to generate the final design. These limitations reinforced the need for case studies detailing these processes.

To this end, two design studies were carried out; a preliminary study using a range of products and a further, more in-depth study on the use of mobile phones. The results of these studies led to the development of a framework of attributes for 'behaviour changing' devices. In response to these findings, two design resources were developed; a detailed design project to reduce the social impacts of mobile phone use in public and a short film on texting whilst on the move. Evaluation by design professionals provided analysis of the effectiveness of these resources and wider reflections on designer's perceived responsibilities for use and the ethics of designing for behavioural change.

Collectively, the findings indicated that resources for designing behavioural change should; be explorative not prescriptive, focus on problem solving, be tailored to meet the needs of the intended recipient and ideally be applied in the early 'ideation' stages of the design process. Additionally, the findings indicated that designer's involvement in, and responsibility for, lifecycle impacts must be extended beyond point-of-purchase. Designers, however, are reportedly often unable to influence product development at a strategic level. Prior work, therefore, is needed to engage those at a senior level. Furthermore, the findings strongly indicate that 'behaviour changing' devices must be prototyped and subjected to rigorous consumer testing not only to establish their effectiveness but also to determine their acceptability.

ACKNOWLEDGEMENTS

I'd like to give thanks to the following people for their support, guidance, interest and encouragement throughout the duration of my PhD;

My supervisors Tracy and Vicky, my Director of Research Mark Evans, my examiners Sam Porter and Martin Woolley, my family, particularly Esther who never failed to chase away my moments of panic. All the design professionals who gave their time, opinions and expertise, particular thanks go to Closed Door Films, Miles Park, The Sustainable Design Network and Garrath Wilson for their excellent creative input and finally, most importantly, I'd like to thank Seymour, whose love, support and encouragement gave me the strength to carry on when it all seemed hopeless. I couldn't have done it without you.

LIST OF PUBLICATIONS

Lilley. D, Lofthouse. V A, and Bhamra. T (2005) 'Investigating Product Driven Sustainable Use' in: Sustainable Innovation 05, Global 'state of the art' in sustainable product/service development and design, 10th International Conference, 24th – 25th October 2005. Farnham Castle International Briefing and Conference Centre, UK, pp. 191-199.

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1 INTRODUCTION

1.1 Background to the Research

Sustainable Development or *Sustainability* (the terms are largely interchangeable) is dependent on achieving economic growth, whilst simultaneously protecting the environment and meeting the overall needs of society. These interrelated domains are often referred to as the three pillars or triple bottom line of sustainability (Elkington, 1997). The model shown in Figure 1.1, adapted from McLaren et al (1997) illustrates these domains and their interrelations using three overlapping circles.

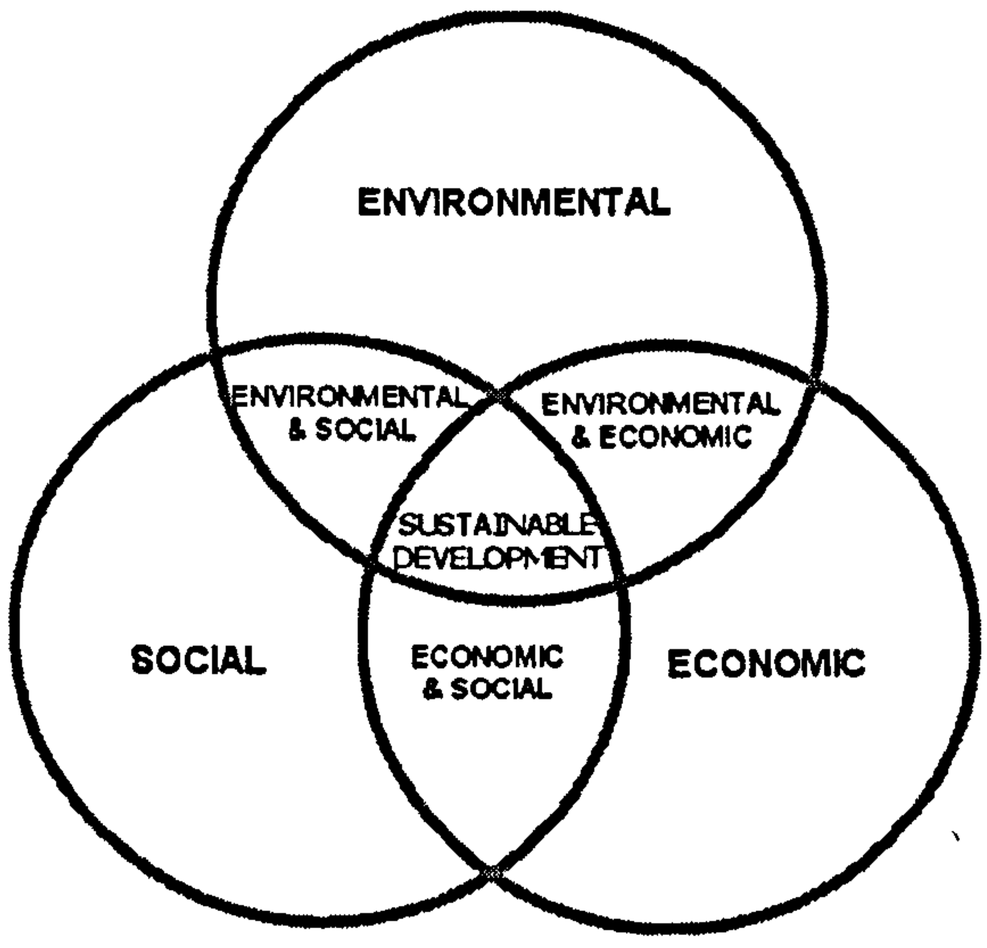


Figure 1.1: Triple Bottom Line Model, adapted from: (McLaren et al., 1997)

The broad and interrelated agenda of sustainable development or sustainability, though clearly evident in the definitions presented, was not reflected in the early discourse of the 80's to mid 90's which was largely dominated by environmental concerns. Although debate widened to encompass economic issues in the mid to late 90's, it was not until the late 90's that societal concerns, which had historically been so marginal in sustainability debate and practice, began to gain prominence within academic research (Zadec, 1999). Subsequently, literature exploring and defining social sustainability is somewhat limited, *"no consensus seems to exist on what criteria and perspectives should be adopted in defining social sustainability"* and those definitions proposed have been derived according to discipline-specific criteria (Colantonio, 2007, p. 4). A cross-section of literature from different disciplines revealed that social sustainability has been linked to notions of governance, corporate social responsibility, personal responsibility, equitable distribution of social capital, meeting basic needs, quality of

life, health, well-being and happiness, democratic participation, trusting, harmonious and cooperative behaviour and preserving social and cultural dynamism (Baines and Morgan, 2004, Polese and Stren, 2000, Sinner et al., 2004, Colantonio, 2007, Blofeld et al., 2002).

Within the design community, the progression from consideration of a single, often environmental, issue in isolation towards a greater awareness of the interconnected nature of sustainability was marked by the transition from *"Green Design"* to *"Eco Design"* towards *"Sustainable Design"* (Bhamra and Lofthouse, 2007). Research indicates that decisions made during design can influence up to 80% of environmental impacts over the life cycle of the product (Graedel and Allenby, 1995). *Sustainable Design* takes into account the economic, social and environmental impacts enacted throughout the product lifecycle from design to manufacture through distribution, sales, use and disposal. Activities in the field of sustainable design to date have historically focused on reducing the *environmental* impacts of manufacturing and disposal. In the research community, although agendas are beginning to shift from issues of production to those of consumption (Hertwich, 2005, Richardson et al., 2005), sustainable consumption research tends to focus largely on purchasing behaviours and not use. It is only fairly recently, through the introduction of the Ecodesign for Energy using Products (EuP) legislation that the impacts of use, which, in the context of the EuP legislation are largely referred to as environmental concerns, have been considered within the manufacturers remit. The social impacts of product use, however, appear to have been largely overlooked by designers (Hertwich, 2003) beyond concerns regarding the ethical sourcing of materials, fair-trade, liability and safety.

The legislative focus on improving energy efficiency and combating climate change through instigating a reduction in greenhouse gases is well placed. Research shows that the most significant environmental impact of most electronic products occurs during use and is largely determined by consumer behaviour (Rodriguez and Boks, 2005, Fletcher et al., 2001, Environmental Change Unit, 1997). NGO and government led information campaigns have, due to the limitations outlined in Chapter 2, not led to sustained behavioural change (Arroyo et al., 2005, Darby, 2001, Barr, 2003). Indeed, in spite of a decade of adverts reminding them to adopt more environmentally conscious behaviours consumers are using more energy than ever (Siegle, 2006). Government is increasingly viewing design as a vehicle to influence consumer actions (HM Government, 2005). Manufacturers of electrical appliances have taken positive steps towards reducing energy use through technological interventions to improve efficiency

and reduce CO^2 emissions. As discussed in Chapter 2, however, the success of technological interventions is often dependent on consumer compliance and increased consumption of goods and services often overrides benefits derived from eco-efficiency initiatives (Chalkley et al., 2001, ESRC Global Environmental Change Programme, 2000). The limitations of information campaigns and technological interventions in achieving sustained behavioural change to reduce the impacts of use, outlined in Chapter 2, prompted the exploration of a new field of enquiry.

'Design for behavioural change' is the collective term applied in this thesis to describe a new field of enquiry exploring how design could influence user behaviour to reduce the negative social and environmental impacts of products during use.

Although design-led research into behavioural change is a growing area of concern, (Park, 2006, Rodriguez and Boks, 2005, Arroyo et al., 2005, Design Council, 2006, Lockton, 2005) research to date has predominately focused on tackling environmental impacts associated with the use of electrical white goods such as energy and water consumption. Few researchers have explored how design could reduce negative social impacts caused by product use and subsequently many of the examples of design for behaviour change described in Chapter 2 of this thesis focus predominately on addressing environmental impacts. It is possible from these examples, however, to draw out design attributes and techniques to inform the development of behaviour changing devices to address societal problems.

At this point, it may be helpful to attempt to define what is meant by negative social impacts of product use within the context of this thesis. As discussed, little prior research exists in this field the following working definition, therefore, has been derived by drawing on the defining attributes of social sustainability described in section 1.1. For the purposes of this research a ***negative social impact of use*** is defined as:

Any action enacted or facilitated by the product or resulting from the behaviour of the user in the use of the product which diminishes the health, wellbeing, social equity or quality of life of others affected by the use of the product.

This working definition will undoubtedly be subject to debate by members of the research and design communities who may view societal impacts of product use in entirely different terms. However, for the purposes of this research it provides a useful

point of reference and serves to clarify the intention and parameters of the Investigation which follows.

1.2 Aim and Objectives

The aim of this research is to address the limitations of prior research by investigating the feasibility of applying design-led approaches to influence user behaviour to reduce the negative *social* impacts of products during use.

The overall research aim will be achieved through the completion of five objectives:

1. To link theory and practice identified in existing literature from diverse disciplinary fields to build knowledge in design for behavioural change.
2. To identify and evaluate existing design-led interventions which attempt to moderate user behaviour towards a reduction in social and environmental impacts of products during use.
3. To devise and run workshop activities which explore designers approach towards designing for behavioural change.
4. To use a product specific case study to explore how design could influence user behaviour to reduce the social impacts of use through;
    a. Exploring literature and gathering user perceptions of perceived social impacts resulting from the use of mobile phones in public, to build an awareness of the issues involved,
    b. Investigating how designers respond to these issues,
    c. Evaluating the perceived effectiveness of applying design-led interventions to change user behaviour.
    d. Generating design case studies exploring how design for behavioural change could reduce social impacts of mobile phone use in public and documentary evidence of the design process for subsequent analysis.
5. To develop and test resources to assist designers in implementing design for behavioural change approaches in their work.

1.3 Thesis Structure

This thesis is comprised of a further seven chapters;

Chapter 2 draws together literature from diverse disciplinary fields to build knowledge in 'design for behavioural change'. It introduces sustainable consumption within the context of consumption theory and outlines the enablers of, and barriers to, the adoption of more sustainable practices. Theories which inform and support design for behavioural change are introduced and three key approaches for design practice are described and illustrated with product design examples. The chapter concludes with an analysis of existing design case studies and a discussion of the issues identified regarding the application of behaviour change approaches in design practice.

Chapter 3 outlines the overarching strategy for conducting the research. It discusses the application of grounded theory in qualitative and exploratory research studies to develop theoretical ideas (concepts, models and formal theories) in design for behavioural change; it discusses how to establish the validity and reliability of data collected and explains why mainstream designers were chosen as the subjects for the studies.

Chapter 4 introduces the Design I Behaviour workshop and discusses the findings of 'Designing Behaviour' and 'Provocations', two of the activities carried out by participants. The aim of this preliminary design study was to investigate how designers tackle designing for behavioural change, using a range of product types, and their perceptions of using behaviour influencing techniques to reduce the impacts of use. The methodology and results of the workshop activities are presented and placed within the context of relevant findings from the literature review.

Chapter 5 presents the methodology and findings of two preliminary user studies and the main user study exploring perceptions of mobile phone use in public.

Chapter 6 investigates the methods employed to reduce *social impacts* of mobile phone use in *public space* and explores how mobile phones could be designed to moderate consumer behaviour. It presents existing design concepts from the literature and reports on the findings of the main design study carried out by Industrial Design MSc students at Loughborough University. The outcomes of this design study are

discussed and the chapter concludes by providing an outline of factors to explore in a more detailed design project.

Chapter 7 describes the development of two design resources in response to previous findings; a collaborative design project aiming to reduce the social impact of mobile phone use in public and a short film on texting whilst on the move. The results of the evaluation of these resources by design professionals are discussed and conclusions drawn in relation to the responsibility for and ethics of implementing strategies to influence behaviour and the effectiveness and suitability of the resources developed in informing design practice.

Chapter 8 discusses two broad concerns emerging from this research; the ethical acceptability and viability of design for behavioural change and the enablers of, and barriers to, the application of design for behavioural change approaches in industrial design practice and their acceptance by consumers.

Finally, **Chapter 9** brings together the overall findings of the PhD. It describes how the aim and objectives were achieved, presents overall conclusions, explores the limitations of the outcomes and demonstrates the wider applicability of the results of this investigation. The contribution of this research in forming new knowledge is outlined and suggestions for further work given.

2 LITERATURE REVIEW

2.1 Introduction

This chapter brings together theory and practice identified in diverse disciplinary fields together to build knowledge in "design for behavioural change". Sustainable consumption is introduced within the context of consumption theory and the enablers of and barriers to the adoption of more sustainable practices are discussed.

Theories which inform and support design for behavioural change are introduced and three key approaches for design practice are described and illustrated with product design examples. The chapter concludes with an analysis of existing product case studies and a discussion of the issues identified regarding the application of behavioural change approaches in design practice.

2.1.1 Research Questions

The following research questions were devised to guide the literature review;

1. How is consumer behaviour currently moderated and by whom? Are these methods effective?
2. What are the barriers to, and enablers for, the adoption of more sustainable practices?
3. Can products be designed to change user attitudes and behaviours?
4. Could products limit socially or environmentally undesirable actions and direct user behaviour towards more sustainable practices?
5. What are the implications of adopting this approach?

2.1.2 Scope & Direction

The lack of design research focusing specifically on this area of research, coupled with the interdisciplinary nature of the enquiry prompted the need for a broad literature search to find relevant information, Figure 2.1.

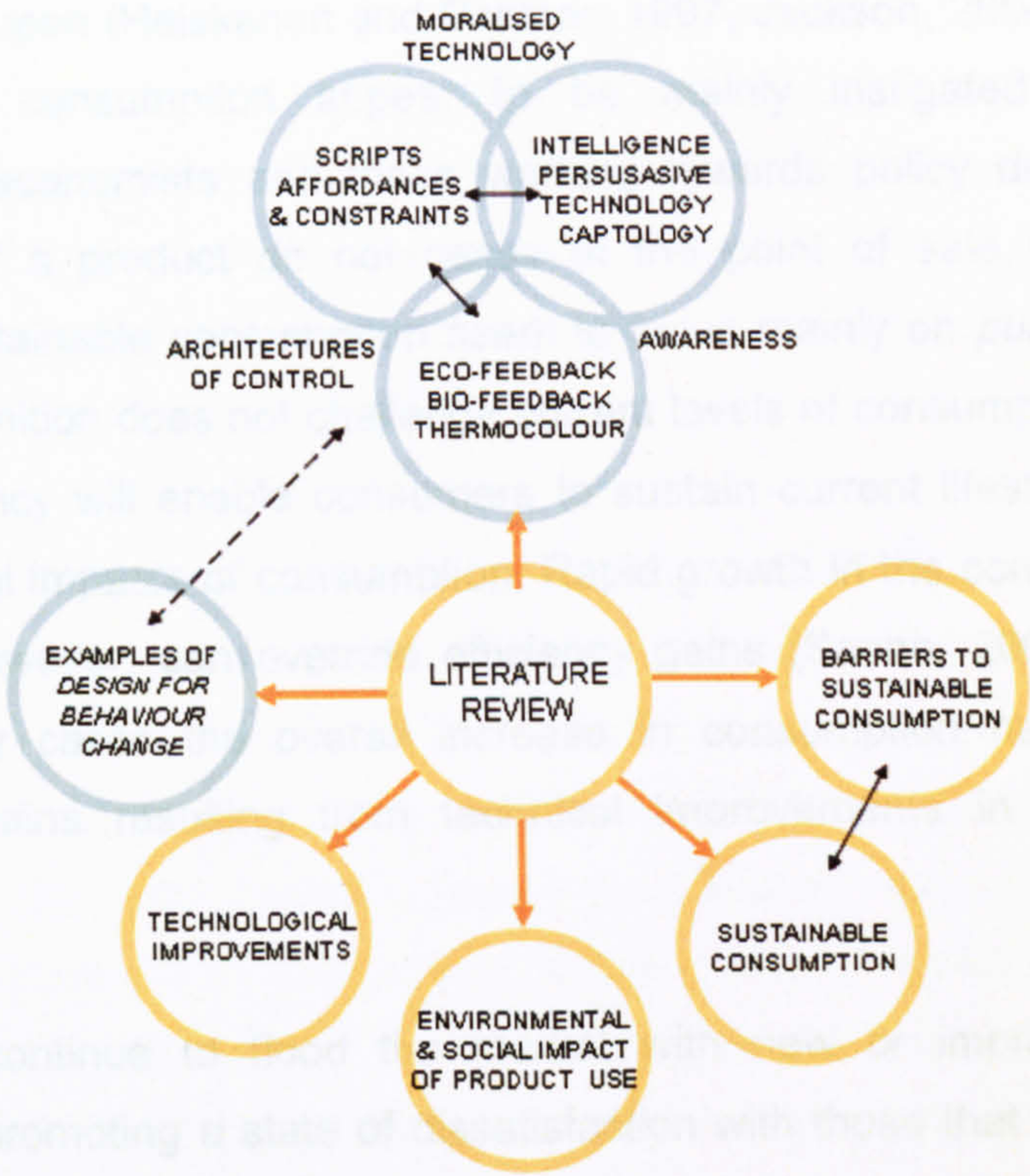


Figure 2.1 Scope of Literature Review

As shown in Figure 2.1 references were drawn from a range of other disciplines asking similar questions. By viewing these different research areas collectively, links between previously unconnected ideas and theories for application in a design context were identified.

2.1.3 Sustainable Consumption

It is now widely accepted that current human activities degrade the environment and cause serious negative consequences for human populations (World Commission on Environment and Development, 1987). Identifying ways of moving towards more *sustainable* consumption patterns is a key policy issue for the UK government (DEFRA, 2005). Continued consumption however is often seen as vital in ensuring economic progress, a key measure of success (Sanne, 2002). Sustainable consumption must, therefore, be balanced against sustained economic growth. *"Sustainable consumption is not about consuming less, it is about consuming differently, consuming efficiently"* (UNEP, 2003a). The extent to which consumers need to change their behaviour is a point of contention.

A clear definition of sustainable consumption and how it should be implemented has yet to be agreed upon (Heiskanen and Pantzar, 1997, Jackson, 2004a). Investigations into sustainable consumption appear to be mainly instigated by sociologists, anthropologists, economists and those working towards policy development. The consequences of a product do not cease at the point of sale (Gowri, 2004) yet definitions of sustainable consumption seem to focus mainly on *purchase* rather than *use*. UNEP's definition does not challenge current levels of consumption; it implies that increased efficiency will enable consumers to sustain current lifestyles whilst limiting the environmental impacts of consumption. Rapid growth in the consumption of goods and services, however, can override efficiency gains (Sanne, 2002, Robins, 1999). Indeed, in many cases the overall increase in consumption has outweighed the environmental gains resulting from technical improvements in product efficiency (Cooper, 1998).

Manufacturers continue to flood the market with new or improved goods whilst simultaneously promoting a state of dissatisfaction with those that consumers already own (Irvine, 1991). Users have become distanced from the realities of how products and services are produced. The shift in manufacturing to East and South East Asia has resulted in a proliferation of cheap mass produced goods which often do not reflect the environmental or social costs of their production. These items, particularly small electronic appliances, have relatively short life spans and, due to *forced* or *psychological* obsolescence, a high turnover (Cooper, 2004). This, coupled with the rise in instantaneous purchase facilitated by credit, has arguably decreased the emotional value of material goods (Walker, 2002).

2.1.4 What Drives User Behaviour?

User behaviour and its resulting impacts are influenced by a number of different factors. To understand how to change behaviour we must first examine the internal and external influences which drive consumption activities.

Early efforts to classify and understand consumer behaviour typically relied on the *Rational Choice* or *Utilitarian Economic Model*, based in conventional economic theory (Shove, 2003). This model suggests that consumers are driven to consume by a desire to maximise utility (Jackson, 2004a). It implicitly assumes that consumer behaviour is rational, consistent, driven by individual choice and informed by careful analysis of the

costs and benefits afforded. The consumption of *mundane commodities* such as electricity, water and basic grocery items is largely driven by the need to satisfy utility. Mundane commodities are not prestigious or meaningful (Shove and Warde, 1998); their consumption, therefore, warrants little consideration by consumers (Jackson, 2004b, Warde, 2002). The drivers behind the consumption of other goods and services however are more complex than simply satisfying basic, utilitarian needs (Jackson, 2004a).

Consumption practices can also be shaped by how individuals perceive themselves and how they wish to be perceived by others. Consumers use products to construct and maintain a chosen self-identify (Shove and Warde, 1998) and to signal lifestyle, social status, wealth and values to others. The way in which products are used or worn by individuals can also indicate personal attitudes and values. Sometimes manufacturers' values are at odds with consumers. Doctor Martin boots, for example, are manufactured using durable materials designed to resist wear and withstand prolonged use. Yet the durability of these boots is often deliberately diminished by consumers who accelerate the deterioration of the material finish by scuffing, scratching and painting their boots to create a *lived in* appearance. Jeans, an inherently durable item, are also subject to individualisation "*purchased like blank canvases, jeans are worked on, sculpted and personified over time*" (Chapman, 2005, p. 116). It is interesting that in this case value is attributed to the object by degrading its appearance.

Historically, the masses looked to the elite for inspiration in terms of consumption trends, nowadays the migration of trends extends upstream from minority groups to the mainstream and elite (Shove and Warde, 1998). The journey from marginal to mainstream fashion however, is no longer an organic evolution. It is a process stage managed by corporations (Gladwell, 1997, Klein, 2001) who often *appropriate* trends originated in minority cultures to create *pre-styled* items. In many ways, brands try to convince us we are all individuals whilst simultaneously encouraging us to follow predetermined fashions and trends. The desire on the part of consumers to individualise items, having been recognised, is now commercialised. The K-Swiss Stripe Shifter, for example, features five stripes, changeable in colour and height, which can be arranged in different configurations to communicate personalised messages to others (Van Hout, 2006). Products are marketed to appeal to the mass consumer on a psychological level by projecting or embodying lifestyles they aspire to be identified

with (Gordon, 2002). Ironically, once trends become mainstreamed they often lose their meaning for the original instigators.

Products do not only fulfil functional needs, they are also symbolically significant. The links between products or artefacts and ritualised practice (Walker, 1997, Van Hinte, 1997) illustrates the symbolic worth of items regardless of their monetary value. Mass-produced plastic Rosary beads, for example, are no less valued by the user than those made from ivory (Walker, 1997). Equally, emotional value may be assigned to an item lacking in monetary worth, if it holds sentimental value. These items, which may be souvenirs, gifts or collectables preserve a memory or emotional connection in a tangible form (Koskijoki, 1997) and as such are cherished, kept and repaired.

Social norms play an important role in establishing, maintaining and reinforcing behaviours (Cialdini, 2007, Sustainable Consumption Roundtable, 2006a). Social pressure to conform to social norms, either externally applied or individually felt, therefore could be used to drive pro-environmental behaviour (Barr, 2003). Personal norms, informed by an individual sense of moral obligation, can also be a powerful driver (Minton and Rose, 1997). The correlation between what is being asked of an individual and what they have already said, done or committed to can inform their willingness to change (Cialdini, 2007). However, information which challenges existing values or beliefs may be less likely to be accepted, when it is judged alongside competing values (Dembkowski and Hanmer-Lloyd, 1994).

Existing practices can hinder the adoption of new environmental behaviours (Linscheidt, 1999). Tackling routinised practices is challenging because ingrained, unconscious actions are less accessible and therefore harder for external parties to influence (Jackson, 2004b). The literature recommends that two factors be considered when encouraging consumers to break old habits and adopt new practices; convenience and repetition (Energy Saving Trust, 2006, Jackson, 2004b). The new pattern of behaviour needs to be easy to follow, regular reinforcement must be provided and to be successful, the intervention must become part of the social norm (Sustainable Consumption Roundtable, 2006a, Cialdini, 2007). Kerbside recycling, for example, is an institutionalised practice. It is collected on specified days at regular intervals and all the facilities are provided making it easy to take part (Barr, 2003). It is also a conspicuous activity, where individuals who do not comply by taking part are often judged by others (ibid).

2.1.5 Barriers to Sustainable Consumption Practices

Having examined some of the motivators for behaviour, it is important to identify what factors may prevent more sustainable practices taking place. Analysis of the literature revealed several internal and external influences which might be acting as barriers to behavioural change.

2.1.5.1 Hidden Effects of Consumption

Consumers have become increasingly dependent on products to fulfil tasks, less emotionally invested in the product and more responsive to the commodity or service it affords (Verbeek and Kockelkoren, 1997, Linscheidt, 1999, Taylor et al., 1999). However, consumers spend little time considering how the commodity is provided. Take electricity, for example; the majority of household goods are reliant on communal resources such as water, electricity and gas. Increasing energy prices, potential supply problems, legislative pressures and an increase in the use of small electrical goods, all indicate the need to significantly reduce energy consumption. Yet despite current efforts, UK domestic energy use continues to rise. Electricity is, for the most part, invisible to consumers. They *"readily accept new objects that are powered by electricity, yet rarely contemplate where the power is coming from"* (Van Hoff, 2003). The invisible nature of resources like energy and water has arguably contributed to consumers' lack of conscious reflection on their use.

2.1.5.2 "Missing Link" between Action and Effect?

Heiskanen and Pantzar reported in 1997 that due to consumers limited knowledge of the links between consumption practices and their impacts, few were actively altering their behaviour (Heiskanen and Pantzar, 1997). Ten years on this situation has not changed greatly. A 2003 report by the National Consumer Council found that although *"consumers say they know how to behave sustainably"* they reportedly *"have low awareness of the effect of their daily lives on the environment"* (Holdsworth, 2003, p1). To encourage consumers to actively change their behaviour, the causal link between behaviour and positive or negative environmental or social consequences must be reinforced (Darby, 2001, van de Velden, 2003b).

Investigative journalists and NGO or grassroots campaigners have repeatedly exposed the environmental and social costs of production and consumption of goods. However, although consumers *are* worried about the effects of increased consumption their concern does not always translate into action (Charter et al., 2002, ESRC Global Environmental Change Programme, 2000). Despite several high profile campaigns highlighting the welfare of those employed to manufacture goods for western consumption, and the introduction of Fair-Trade labelling schemes, few consumers consider the *"people whose labour is embodied in commodities"* (Warde, 2002, p. 20) at the point of purchase (Strong, 1997). Similarly, despite several campaigns imploring consumers to reduce energy usage in the home *"few actually link the importance of energy saving to their own personal behaviour"* (Darby, 2001).

2.1.5.3 Competing Values

As discussed above, personal and social norms coupled with a sense of duty or moral obligation can be powerful drivers for behaviour (Minton and Rose, 1997). Previous personal commitments or existing values and beliefs can inform the users willingness to change (Cialdini, 2007), prescribed actions therefore may be less likely to be adopted if they challenge existing values or beliefs (Dembkowski and Hanmer-Lloyd, 1994). An interesting theory posited by Edahiro suggests that it is not the drive for a better or more sustainable world that motivates people; it is the pursuit of personal happiness; *"people are willing to use their time and money to become happier more than to become a sustainable citizen"* (Edahiro, 2004). Therefore to *sell* sustainability into the mainstream, a *Trojan Horse* approach must be adopted, whereby sustainability values are concealed inside other more desirable attributes (ibid).

2.1.5.4 What Can I Do?

Inaction may in some cases be the result of diminished belief in the power of the individual to make a difference. This can often be due to the scale and complexity of global environmental problems (ESRC Global Environmental Change Programme, 2000). Gordon's (2002) research led to the development of a model illustrating two circles; an inner circle of influence relating to consumers immediate surroundings and an outer circle of concern in which global issues, such as global warming, are located. She asserts that although many consumers express concern about global issues, it is

in the inner circle where the majority feel most able to take action as they feel more empowered to tackle problems in their own community. Tackling local problems, she says, enables consumers to frame environmental issues in the context of their everyday life (Gordon, 2002). It has been suggested that to overcome consumers sense of powerlessness, initiatives should focus on areas in which people can make a noticeable difference (ESRC Global Environmental Change Programme, 2000). Holdsworth (2003) argues that in order to engage consumers, issues must be tangible and close to home. The literature also suggests that the provision of positive feedback can be beneficial in motivating consumers to continue practicing new behaviours (Scott, 2004).

2.1.5.5 I Will if You Will

To be effective, sustainability practices and values must be adopted by all. However, the desires of the individual are often not in the best interests of the majority. Despite the government position that sustainable consumption need not signify a reduction in the quality of lifestyle, acting in the best interests of the global community may require individuals to change some previously practiced behaviour. Evidence suggests that people are willing to change but feel unwilling to make sacrifices unless they know other people are acting as well (Sustainable Consumption Roundtable, 2006a, Jelsma, 1999). This applies not only to other consumers, but to businesses and government bodies as well, who, to earn consumers trust must been seen to be acting responsibly, otherwise many people will remain *"sceptical about whether government and business.....match their rhetoric about sustainability with action"* (ESRC Global Environmental Change Programme, 2000, p. 13). To act in isolation is often seen as futile; therefore interventions need to be based on collective actions (Sustainable Consumption Roundtable, 2006a). Those who enjoy a *free ride* by deferring responsibility for environmental protection to others further reduce the majorities inclination to act (Moisander, 1997).

2.1.5.6 Information – Scarcity or Overload?

Consumption activities require consumers draw on information from a range of often conflicting sources and sift through evidence to *"identify and understand the numerous environmental consequences – and the complex trade-offs and interrelations among*

these consequences" (Moisander, 1997, p. 2). Due to the complexity of information, and the raft of decisions consumers are required to take, even the most informed consumers can remain confused as to the best course of action when purchasing, using or disposing of items (Sustainable Consumption Roundtable, 2006a).

2.1.5.7 Context of Use – Are Consumers "Locked In"?

It is widely agreed that factors related to the physical environment and social context in which a product is used can facilitate or impede certain practices taking place (Jackson, 2004b, Sanne, 2002, Sustainable Consumption Roundtable, 2006a). Rapidly changing technology can also act as a barrier to the adoption or maintenance of environmentally and socially preferable actions.

Urban planning decisions can have a significant bearing on the ability of consumers, particularly those without cars, to access facilities. The rise in global super-retailers, often located in out of town retail parks, has changed the scale of consumption practices and made private ownership of a car unavoidable, thereby increasing the environmental load (Sanne, 2002). These stores have progressively succeeded in monopolising local trade by offering a huge range of goods, and increasingly services, at extremely low prices (Klein, 2001). Longer working hours, reduced leisure time and the rise in single occupancy households are all contributing factors in pushing consumers towards the convenience offered by *"one stop shops"*.

The suitability, reliability and accessibility of facilities and services provided can facilitate or impede sustained pro-environmental actions taking place. Insufficient information, inadequate or unequal access and incompatibility between different service provisions can contribute to reduced participation (Jackson, 2004b). Kerbside recycling schemes, when efficiently managed and consistently delivered, can increase household recycling rates. Yet in some cases the type of accommodation people live in can restrict their ability to recycle household waste (Nicholls, 2007). The expansion in single households has prompted the construction of several apartment complexes. The ability of residents of such developments to recycle their household waste can be impaired if communal recycling points are not provided, or if their residence is not included in the kerbside recycling scheme (ibid).

Rapid technological improvements, particularly in electronic products, have locked consumers into a cycle of having to constantly replace items. In order to protect revenue and enhance further sales, many manufacturers use "tying", which is the practice of making the sale of one product (the tying item) dependent on the conditional purchase of a connected product (the tied item) (Gilbert and Riordan, 2007, Leslie, 2004). The *"razor and blades business model"* largely attributed to Gillette is a good example of tying. In this model, the original product or *"master"* is sold at a subsidised price whereas the *"consumables"*, essential to the continued use of the master, are sold with a high profit margin. The company may make a loss on selling the razor but they recoup the revenue by making profit on the blades.

Advances in technology have led to forced obsolescence through the displacement of older operating technologies with newer ones; video to DVD, for example, and more recently analogue to digital TV. These changes are often industry-wide and as such leave consumers with little choice but to comply by replacing the product. In some cases replacing older machines with newer, more efficient ones can be beneficial in reducing energy consumption (Fletcher et al., 2001). It is reported that a ten-year-old fridge or freezer for example uses up to a third more energy than a newer A-rated model (Siegle, 2006). Parts for products rendered obsolete by the introduction of newer models however are increasingly difficult to locate leaving many consumers unable to maintain products which are still fit for purpose. Manipulating, repairing or upgrading functioning items is also problematic due to the trend towards smaller *black box* products which conceal their internal mechanisms (Blackler et al., 2003, Demirbilek and Sener, 2003). The cost of repairing items is often seen as prohibitive, especially seeing as buying a replacement item is often cheaper than having the original item repaired. In some cases however it is economically viable to reuse an existing item. The prohibitive cost of Original Equipment Manufacturer (OEM) consumables such as printer cartridges has prompted a proliferation of websites detailing simple procedures for refilling cartridges at home. This practice is actively discouraged by OEMs, some of whom have incorporated electronic chips or spoiler mechanisms into their ink or toner cartridges to inhibit users' ability to refill cartridges. In some HP cartridges for example the mechanism will automatically shut down the cartridge 30 months after installation (PC Plus, 2002). Some third party refill suppliers have, however, found methods of bypassing these chips.

A further consequence of technological advancement has been the increasing reliance of households on the *system* to provide electricity and water to power items (Sanne,

2002) which were previously operated by hand. Hand held whisks have been replaced by food processors and carpet sweepers superseded by vacuum cleaners, for example. Numerous functional tasks in the household are now completed not by hand but by mass produced, cheap electronic devices which are susceptible to power failure, breakage and obsolescence. These devices increase dependence on the system and fail to encourage users to reflect on the energy expended in completing the given task (Van Hoff, 2003).

2.1.6 Modifying Consumer Behaviour

In addition to consumers, two other key players arguably hold both responsibility for, and influence in, challenging unsustainable patterns of behaviour, the government and business. The relationship between these players can be seen in Figure 2.2 below, adapted from Sustainable Consumption Roundtable, 2006. The government, NGOs and businesses all employ different methods to reduce social and environmental impacts of consumption, these methods, particularly those related to use, are discussed below.

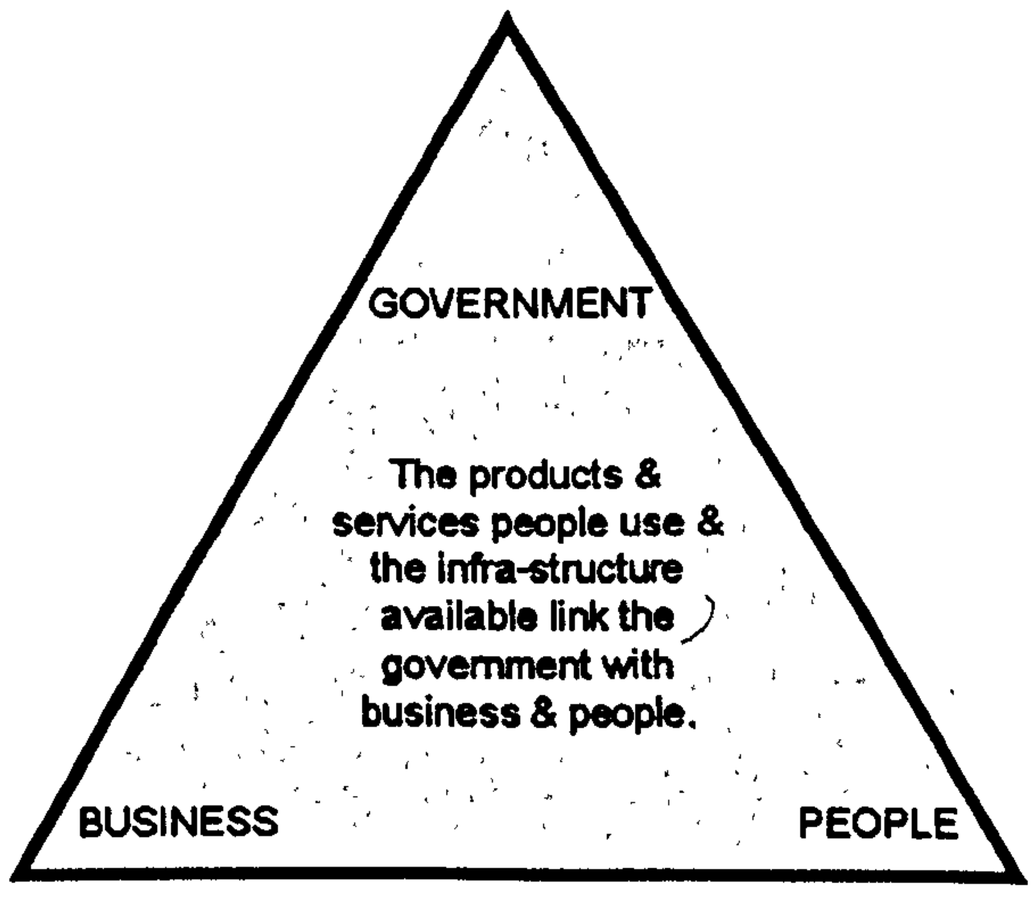


Figure 2.2: Triangle of Change

2.1.6.1 Government and NGO Intervention

The government regularly use a range of techniques to encourage the general public and companies to change their behaviour. Making consumers feel guilty about their lifestyles to effect a change in behaviour was a tactic favoured by many government

bodies and NGOs alike (Robins, 1999). Yet more recently, policy makers are beginning to realise that this approach achieves only limited success (UNEP, 2003a).

Penalties and incentives, so called carrots and sticks, are commonly applied as tools to persuade consumers and businesses to adopt different practices. The congestion charging system designed to curb excessive car use and cut pollution is a primary example of a fiscal penalty scheme (Transport for London, 2003). Grants for home insulation on the other hand illustrate an incentive based scheme. Evidence suggests that consumers respond more favourably to incentives to consume more sustainably over fiscal penalties to inhibit unsustainable practices (Holdsworth, 2003). It is widely felt that facilities enabling more sustainable practices should be provided before a financial penalty is introduced, i.e. increased public transport in congestion charge areas, for example (ibid).

As discussed previously, many consumers fail to realise the consequences of their behaviour and the cumulative effects of individual acts (Cooper, 1997). The government and selected NGOs have instigated several cause-related information campaigns which inform consumers of the consequences of their behaviour and prescribe simple actions users can take to reduce their impact by behaving differently (Shove, 2003). These informative campaigns often focus on large scale issues such as climate change, poverty or resource scarcity. Campaigns seeking to alert the public of increasing social and environmental problems can, however, result in the normalisation and legitimisation of damaging behaviours by implicitly saying *"everyone is doing this"* (Cialdini, 2007). Equally, when the media focus on a particular issue, such as excessive littering by referring to a disproportionate number of testimonies, this creates a myth that this behaviour is more normative than it is. On the other hand, communicating pro-environmental behaviour such as recycling as being normative and marginalising those who do not recycle can increase compliance without diminishing the severity of the problems caused by waste disposal (ibid).

Credibility, linked to knowledge and trustworthiness, is considered to be vital in influencing behavioural change (Cialdini, 2007) yet many consumers do not trust the government departments or businesses that are trying to persuade them to change (Sustainable Consumption Roundtable, 2006a, ESRC Global Environmental Change Programme, 2000). Due largely to the factors discussed above, it is widely suggested that the provision of information via educational campaigns does not necessarily result in sustained behavioural change (Darby, 2001). Although informative campaigns can

affect behaviour in the short term, unless actions prescribed by campaigns are convenient, supported by infrastructure and constantly reinforced, any changes in behaviour are often short-lived (Scott, 2004).

2.1.6.2 Technological Innovation

Technological innovation on the part of manufacturers has been beneficial in reducing the environmental impact of some domestic products during the use stage. However, the success of many of these innovations is dependent on customer compliance in using the features employed and selecting the optimised settings. The practice of clothes washing provides an interesting example;

The main impact of clothing, detergents and the washing machine itself is the energy expended during the use phase; 95% of the total environmental impact of a typical washing machine, for example, occurs when it is in use (Fletcher et al., 2001). The efficiency of the wash can be reduced by user practices such as using excessive detergent, washing at unnecessarily high temperatures and only partially loading the machine (ibid). Improvements in the quality and performance of detergents, advances in the design of fabrics and increased efficiency of washing machines mean that is no longer necessary to wash clothes at high temperatures (Hickman, 2007, Unilever, 2001). Newer washing machines designed specifically to wash clothes in cold water reportedly achieve comparable results those using warm water (Fletcher et al., 2001). Clothes are now specifically designed to be washed at lower temperatures (Hickman, 2007) and liquid detergents have been optimised to reduce consumption whilst achieving a satisfactory level of cleaning (Unilever, 2001).

In a recent study 44% of those surveyed admitted to regularly washing clothes at 60 degrees and only 3% considered this to be an important habit to break (Energy Saving Trust, 2006). It has been over 30 years since a new ingredient introduced to detergents enabled clothes to be washed at lower temperature without a loss of performance (Unilever, 2000). Yet some users evidently still opt for a 90 degree cycle for some loads (Hickman, 2007). The question is; why are consumers continuing to wash clothes at high temperatures in the face of evidence from manufacturers and informative campaigns urging them to reduce their energy impact? There are several interlinking factors informing behaviour, which can impede planned efficiency gains associated with improved technologies. One such causal factor revolves around perceptions of

cleanliness. Prior studies have indicated that although consumers reportedly rarely wash clothes to remove dirt, cotton items are often washed above 70° (Fletcher et al., 2001) with extra detergent added (Unilever, 2000) to ensure a *whiter than white* result. The realities of a hectic lifestyle, and the resulting time pressures, often override more environmentally considered behaviour. Washing is not always planned in advance; urgent impulsive washes, like school uniforms on a Sunday night, can necessitate a fast turnaround in the washing machine followed by an inefficient energy consuming spin in the tumble dryer. A 40° AA rated wash often results in a longer cycle and drying on the line is not always an option. Although the consumer may be aware that the course of action they are following is energy intensive and perhaps not the best option, environmentally speaking, other factors or indeed values, may override their concerns for the environment.

Technological innovations can be subject to "rebound effects". A rebound occurs when the unintended use of the product leads to unexpected and often negative environmental, economic or social consequences (van de Velden, 2003b). For example, the energy efficiency of a mobile phone charger with a reduced energy footprint is compromised if an uninformed user leaves the charger plugged in without the phone attached, as the charger continues to consume electricity.

2.2 Design for Behavioural Change

As discussed above, technological innovation and consumer education through NGO or government-led campaigns is not sufficient to reduce the impact of product use, a new approach is required.

Questions are beginning to emerge in social sciences, and to a lesser extent design, regarding the *morality of things* (Dant, 2006a, Molotch, 2003, Gowri, 2004). Concurrently, design theorists and practitioners are beginning to explore how consumer products could influence user behaviour towards a reduction in use impacts (Rodriguez and Boks, 2005, Rodriguez, 2004, Design Council, 2006). *"Design for behavioural change"* is the phrase used throughout this thesis to describe this new research area.

As discussed previously, the application of design for behavioural change approaches in product design is still an under-researched area. Manzini's research (Manzini and

Jégou, 2003, Manzini et al., 2004), and that of others (Hirschl et al., 2003, Fletcher et al., 2001), is concerned with the development of sustainable scenarios and service-based initiatives to promote behavioural change. On first reflection, this area of study may be considered relevant for this research. However research in product-service-systems focuses its efforts on the environmental and social benefits of service-based provisions, not on the design of individually owned products. Product-service-systems face the dual problems of changing consumer attitudes whilst competing with established personal and societal values (Rodriguez, 2004). Therefore, although this thesis acknowledges, and indeed supports, endeavours towards establishing workable service provisions to support sustainable use, the boundaries set for this investigation will not encompass the study of product-service-systems. Equally, although research in other complementary areas such as design for society (Whiteley, 1993), inclusive design (Jordan and Green, 1999) and emotional design (Norman, 2004) may, on first reflection, appear linked to this research enquiry. These disciplines seek to explore how products can be better designed to meet user's needs and enhance their experience during use. Their emphasis, therefore, is on the relationship between the product and the user not those affected by the behaviour of the user. For these reasons, product-service-systems, design for society, inclusive design and emotional design have not, been explicitly discussed in this literature review, their influence may, however, be present in some of the design concepts found in the literature and presented in this chapter.

The field of enquiry known as *Architectures of Control*, when applied in consumer product design is, however, very relevant for this thesis. Architectures of Control are features designed into products, software or physical environments which limit the scope of behaviours afforded to the user (Lockton, 2005). These are commonly integrated into software and computing design to prevent unauthorised editing of content and protect revenue. Ink cartridges, as discussed previously, serve as an example of where manufacturers build in architectures of control to increase revenue by rendering the cartridge unusable by specified date or preventing usable cartridges being refilled. Architectures of control have also been observed within the physical environment; park benches with central armrests designed to prevent individuals sleeping on them; seating in the form of angled *perches* in bus stops to signal a short-wait area; deliberately uncomfortable chairs in cafes to avoid lingering and traffic calming measures such as road humps can all be classified as architectures of control (Lockton, 2005). A further example is the use of blue lighting in public toilets to discourage drug use. Blue lighting makes it more difficult for drug users to inject

themselves as it obscures the veins. An unanticipated "rebound" which has impeded the success of this method of control in stopping drug use is users practice of marking their veins with magic markers before entering the toilets (Lockton, 2006).

Lockton's earlier research (2005) sought to locate architectures of control in consumer product design. This work was largely theoretical and did not include practical applications of the theories he identified. The examples cited were, for the most part, commercially available products which had been subjected to post-production analysis and the theory, justification and processes behind decisions made in the design of these products were not discussed in sufficient detail. Lockton's research, however, is ongoing and his future PhD research (set to begin in 2007) will explore design for behavioural change in greater detail.

2.2.1 Application of Theories in the Context of Product Design

Work carried out by researchers in other disciplines seeking answers to similar questions was drawn on to supplement the limited theoretical and practice-led research emerging from product design. The findings of this literature review led to the classification of three main theories which could be considered as possible approaches for designing behavioural change;

- *Feedback*; products or systems which inform users of their impact in an attempt to persuade them to modify their behaviour,

- *Behaviour steering*; those that influence user behaviour towards certain outcomes prescribed by the designer through the use of *scripts* or *prescriptions of use* embedded in the design.

- *Intelligence*; those that persuade, coerce or control user behaviour, sometimes automatically.

The following sections provide a theoretical background to each of these approaches and some examples of where they have been applied in products to reduce the environmental or social impacts of use.

2.2.1.1 Feedback

As previously discussed, to encourage behavioural change the causal link between action and effect must be reinforced. Feedback, grounded in Feedback Intervention Theory (Kluger and DeNisi, 1996), makes tangible the links between action and consequence through visual, aural or tactile means. Widely used as a safety measure, particularly in electronic household appliances and medical equipment, feedback can confirm an action has been performed correctly (Lockton, 2005). A standard feature of most food processors, for example, is a locking mechanism on the lid as shown in Figure 2.3, which clicks shut when properly fastened. The machine will not operate unless the lid is securely fixed. The feedback provided is aural, i.e. a click is produced; visual, the lid fits into the safety housing; and tactile, the sliding motion stops when the lid is safety fixed in place.

Figure 2.3: Food Processor Body & Lid featuring Safety Locking Mechanisms

Feedback has also been used as a means of ensuring optimal performance during use. The Thermocolour Iron depicted in Figure 2.4 below uses simple visual feedback to tell the user what temperature the iron is functioning at. The LED lights located in the water tank change colour automatically depending on the temperature of the soleplate to indicate that the iron is at the correct temperature for ironing different fabrics. This reduces the risk of users damaging fabrics whilst ironing (Russell Hobbs, 2006).

Figure 2.4: Russell Hobbs Thermocolour Iron (Russell Hobbs, 2006)

2.2.1.2 Bio-Feedback

Feedback has also been widely used in products designed to address physical and psychological disorders. *Bio-feedback* involves measuring physiological responses such as heart rate, skin temperature, sweating, blood pressure and muscle tension and conveying this information to the subject, in real-time, in order to raise awareness and conscious control of bodily functions. The use of biofeedback is thought to enable users to gain control over bodily actions formerly considered unresponsive to conscious effort (AAPB, 2007).

Res[t]piration, a floor standing lamp designed by Kooijman (2005) provides an example of how biofeedback works. Res[t]piration monitors the user's breathing via a silicon sensor incorporated in their pyjamas, then mimics this pattern in moving shadows projected on the wall and ceiling. By regulating and controlling their respiration the user can manipulate the visual image produced.

Figure 2.5: Res[t]piration (Kooijman, 2006)

2.2.1.3 Eco-Feedback

Prior research from a range of disciplines has illustrated the effectiveness of using visual, aural or tactile feedback to encourage behavioural change. *Eco-feedback* aims to link actions with environmental and social consequences by providing consumers with adequate information in an appropriate format to enable them to make more informed choices. There are several product examples, the majority of which address issues of energy and water consumption.

A range of prototypes developed as part of *Static!* (Interactive Institute, 2004) aimed to make resource use visible and raise users awareness of energy and water use in order to motivate conservation. The *Disappearing Pattern-Tiles* act as a subtle yet effective reminder of energy and water use. Decorated with heat-sensitive thermo-chromic ink, these highly patterned tiles communicate heat loss generated during prolonged showering visually by fading over time, the longer one showers the less decoration on the tiles. The *Power-Aware Cord* makes energy use visible rather than hiding it. The electrical current is expressed through the flow of electrical pulses and light intensity generated by the cord. This enables the user to visualise and reflect on the energy consumption of household devices.

The literature revealed several examples of showers designed to save water by providing feedback on water use and time spent in the shower (van de Velden, 2003a, Rodriguez, 2001, Coram, 2004). The theme of Coram's (2004) competition *Sustainable*

Bathing: the eco-shower was to save water in the shower whilst increasing comfort. The competition drew several interesting responses, some of which are described below;

- Rutokowski's *Water Flow Consciousness Shower* aims to raise user awareness by making water use more visible. Based on an hourglass shape, the design features a 40 litre container which is filled with the amount of water required for the shower. This container features a scale comparing the amount of water with flow time, helping the user to plan the efficient use of water.
- Bourette's design features a balloon filled with water which hangs inside the shower, the water is heated inside the balloon and when operated is dispersed, to create a shower. Heating water inside the balloon helps to reduce water being wasted while the user waits for it to heat and through the visual presence of the balloon the rate of water used is reinforced.
- Brewin's eco-shower *Sahara*, reduces water wasted while the user waits for it to heat by cycling it back to the heating unit via a hydro cyclone pump system. The user can pause the water flow until it reaches an adequate temperature and monitor the volume of water used per shower using an eco-feedback water meter.

The *Kambrook 'Axis' Kettle* used eco-feedback to reduce energy use and conserve water. Analysis of a previous Kambrook kettle revealed a high use impact particularly in terms of the energy used for heating and re-heating water. User centered research showed that a typical user often boiled the kettle, walked away to do something else, then re-boiled the kettle on their return (RMIT, 2003). These findings led the designers to include three new ways to reduce the kettles energy consumption. The jug cavity insulation was improved with a double wall to help retain heat and reduce the need to re-boil the kettle; the water gauge was relocated to the top of the jug to improve visibility and a temperature indicator was added so the user could judge if the water needed to be boiled again (Sweatman and Gertsakis, 1996).

To effectively link action and consequence, EU Legislation states that consumers must be provided with real-time information about their energy use (Darby, 2006). Energy statements detailing consumers' consumption patterns had historically been used as a method of persuading them to reduce their consumption. More recently "real-time smart energy monitors" are being considered as a viable technological "solution" to promote more energy efficient behaviour (Kinver, 2007). These devices typically make energy use more visible by providing instant feedback on how much energy is used in

the home. The functionality, aesthetics and user interface design of smart energy monitors has undoubtedly improved.

The *Wattson* i.e. *What Watts are On* designed by DIY Kyoto (2005) and shown in Figure 2.6 is a wireless energy monitor which aims to reduce energy consumption and costs by making consumers more aware of the energy used by household devices. It indicates total kilowatts consumed on a simple graphic display and through graduated light - blue for low energy use, red for high. Being portable, and therefore highly visible, helps Wattson overcome the limitations of fixed monitors which are often located out of sight by the electricity meter (Brown, 2007). Its visibility is furthered by the retro style and high quality finish which make Wattson less a functional meter and more an ornament to be displayed and admired (ibid).

Figure 2.6: Wattson (DIY Kyoto, 2005)

The *Energy Lock and Energy Clock* concept was developed by More Associates as part of the Red Future Currents project. It provides feedback on energy use in the home and, via a single switch operated by the user, deactivates all unnecessary devices whilst the house is vacant (Design Council, 2006).

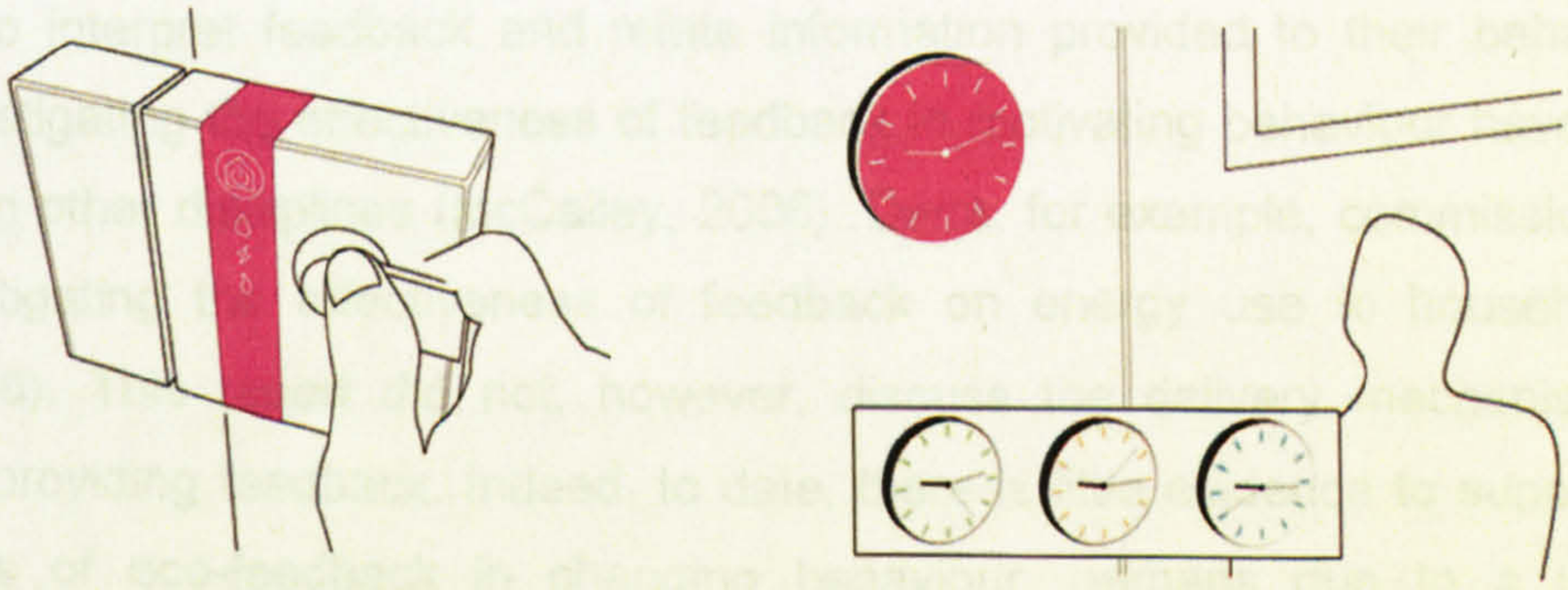


Figure 2.7: Energy Lock & Energy Clock (Design Council, 2006)

The *Tyranny of the Plug* series (Van Hoff, 2003) explores consumers overriding reliance on electricity, in the face of their of the lack of consideration as to its source. The prototypes developed investigate the use of *physical feedback* as a means of exposing users to the power required to operate kitchen appliances.

Figure 2.8: Tyranny of the Plug Series (Van Hoff, 2003)

The use of physical feedback requiring users to exert some effort to make the product work shares some similarities with research into human-powered devices. Human Powered Devices are designed to actively encourage user involvement or in some cases require user involvement for the product to function. They attempt to bridge the gap between machinery and commodity through engaging the user. Human powered devices, which are similar in intent to those using physical feedback, are believed to be instructive in educating users about energy use issues in real time (van de Velden, 2003b, Vonk, 1999).

There is widespread support for the use of eco-feedback, particularly applied in smart energy meters. However, opinions are divided as to whether they will produce the required changes in consumption habits (Kinver, 2006). Their effectiveness relies on an assumption that increased visibility of usage patterns, particularly relating to cost, will motivate consumers to reduce their consumption. As discussed, technological interventions designed to reduce use impacts often rely on consumer compliance to succeed. Additionally, feedback alone may not be sufficient. Consumers may need assistance to interpret feedback and relate information provided to their behaviour. Studies investigating the effectiveness of feedback in motivating behaviour have been carried out in other disciplines (McCalley, 2006). Defra, for example, commissioned a report investigating the effectiveness of feedback on energy use to householders (Darby, 2006). This report did not, however, discuss the delivery mechanisms or devices for providing feedback. Indeed, to date, there is little evidence to support the effectiveness of eco-feedback in changing behaviour, perhaps due to a lack of

comprehensive testing. Arroyo et al's (2005) work however, is a notable exception as their prototypes have been tested and the results published in the public domain.

Arroyo et al's (2005) findings highlighted the limitations of information campaigns in achieving behavioural change and the limits imposed on user interactions by flow-restricting fixtures and automatic taps. Their research sought to investigate how devices could alter behaviour to promote water conservation. *Waterbot*, one of the concepts developed, (Arroyo et al., 2005) employs audiovisual feedback and persuasive techniques to motivate users to conserve water by turning off the tap when it is not in use. Waterbot features an adaptive interface which uses *just-in-time* feedback coupled with positive, varied reinforcement and social validation to influence behaviour. It is responsive to the current and previous user's patterns of use and alters its response accordingly. By providing comparative data on water usage which suggests that other household members have reduced their water consumption, Waterbot aims to motivate the current user to comply in saving water. The use of audio-visual feedback enhances the experience of using the device and serves as motivation for water savings by offering a reward.

To test the effectiveness of Waterbot, the designers recruited ten test subjects aged 18-50 for a pilot study. Volunteers were observed washing their hands in a regular sink fitted with Waterbot. The results indicated that feedback on the patterns of use, represented in simple bar graphs on the display, was intuitively understood and did, in some cases, inform the type of activity carried out. Half of the volunteers reported that having a visual reminder of the duration the tap was on prompted them to be more likely to close the tap between activities. The incentive to compete with other users in order to save more water was not so successful in motivating behaviour and the most effective feature was the use of visual prompts, such as lights which changed colour to indicate water temperature. A secondary pilot test, involved the installation of Waterbot on a sink over a longer period of time. This test confirmed the previous findings concerning the use of visual and auditory feedback. The adaptable interface worked well to ensure the variety and appropriate frequency of the feedback provided, and subsequently, the test subjects did not report being annoyed.

Arroyo et al's (2005) research indicated that presenting clear, explicit *just-in-time prompts* at the point of use was beneficial, as was the use of *adaptive* and *responsive* positive and negative reinforcements. By varying the frequency and type of reinforcement they increased the spontaneity of the interactions made and reduced

predictability and irritation (ibid). Eco-feedback has the potential to change user behaviour through information provision. However, as discussed previously, information does not necessarily lead to action. The speed in which feedback is delivered, however, could enhance its effectiveness in directing behaviour (McCalley and Midden, 2002, McCalley, 2006, Arroyo et al., 2005).

2.2.1.4 Behaviour Steering

Behaviour steering technologies or *scripts* encourage users to behave in certain ways as prescribed by the designer (Jelsma and Knot, 2002). Through the inscription of incentives and rules, designers can encourage desirable behaviours whilst blocking undesirable ones (Jelsma, 2003). Scripts are often employed to ensure the product is used correctly; computer cables, for example, are designed with *male* and *female* connectors to ensure they are plugged into the correct points and batteries feature positive and negative points corresponding to cavities inside the product. Scripting can also become apparent in the choice of materials; a polystyrene cup, for instance, contains the script *"throw me away after use"* (Verbeek and Kockelkoren, 1997, p. 108) whereas delicate bone china tea-cups imply the need for careful, considered behaviour.

Ingram points to the correlation between *scripting* and the notion of affordances (Ingram, 2005). The notion of affordances conceived by Gibson (1979), was transferred into the design arena by Norman (1998). *Perceived* affordances inform the user of the potential actions and functions which could be taken while constraints place limitations on what actions can be performed. The combination of the two, determines an appropriate course of action for the user (ibid). Forcing behavioural change, through the use of constraints however, may be counterproductive if it incites users to try to counteract these impositions. The user's inclination to avoid restrictions put in place by a forcing mechanism can depend on the perceived ease of doing so, the so called *"work factor"* (Lockton, 2005, p. 19).

Unexpected user behaviour can reduce the effectiveness of behaviour steering interventions unless it is recognised and designed around (Jelsma and Knot, 2002). "Anti-scripts" (ibid), can be thought of as more considered pro-active "rebound effects" where the consumer actively finds ways to disrupt or circumvent the intended use patterns prescribed by the designer. An example of "anti-scripting" could be drivers

who plug the seat belt in, and then sit over the top of it, to fool the cars in-built safety warning to fasten seatbelts and override the consequence of the ignition refusing to work. Literature suggests that integrating an analysis phase into the design process to identify unexpected behaviours associated with the use of a product could help designers to *"foresee these mechanisms and to find responses by clever designs"* (Jelsma and Knot, 2002, p. 123). Through user centered research Unilever (2000) found that their customers tended to use more washing detergent than needed to ensure a good result. Unilever effectively reduced resource consumption whilst increasing the efficiency of the wash by *prescribing* the correct amount of detergent to use in tablet form.

2.2.1.5 Intelligent Products & Systems

Intelligent, also referred to as *Ambient*, technology is a fast growing area of enquiry in computing studies, science and technology studies and some fields of product design, particularly electronics. Several trends in technology have characterised the advancement of *intelligence* in machines; ubiquitous computing, context-awareness, wearable technologies and persuasive technology, also known as Captology, which is of particular interest to this research.

Ubiquitous computing, the *"use of computers everywhere"*, refers to the integration of microprocessors into everyday objects such as white goods, toys, furniture and clothing (Rey and Alcañiz, 2005). These networked devices are integrated seamlessly and transparently into the user environment enabling unrestricted access to information on demand. Via *ubiquitous communication* networked devices can communicate to the user and between themselves. *Counter Intelligence*, developed by the Massachusetts Institute of Technology (MIT), is one of several projects MIT are using to investigate how networked devices and environments can facilitate information exchange to inform user behaviour (Hardy, 2004). The *Electrolux Screen Fridge*, a further example, features a 15 inch integrated touch screen connected to broadband, TV and radio allowing seamless access to an organiser, message system and phone (Electrolux, 2000).

An example more specifically related to this research is Rodriguez and Boks (2005) investigation into reducing the energy impacts associated with televisions by influencing behaviour. They envisaged a television which could *"reduce [its] energy use*

[itself] depending on the user's activities" (p. 58) based on information gathered via ubiquitous communication with other devices. If, for example, the user was cooking the TV would alter its power modes and the volume and brightness would temporarily decrease; if they were talking on the telephone the image would dim, the volume revert to mute and the movie pause as illustrated in the scenario below in Figure 2.9.

Figure 2.9: Beth and Edgrrr Scenario (Rodriguez and Boks, 2005)

Context Aware Technology, which originated in computing systems design, describes the use of data inputs such as Bluetooth, GPS and motion sensors by a device to gather information which can be delivered to the user or used by the product. Context-aware mobile technologies have been particularly exploited in the design of small consumer electronic devices such as PDAs and mobile phones (DeVaul and Dunn, 2001, Siewiorek et al., 2003, Madan and Pentland, 2005). The *Electrolux Trilobite* vacuum cleaner is a good example of a product which uses sensors to gather data on its location and proximity to other objects to enable it to function. It works by sending out ultrasonic signals to locate dirt and navigate around obstacles. It is entirely programmable enabling the owner to set a convenient cleaning schedule. It senses its own energy levels and when it is beginning to run out of power it automatically returns to the charger. *"After recharging it will either stop and wait dutifully for your next command, or keep on cleaning until done"* (Electrolux, 2007).

Figure 2.10: Electrolux Trilobite (Electrolux, 2007)

In the clothing arena, ubiquitous computing, and context-aware technologies have been integrated into *wearable technologies* (University of Wales, 2007, Bristol University, 2007). Wearable technology, or wearable computing, developers aim to design *"innovative smart clothing that addresses end-user needs from technical, aesthetic and cultural view points"* by providing information in a manageable, flexible and accessible format (University of Wales, 2007). Research in this field typically focuses on the development of products and devices for use in sport and fitness, personal communication or healthcare fields.

Captology (Fogg, 2003), the study of *Computers as Persuasive Technology*, is the most closely related field of enquiry to this research. Captology focuses on the development of technology to change what people think or what they do (ibid). Persuasive technology has been applied in many fields including business, particularly for software and internet applications, healthcare and education. Fogg sets out several strategies used by persuasive technologies to influence behaviour;

- *Reduction*; technologies which persuade by reducing a complex activity into a series of simple steps; Amazon's *One Click* shopping is a good example of this.

- *Tunnelling*; technologies that lead the user step-by-step through a prearranged sequence of actions towards an end goal, such as software installation programs.

- *Tailoring*; technologies which customise the information provided to users to ensure its relevance, making it easier for them to act. This can be seen in several internet purchasing sites where personalised *stores* featuring products selected to best match the user profile are created to persuade users to buy items. These stores are constructed using data relating to previous purchases.

- *Suggestion*; interactive technologies which suggest an action at a favourable moment, Fogg cites the Speed Monitoring Awareness and Radar Trailer (SMART) as an example of this. SMART is a portable trailer, parked in lay-bys, which displays the speed at which cars passing by are travelling as they approach. Its goal is to encourage drivers to reconsider and adjust their speed.

- *Self-Monitoring*; those that encourage self monitoring towards a predetermined goal, good examples of this include heart monitors and pedometers.

- *Surveillance*; products or systems that aim to ensure compliant behaviour by allowing a third party to monitor actions taken by another individual; an example of this cited by Fogg, is the *Autowatch*, a black box monitor which parents can install in their children's cars to record and later download data relating to their driving practices. To be effective, Fogg argues, surveillance must be overt not covert, to provide subjects with the ability to elect to behave within acceptable boundaries. When used covertly, surveillance can be a tool for punishment rather than persuasion.

- *Conditioning*; those that reinforce target behaviours through positive and negative feedback (also known as *behaviourism* or *instrumental learning*). Operant conditioning is commonly used in interactive computer games.

Fogg (2003) suggests that to increase the effectiveness of the device, two or more of these strategies be used in tandem.

2.2.2 Ethical Considerations

As discussed earlier the morality of products is beginning to be discussed in social science circles (Dant, 2006a, Molotch, 2003, Gowri, 2004). Few designers however, particularly those practicing in industry, are openly discussing the moral consequences of products and their use (Gowri, 2004) or designing products which address these issues. When considering the ethics of designing behavioural change approaches, three key questions emerge;

1. S*hould* products be designed with the intention of creating behavioural change towards more sustainable use patterns?
2. Are products which *encourage* or *persuade* more or less morally acceptable than those which *coerce* or *force*?
3. How can we begin to assess the ethical dimensions of *behaviour changing products*?

The distinction between persuasion and coercion is, according to Fogg (2003), an important point for consideration; a persuasive approach seeks to achieve a *voluntary* change in behaviour; a coercive technology, on the other hand, *forces* behavioural change. *Square-eyes* for example, is an insole designed for children's shoes which

aims to reduce childhood obesity by incentivising regular exercise (Swan, 2005). *Square-eyes* records the amount of exercise a child does and converts it into television watching time. The insole contains two electronic pressure sensors; the first records the number of steps taken, the second contains a wireless transmitter which passes this information to a receiver which is connected to the TV. The receiver calculates the screen time earned and displays it on the TV screen. When the time runs out the TV switches itself off until more credit is earned. Square Eyes, which uses constraints or *forcing* functions as part of its *prescription of use*, is classed as coercive rather than persuasive (Lockton, 2005) as it forces the child to exercise in order to receive the reward of watching television. Although Lockton views this as a coercive approach, it could be viewed as one which rewards children for exercising. Whether an intervention is classed as coercive or persuasive may, in fact, be guided by individual perceptions of what is an acceptable level of influence given a particular situation.

By placing each approach on an axis of influence the interplay of power between the user and product i.e. the degree to which responsibility for decision making is held by the user or delegated to the product can be observed, Figure 2.11. In this diagram, eco-feedback is located towards the user end as this approach provides the user with information to make informed decisions autonomously; intelligent products however retain a greater degree of influence and control.

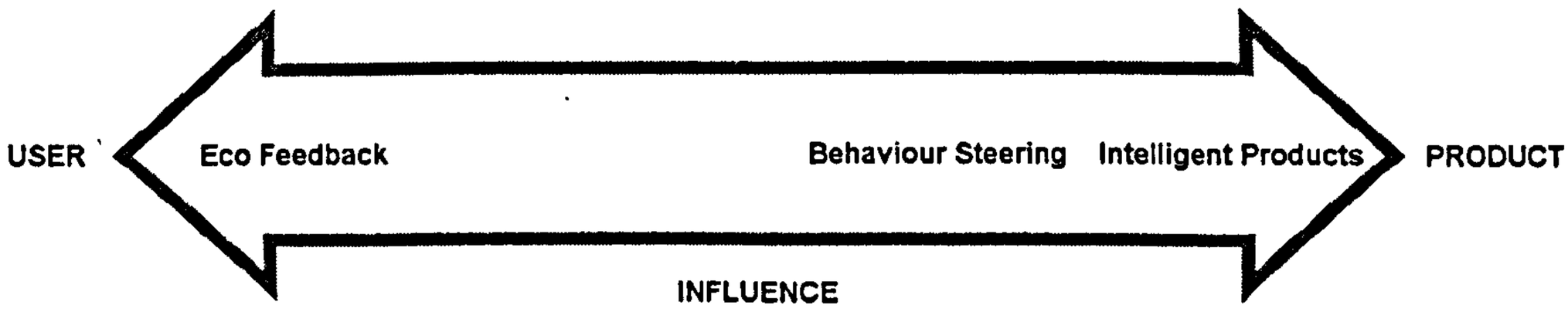


Figure 2.11: Axis of Influence

Intelligent products, operating autonomously and ubiquitously, have the potential to be incredibly effective as they automatically override any decision making by the user, however the disadvantage is that with this lack of choice can come a lack of awareness. Is it better to educate the consumer and risk failure? Or, overrule users to gain environmental improvements, and in doing so spread naivety. If a product designed to reduce use impacts does so by intentionally restricting user's actions can this approach be justified when weighed against benefits derived from the outcomes produced? When considering the substantial impacts associated with user behaviour, should the urgency of the problem dictate the strength of the solution? Or is

sustainability by stealth morally unacceptable in all situations? In some cases, it could be argued that the invisible nature of an intervention may be critical to its success in persuading the user to change their behaviour; should the designer's intentions remain hidden in these cases?

For the purposes of this research, it is essential that methodologies for measuring the ethical acceptability of an intervention and classifying its relative *strength* or *weakness* in informing, persuading or coercing actions are either found or developed. This will enable any interventions developed as part of this research to be evaluated and critiqued. There does not appear to be any hard and fast answers to the underlying moral concerns of influencing behaviour through design and few are actively questioning how to develop appropriate and ethical guidelines. Berdichevsky and Neuenschwander's (1999) have, however, begun to address these concerns by authoring a set of ethical principles to assist in the development of ethical persuasive technologies as shown in Table 2-1.

Ethical Principles Of Persuasive Technology
I. The intended outcome of any persuasive technology should never be one that would be deemed unethical if the persuasion were undertaken without the technology or if the outcome occurred independently of persuasion.
II. The motivations behind the creation of a persuasive technology should never be such that they would be deemed unethical if they led to a more traditional persuasion.
III. The creators of a persuasive technology must consider, contend with, and assume responsibility for all reasonably predicted outcomes of its use.
IV. The creators of a persuasive technology must ensure that it regards the privacy of users with at least as much respect as they regard their own privacy.
V. Persuasive technologies relaying personal information about a user to a third party must be closely scrutinized for privacy concerns.
VI. The creators of a persuasive technology should disclose their motivations, methods, and intended outcomes, except when such disclosure would significantly undermine an otherwise ethical goal.
VII. Persuasive technologies must not misinform in order to achieve their persuasive end.
VIII. **The Golden Rule of Persuasion.** The creators of a persuasive technology should never seek to persuade a person or persons of something they themselves would not consent to be persuaded to do.

Table 2-1: Ethics of Persuasive Technology

These principles could be a useful starting point for interrogating the ethical acceptability of interventions integrated in products aiming to change user behaviour towards more sustainable practices.

2.3 Conclusions

2.3.1 Analysis of Existing Design Concepts

The product design concepts described and analysed in this chapter as examples of design for behavioural change have, for the most part, focused on addressing *environmental* concerns. The focus of this PhD is to identify and apply design for behavioural change approaches to reduce the *social* impacts of product use. This does not mean that environmental issues are to be discarded. Environmental issues should be taken into account alongside social issues to ensure the product re-design is sustainable. Although the approaches presented in this chapter have not been specifically been applied to target social issues arising from the use of products; there are some generic conclusions relating to design for behavioural change which are of interest and could help shape further research in this field.

By comparing the design concepts and theories described above, it is possible to draw out similarities and differences. It is also possible to identify potential limitations of prior work from the perspective of this research. Limitations in the information available in the public domain made it problematic to assess the research and design processes undertaken by many of the designers work depicted above. In a general senses, however, there appears to be a tendency, on the part of designers to publish design work as isolated solutions with little or no supporting contextual research unless it is developed as part of a research project. The analysis below, therefore, is based on available information, and cannot be considered indicative of all products described in this chapter.

2.3.1.1 Trans-disciplinary Research

Some of the design concepts generated have *appropriated* theories from other disciplines to inform their work. Transferring theory from disciplines such as; science and technology studies, computer studies or sociology into design appears to be a relatively new research agenda for designers (Shove et al., 2004). By taking theories

from other disciplines and applying them within the field of consumer product design, though not explicitly with the aim to reduce use impacts, Lockton (2005, 2006) demonstrates the value of horizontal knowledge transfer between disciplines. His work is, however, subject to some limitations; various existing examples of where architectures of control can be observed in consumer products are cited yet he does not apply insights gained from links made in the literature in a practical way, his research is largely theoretical.

2.3.1.2 User Centred Research

Many of the design concepts described in this chapter were developed with reference to user centred research activities. The results of these studies, for the most part, were used to assist the designer in identifying environmental and social impacts of product use caused by user behaviour. (Rodriguez and Boks, 2005, RMIT, 2003, van de Velden, 2003a, Interactive Institute, 2004). Favoured methodologies included the use of cultural probes i.e. disposable cameras, logbooks or diaries, interviews and observational studies of user trials, using prototypes installed in an appropriate environment or existing products used in the home. The Static! team (Interactive Institute, 2004), for example, distributed cultural probe packages containing a disposable camera and logbook to capture users experiences and perceptions of energy use in a domestic setting. They also conducted interviews with a mixed demographic of family groups. These *"experiences, stories and moments of interaction"* were used to develop use scenarios and prototypes (ibid). Rodriguez and Boks (2005) also used cultural probes in the form of disposable cameras and diaries to test subjects. They followed these up with interviews to explore the subjects' motivations for taking certain actions. Finally, they video recorded user interactions to assess points of intervention which, when addressed in the design, could encourage behavioural change.

2.3.1.3 The Product as Part of a System

The importance of *"look[ing] at the system within which the product functions, not just the product itself"* should not be underestimated (Market Transformation Programme, 2007). As described above, limitations or affordances within the environment in which a product is used can facilitate or impede prescribed actions taking place. The

Awareness project, for example, considered the kitchen as a system where users complete a series of tasks, to fulfil different needs, by interacting with various products (Thompson and Sherwin, 2001). Van de Velden (2003a) also took a systemic approach to the design of a shower, considering the context and mode of use. Through user centred research studies she captured some of the underlying values of showering and the different practices and habits associated with bathing. These *context factors* were used to form a schematic outline of the contextual domain in which the shower is located.

2.3.2 Reflections on Approaches Identified

Upon comparison, it has become clear that feedback, behaviour steering and intelligence are not as distinct from each other as first believed and there is quite a lot of crossover. Ideas within wearable technology research, for example, can be seen in ubiquitous computing and in research into developing context-aware technologies.

The most similarities could be observed between several theories presented and the notion of eco-feedback. *Suggestion*, particularly when combined with *conditioning* and *self-monitoring* (Fogg, 2003), is very similar to feedback mechanisms described by Arroyo et al. (2005). Operant conditioning, as evident in Arroyo et al's (2005) design concepts, also clearly relates to the use of feedback mechanisms. There is also some cross-over between eco-feedback and the provision of information via campaigns, but the former is perhaps provided in a more immediate, context specific and tangible way.

It was generally agreed, across disciplines and approaches, that the importance of providing *real-time* feedback, either in persuasive technology or eco-feedback mechanisms, is vital to ensuring success (Fogg, 2003, Arroyo et al., 2005, McCalley, 2006). The visibility of the feedback provided, be it through the portable nature of the device (DIY Kyoto, 2005), the location of the of the indicator (Sweatman and Gertsakis, 1996, Coram, 2004) or the variety of the feedback given (Arroyo et al., 2005) was considered to be significant in ensuring its message is received, and acted on. Human powered devices, which share some of the same characteristics as physical eco-feedback techniques, were believed to be instructive in educating users about energy use issues in real time (van de Velden, 2003b, Vonk, 1999).

In some cases it was difficult to classify all of the interventions used in the design of the product as belonging to one singular approach. Some products combined two or more approaches in one product or a system of products, a strategy recommended by Fogg (2003). Prototypes developed during the *Awareness* project (Thompson and Sherwin, 2001), for example, sought to facilitate behavioural change using a combination of *feedback* and *intelligence*. The type of interactions carried out in the kitchen, the range of products used and the interplay of resources between these items called for a systemic design solution. The ubiquitous nature of the *Awareness* prototypes allows information exchange and intelligent management of resources to minimise waste and maximise efficiency. The *Smart Sink*, for example, features a water-level indicator and consumption meter to provide feedback on water usage. The Smart Sink is networked to the *Datawall*, the brain of the kitchen, which provides feedback to the user on collective resource use. The *Portion Projector* also linked to the Datawall, accesses information regarding the correct measure of ingredients for a chosen meal and projects the exact quantities on to the plate, thereby reducing waste.

In addition, many of the products discussed used design for behavioural change approaches in combination with eco-efficiency techniques. Brewin's eco-shower *Sahara*, for example, used a hydro-cyclone pump system to recycle cold water back into the system to avoid wastage while the shower heats up and complemented this with an eco-feedback water meter to enable users to monitor the volume of water used per shower (Coram, 2004). Equally, although the designers of the *Kambrook Kettle* introduced eco-feedback measures in the form of a water gauge and temperature indicator, they also added a second wall in the jug cavity to improve heat retention (RMIT, 2003).

2.3.3 Next Steps

Prior investigations have produced some interesting conceptual ideas, but few, with the exceptional of the Static! Project (Interactive Institute, 2004), Axis Kettle (RMIT, 2003) and Wattson (DIY Kyoto, 2005); have applied these ideas in products for consumer use. In addition, few, have commented on their research and design processes, with the majority of publications focusing on the end result. With the exception of Arroyo et al (2005), the effectiveness of these approaches in changing behaviour has yet to be tested and reported on publicly. The findings of this chapter indicate that it is of benefit to the designer to employ User Centred Research techniques to find out which types of

behaviour should be addressed in the design to produce more sustainable behaviour or conversely *"what characteristics, intrinsic to products, facilitate waste of energy or resources during their use"* (Rodriguez and Boks, 2005, p. 60). Although many of the concepts presented referred to some element of user centred research having been undertaken, the process, techniques and results of these studies are, for the most part, omitted from any publications, with the exception of those designs produced as part of a research project.

The limitations of the information provided in support of some of the concepts described in this chapter has reinforced the need to access information not only about the end product, but also the intent and decision making process behind the design. In the following chapters, the existing research will be taken an important step further through the production of design case studies which record the process of applying user centred research techniques and design for behavioural change approaches extracted from the literature to identify and reduce negative *social impacts* resulting from product use.

3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the overarching strategy for conducting the research. It discusses the application of grounded theory in qualitative and exploratory research studies to develop theoretical ideas (concepts, models and formal theories) in design for behavioural change; it discusses how to establish the validity and reliability of data collected and explains why mainstream designers were chosen as the subjects for the studies.

3.2 Research Strategy

A comprehensive, cross-disciplinary literature review was undertaken in Chapter 2 to identify and centralise knowledge originating in other fields which could contribute to building theory in design for behavioural change. The limitations of the design case studies reported highlighted the need for additional studies to develop theories identified in the literature further and generate documentary evidence of the process, techniques and results of the application of these theories in design practice.

The literature revealed that although investigations in the field of Captology have begun to discuss ethical considerations regarding the use of persuasive technology (Berdichevsky and Neuenschwander, 1999) these issues are not represented in research from product design disciplines. Indeed, little discussion or analysis of the ethical or operational considerations involved in implementing design for behavioural change approaches in product development processes could be located within the literature surveyed. To explore designer's views and perceptions of design for behaviour change in greater detail, therefore, further research was required.

The motivations for carrying out research can be classified as; *explanatory*: to describe a particular event or situation, *descriptive:* to explain a given situation or problem or *exploratory*: to investigate an emergent issue (Robson, 2002). As discussed in Chapter 2, design-led research into behavioural change is a relatively new field of enquiry, prior research to date is limited and any knowledge available resides across several disciplinary areas. This research, therefore, can be described as *exploratory*.

Quantitative research is the interpretative and systematic study of a specified phenomena, issue or problem (May, 2001, McQueen and Knussen, 2002). In contrast to quantitative research which investigates the what, where and when in an effort to produce conclusive, measurable results, qualitative research examines the why and how and is *exploratory* in nature. Quantitative researchers seek to establish causal determination, generalisation of findings and prediction. Qualitative researchers, on the other hand, seek understanding, illumination and extrapolation of findings to inform similar situations (Golafshani, 2003). This research can, therefore, be described as *qualitative.*

3.3 Grounded Theory

Qualitative researchers typically adopt a grounded theory approach. Grounded theory is used to develop theoretical propositions grounded in data (Schwandt, 2001, McQueen and Knussen, 2002). Using a grounded theory approach, researchers *"embark on empirical work and collect data which ...initiate, refute or organize [their] theories and then enable [them] to understand or explain [their] observations"* (May, 2001, p. 32). Qualitative data derived from research studies is coded and clustered (Miles and Huberman, 1994) according to a *"limited number of predetermined response categories to which number are assigned"* (Patton, 2002). Coded data is continuously compared with emergent data from concurrent or separate studies in an iterative mode to identify *"patterns and relationships that can generate theories and hypotheses"* (McQueen and Knussen, 2002, p. 200). The researcher seeks additional data to support or refute assertions to refine his or her proposition *"until adequate theories emerge to explain the phenomenon under investigation"* (McQueen and Knussen, 2002, p. 200), additional analysis no longer contributes any new insights (Schwandt, 2001) or, in the case of a doctoral study, the time available to complete the study has elapsed.

A grounded theory approach was taken in the design of four phases of exploratory, qualitative research. These phases, their component parts and their relationships can be seen in Figure 3.1. A detailed account of the research methodologies and analysis techniques used in each phase, and how each phase informed the development and focus of the next can be found in the methodology and next steps sections of Chapters 4, 5, 6 and 7.

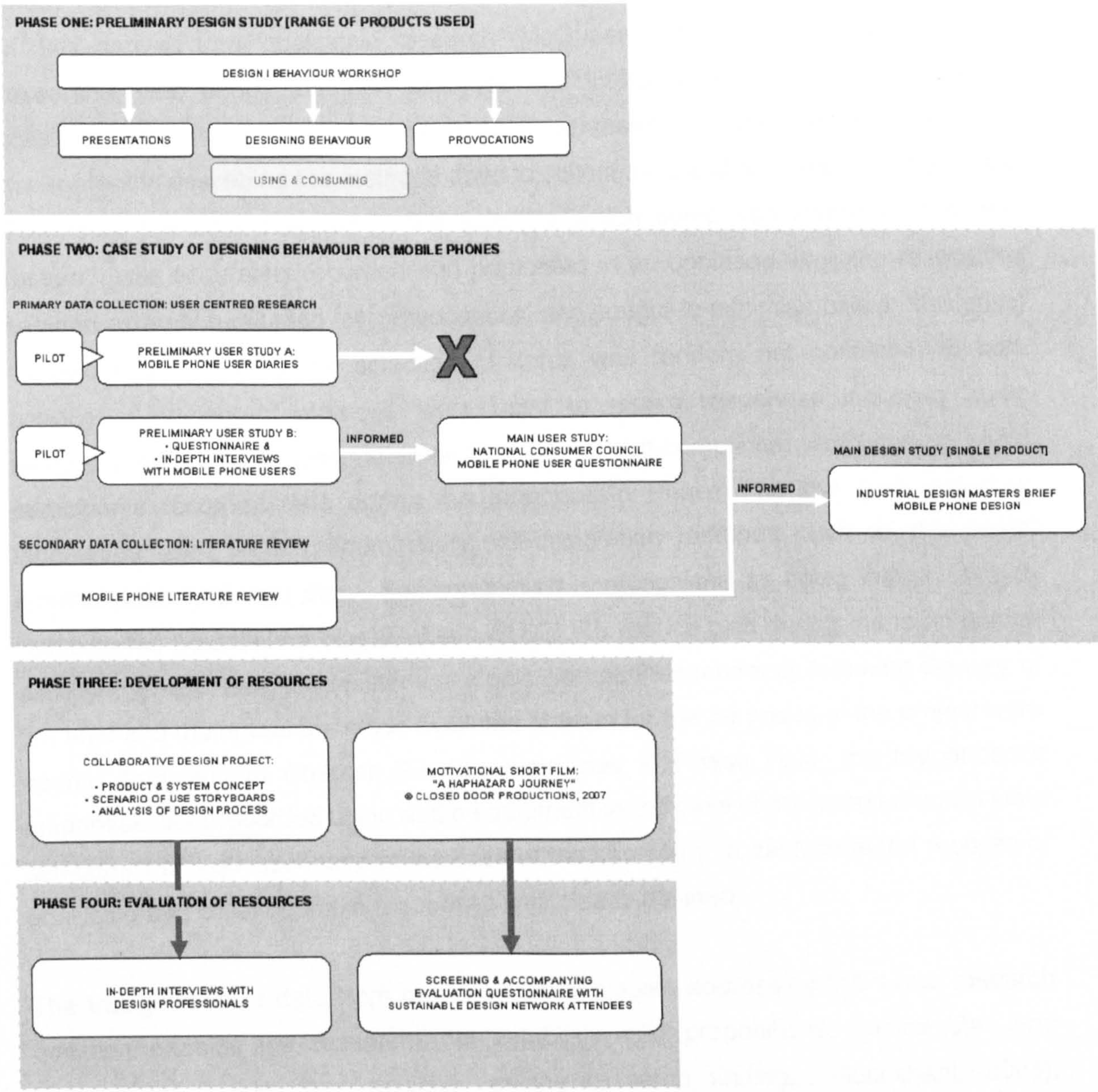


Figure 3.1: Research Phases

3.4 Validity and Reliability

Accordingly to Hammersley (1990, 1992) validity is *"the extent to which an account accurately represents the social phenomena to which it refers"* (Hammersley, 1990). Reliability *"refers to the degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions"* (Hammersley, 1992). Guba and Lincoln, who substituted reliability and validity for *"trustworthiness"* set out four criteria for assessing trustworthiness in qualitative

research; credibility, transferability, dependability, and confirmability (Lincoln and Guba, 1985). According to Parker (1994) the *"researcher is central to the sense that is made"* of data derived from qualitative research (McQueen and Knussen, 2002). It is the researcher who brings together, analyses and interprets the data. To ensure the credibility and dependability of the results the researcher must endeavour to be transparent in describing the methods used to collect data and be mindful to avoid bias. To ensure the data collected in the activities which comprised Phase One of this research was accurately recorded and presented in an unbiased way, the researcher secured external facilitation for 'provocations' and sought to minimise bias in 'designing behaviour' by ensuring the selection of cards was random not contrived. In both activities a variety of methods were used to record responses including audio recording, note taking, observation and the use of self-completion templates on which participants recorded data during the exercise. In Phase Two the data collection techniques used were predominately self-completion methods such as the postal questionnaire and user diary. Self-completion is recognised as being instrumental in reducing the potential for bias (Robson, 2002). To reduce bias during the main design activity in Phase Two, the master's students worked independently following delivery of the brief and the resources made available to them for the purposes of the project were openly discussed in Chapter Six. To avoid bias in Phase Four, the respondent's responses were recorded using audio equipment in the case of the interviews and via a self-completion questionnaire in the case of the short film. In each case the process of analysing and collating these responses was clearly outlined.

The triangulation of data from multiple methodologies addressing the same research question enables the researcher to establish valid propositions, control bias and improve the validity and reliability of the research findings (Golafshani, 2003). Triangulation is *"a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study"* (Creswell and Miller, 2000, p. 126). The greater the consensus between different data sources on a given issue, the more reliable the explanation of the data is. In the case of this research, the results of 'provocations' in Phase One were triangulated with the findings of the interviews with design professionals in Phase Four and the literature reported on in Chapter Two; the results of the preliminary design study in Phase One were triangulated with those of the main design study in Phase Three and the existing design studies presented in Chapter Six and the findings of the preliminary user studies in Phase Three were triangulated with those of the main user study and those of existing studies reported in the literature review in Chapters Five and Six. Triangulating

the findings of these separate studies helped to strengthen and justify the data presented and improve the validity and reliability of the conclusions drawn.

3.5 Sampling

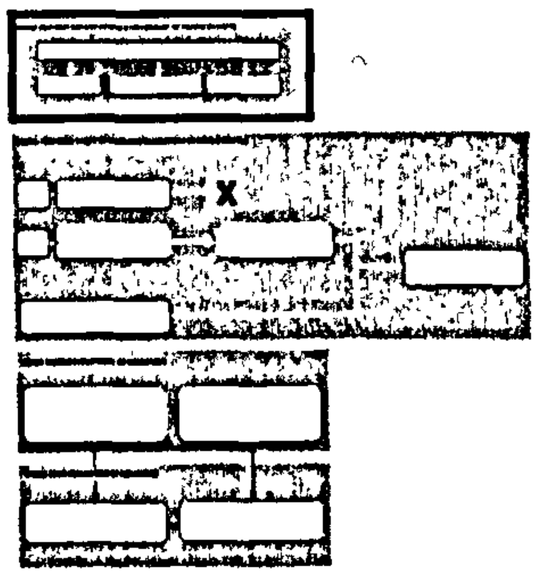
The collaborators for the exploratory studies in Phases One, Two, Three and Four, shown in Figure 3.1 above were either practicing designers or students undertaking a Masters of Science in Industrial Product Design. It is well documented that *"product development teams are .... cross–functional, representing different functional units, or multidisciplinary, involving several disciplines, or both"* (Vissers and Dankbaar, 2002). IDEO, for example, draws upon the skills and experience of ergonomists, psychologists, engineers and designers in its product development teams. Prior research by the author has demonstrated that designers do not work in isolation and are often part of a wider network of decision makers (Lilley, 2003, Holbird et al., 2003). With this in mind, industrial partners were sought in the early stages of the project as this has, in previous research conducted by others, proven to be a successful method of grounding and applying academic research in a commercial context (Lofthouse et al., 2001, Thompson and Sherwin, 2001, Lofthouse and Bhamra, 2006). Although multidisciplinary design teams are more common in industry, consultancies can be reluctant to become involved throughout the duration of a PhD research project unless they can see a commercial benefit or they initiated the research themselves. Securing support on a shorter timescale for evaluation purposes, however, can be easier. Despite several interesting conversations with companies such as Nokia, an industrial collaborator could not be secured. It was possible, however, to draw on the expertise of a range of practicing design professionals working in industry to participate in Phases One and Four, as these activities were not as demanding on their time.

Design students are, for a PhD researcher, a useful and accessible resource for testing ideas and can be used as initial subjects in pilot studies. However, as many Industrial Design courses operate in relative isolation with little cross-departmental or cross-disciplinary working between students and major coursework is often assessed on an individual basis, the projects produced by students as part of their academic practice are likely, therefore, to be individually based, as was the case in Phase Two.

This chapter has presented an overview of the general methodological approach taken to conduct the research. The following chapters will detail the research methodologies and analysis techniques used in each phase and how each study relates to the next.

4 PRELIMINARY DESIGN STUDY: DESIGN I BEHAVIOUR WORKSHOP

4.1 Introduction



This chapter reports on **Phase One** of the primary research. It introduces the Design I Behaviour workshop and discusses the methodology and findings of two activities carried out by participants; 'Designing Behaviour' and 'Provocations'. The results of these activities are placed within the context of relevant findings from the literature presented in Chapter 2 and conclusions are drawn.

4.2 Aim & Objectives of Preliminary Design Study

The aim of this preliminary design study was to investigate how designers tackle designing for behavioural change using a range of product types and their perceptions of using behaviour influencing techniques to reduce the environmental or social impacts of use. This aim was broken down into the following objectives;

1. To test designers ability to engage with Design for Behavioural Change without the introduction of methodologies or approaches,
2. To collect documentary evidence of the design processes and techniques adopted for subsequent analysis,
3. To understand what designers consider their responsibilities to be for the way in which consumers use the products they design,
4. To gather their perceptions of the ethical and operational issues involved in applying Designing for Behavioural Change in practice,

4.3 Research Methodology for Preliminary Design Study

The research methodology for the Preliminary Design Study was a workshop with embedded design and discussion activities. A workshop format was considered most appropriate as it allowed the researchers to run several linked activities with a targeted audience and to fulfill their individual aims. Additionally, a workshop in a central location, as opposed to a series of separate activities, enabled a wide range of

participants to take part in consecutive activities across one-day only. This also enabled the researchers to centralise and share costs incurred (i.e. venue rental, AV support and catering).

The Design I Behaviour workshop was held at the Design Council, London on the 12th April 2006. This event was run in conjunction with the Sustainable Design Network (SDN) and Miles Park, a PhD researcher from Kingston University. The Sustainable Design Network brings together individuals from academia, public, government and industry who share an interest in sustainable design. Its mission is to *"provide an exchange of knowledge and experience .... via the collaboration, structured discussion and dissemination of key research topics ...."* (Lofthouse and Bhamra, 2005). The SDN has considerable experience in promoting and organising meetings and workshops; since its inception in November 2001 eleven meetings, focusing on a variety of relevant topics, have been held. Collaborating with the SDN enabled the researchers to benefit from their extensive and diverse membership, established paths for dissemination of information and expertise in organising and running events. In addition, due to the diverse membership of the network, the researchers were able to tap into *"creative input from people working in different but related areas"* (Lofthouse and Bhamra, 2005) and investigate how alliances between different disciplines could be formed.

The workshop agenda, a copy of which can be seen in Appendix A, balanced participatory and non participatory elements. A session of presentations by relevant speakers was followed by two parallel design activities. In terms of roles and responsibilities, Miles Park devised and facilitated 'Using & Consuming' to explore his research aims. This activity will not, therefore, be discussed as part of this thesis. 'Designing Behaviour', a design activity, and 'Provocations', a facilitated discussion, were developed solely by this researcher.

An effective workshop facilitator can promote discussion around points of interest and encourage participants to explain and clarify their views (Bruseberg and McDonagh-Philp, 2001). 'Designing Behaviour' and 'Using & Consuming' were facilitated by each researcher respectively. 'Provocations', however, was facilitated by an external party. This was because it was felt that the researcher's vested interest in the outcomes, prior knowledge, perceptions of the subject matter and proximity to the material would potentially bias the outcome by inadvertently leading the discussion. A good facilitator should remain impartial and avoid prompting or influencing attendees (ibid). The researchers could not, for the reasons described above, remain neutral.

4.3.1 Selection of Participants

The ideal composition of participants was envisaged to be predominately practicing designers, design and social sciences researchers and marketers. A poster to advertise the event was generated and posted on mailing lists, websites and in on-line newsletters run by organisations that specifically target designers who have an interest in sustainability issues such as O2. It was also distributed via complementary research networks including the Network on Product Life Spans.

Participants were selected to ensure an acceptable composition of participant 'types'. May (2001) suggests that to ensure all participants have an opportunity to contribute, the optimum size of the group should be between eight and twelve people. Although Design I Behaviour was attended by 35 people in all, the participants were classified by type prior to the event and split into small mixed groups for each activity. In a prior workshop which the researcher co-developed, (Holbird et al., 2003), coloured stickers were used to track participants decisions-making throughout the workshop activities. This process was adopted in Design I Behaviour. Each participant was provided with a name badge featuring a different coloured and shaped sticker. The shape of sticker was used as a means of dividing the group into two for the design activities. The colour sub-divided each half into three groups. These six groups remained the same for 'Provocations'.

Lofthouse and Lilley (2006) point out the limitations of focus group data obtained from a small percentage of respondents in representing the entire population. Therefore, to further strengthen the opinions of those designers who participated in this workshop, the results in Chapter 4 were triangulated with those of workshops with complementary themes carried out by other parties including; Design for Durability (EPSRC Network on Product Life Spans, 2006) and the Designing and Consuming series (Shove et al., 2004).

4.3.2 Methodology for 'Designing Behaviour' Workshop Activity

The aim of 'Designing Behaviour' was to observe how designers working in multi-disciplinary teams tackle designing for behavioural change. To this end, the groups were tasked with redesigning a given product to change the user's behaviour in response to a specific design challenge. Both environmental and social impacts were

represented in the design challenges issued. The respondents were not given any references to specific approaches or techniques. To enable a series of issues to be explored in a design context it was necessary to set a different brief for each group. Designers traditionally work to a brief and are therefore familiar with this process. To allow comparisons to be made each brief had a different product and challenge but the same requirements in terms of the outputs. In order to set the parameters of the brief, to enable the groups to work through the task and to record their outputs, a series of devices were required. Due to the nature of the audience and the limited time allocated to completing this activity, it was felt that materials should be developed in a visual format.

The use of Design Cards is an established technique within the design profession. Cards can be used as stimulus for generating briefs, providing inspiration, offering a new perspective, showcasing innovative design methodologies or introducing pertinent issues for consideration. The Design Council's *Knowledge Cards* for example, succinctly summarise information compiled by expert contributors on the what, why and how of various design topics and issues (Design Council, 2005). IDEO's *Method Cards* use this format to encourage designers to empathise with the user. Each set of Method Cards features 51 different research techniques developed or appropriated by IDEO, which are split into four suits; *Learn, Look, Ask* and *Try* (IDEO, 2003). These cards have a representative photo on one side and a description of how IDEO have applied the technique on the reverse (Pink, 2003). Two sets of cards were designed for this activity to assist in setting a brief for each group. The first card featured a product, the second a design challenge, as shown in Figure 4.1. The products depicted were; a desk telephone, a handbag, a fountain pen, a hairdryer, hair straighteners and a mobile phone. The design challenges, which represented a mix of social and environmental issues relating to use, were;

- To prevent premature disposal,
- To encourage resource efficiency,
- To prevent anti-social behaviour,
- To prevent theft,
- To encourage communal use,
- To create an emotional attachment.

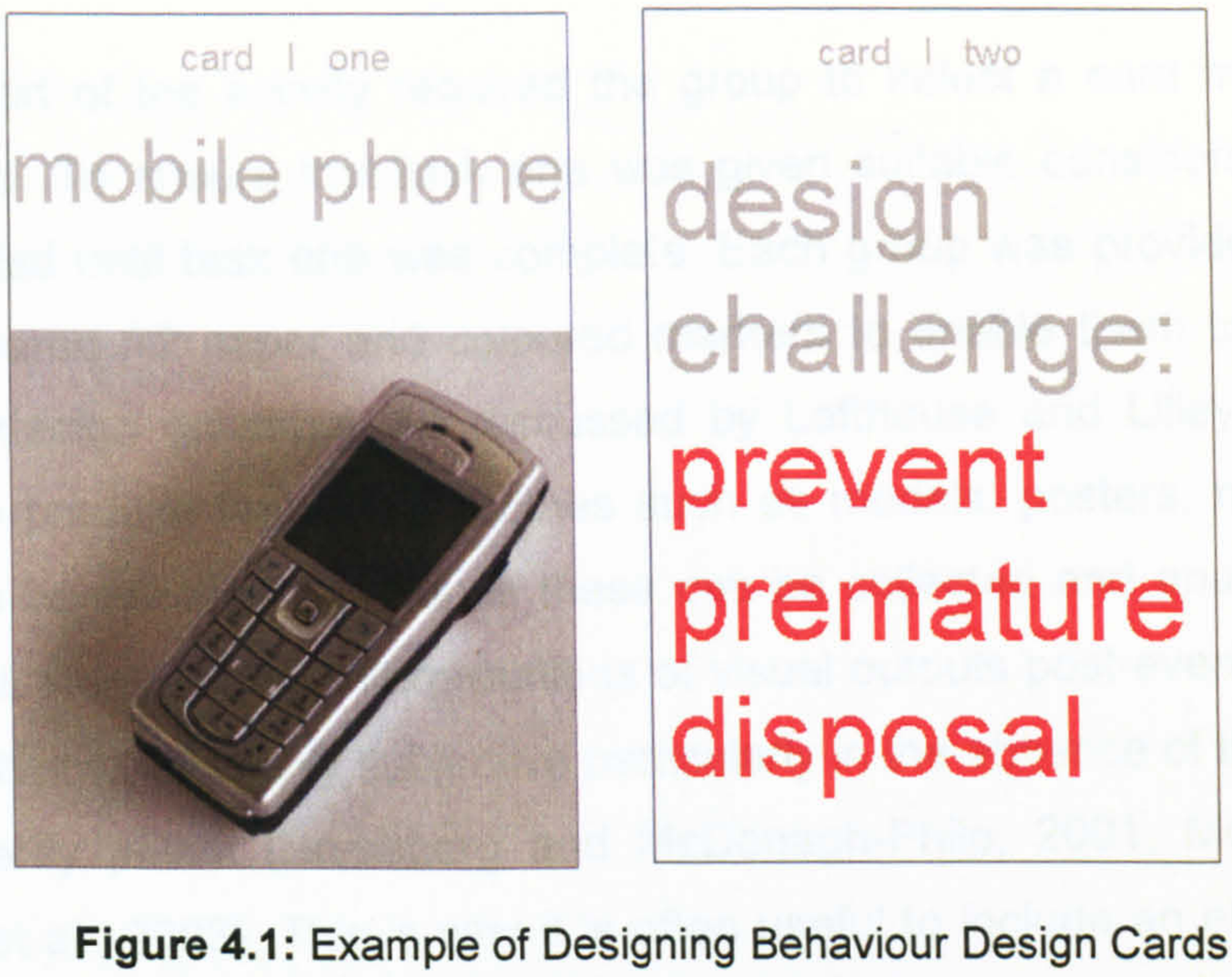


Figure 4.1: Example of Designing Behaviour Design Cards

To avoid predetermining the selection, the cards were laid out face down in a grid formation and randomly selected. Vertical stacking could have enabled the cards to be layered to ensure a particular product was selected alongside a particular issue, so this arrangement was avoided.

The first part of the activity required each group to consider the social and environmental consequences resulting from consumer's behaviour when using their chosen product. For this activity a simple template, illustrated in Figure 4.2 was provided. Societal and environmental consequences were deliberately been kept separate to observe how participants distinguish one from the other.

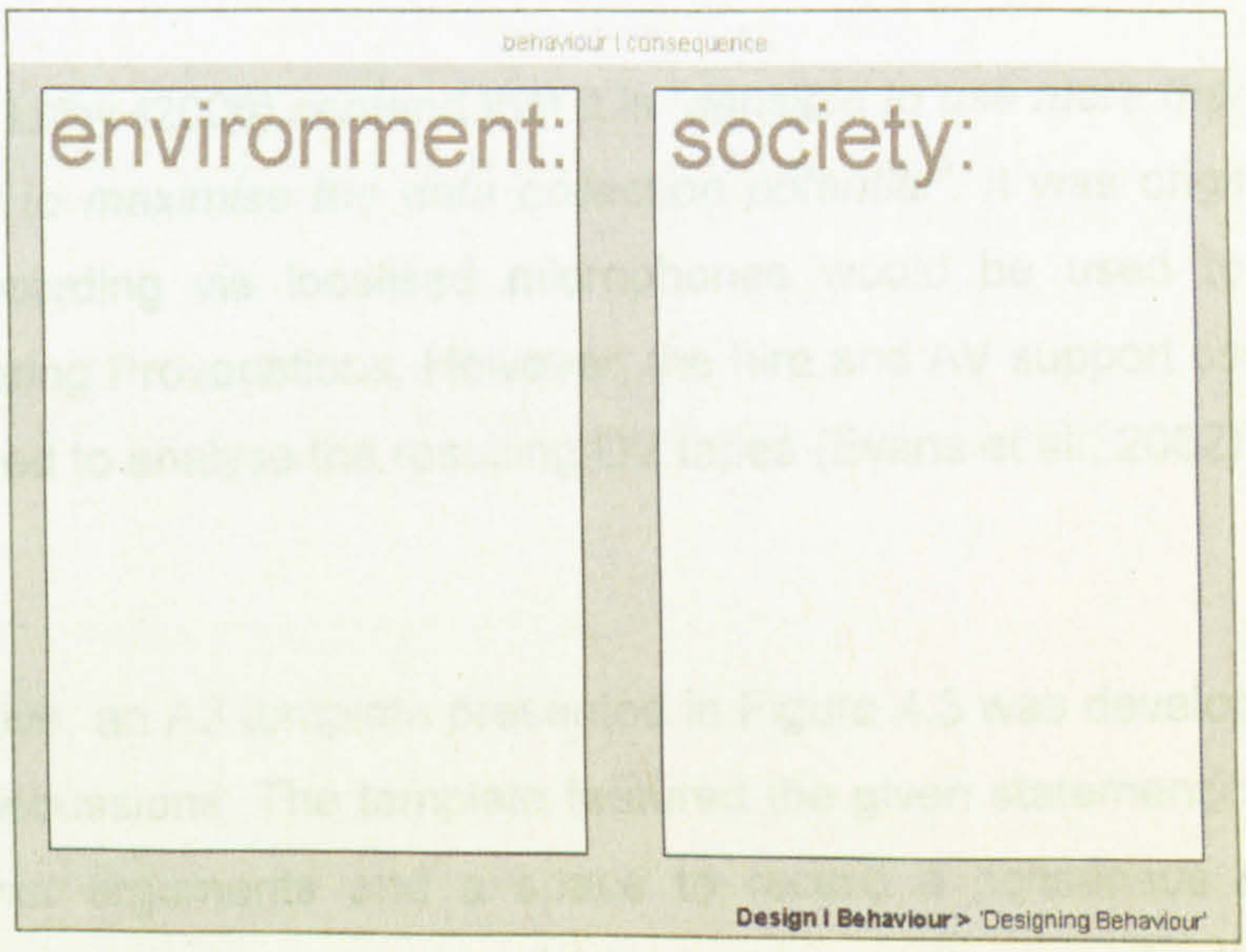


Figure 4.2: Designing Behaviour Template

The second part of the activity required the group to select a card from the design challenges grid. To ensure that task one was given suitable consideration, card two was not selected until task one was complete. Each group was provided with several sheets of coloured A2 paper and coloured markers to enable them to generate and present their design concepts. As discussed by Lofthouse and Lilley (2006) asking participants to produce tangible outcomes such as models, posters, mood boards or templates can be extremely useful as these can be collected and analysed at leisure after the event. Researchers interpretations of visual outputs post-event can, however, as discussed below, be highly subjective particularly in the absence of the participant to explain or clarify points (Bruseberg and McDonagh-Philp, 2001, McDonagh et al., 2002, Costa et al., 2003). This is why it is often useful to include an element of verbal feedback as part of the exercise, where the group explains the concept using the visual material. With this in mind, following completion each group was required to give a ten minute presentation to pitch their re-design to the rest of the group using the material generated. These presentations were recorded using a Dictaphone and notes were taken to record useful verbatim.

4.3.3 Methodology for 'Provocations' Workshop Activity

'Provocations' was essentially a facilitated discussion session in which participants were provided with a provocative statement, asked to discuss this statement in groups and to record their viewpoints.

Lofthouse and Lilley (2006) contend that it is *"sensible to use more than one method of data gathering to maximise the data collection potential"*. It was originally envisioned that sound recording via localised microphones would be used to capture group discussions during Provocations. However, the hire and AV support costs coupled with the time required to analyse the resulting DV tapes (Evans et al., 2002) was considered prohibitive.

As an alternative, an A3 template presented in Figure 4.3 was developed for groups to record their discussions. The template featured the given statement, spaces to record *for* and *against* arguments and a space to record a consensus conclusion. Four statements were devised to address the research questions set for this activity and to test theories and assumptions which had arisen from the literature review, Chapter 2.

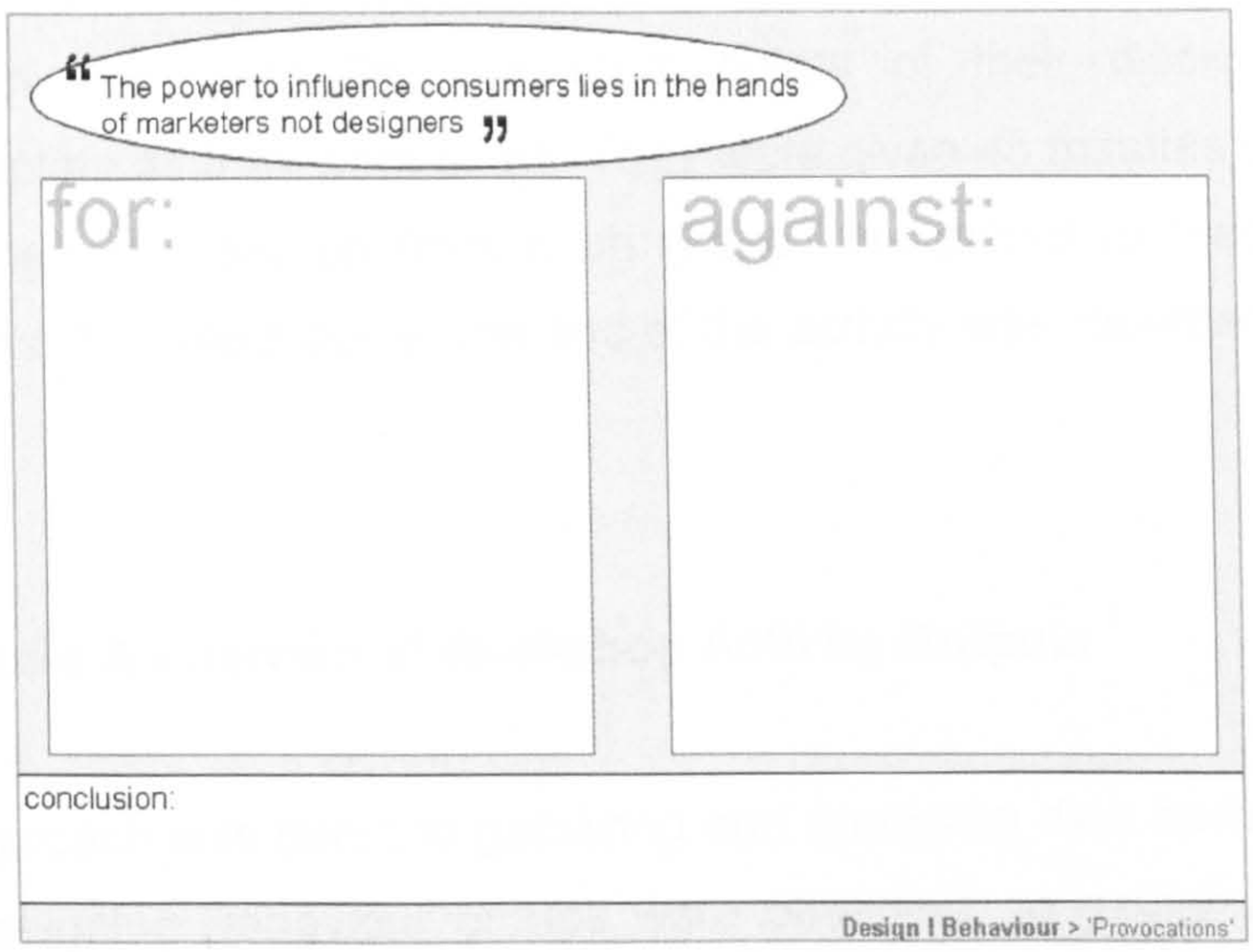


Figure 4.3: Example of Provocations Template

As seen in Table 4-1 below, these statements were deliberately phrased in a provocative way to encourage the participants to discuss and debate the issues and to fulfil the objectives of the study.

Objective(s)	Provocative Statement
To understand what designers consider their responsibilities to be for the way in which consumers use the products they design.	'The power to influence consumers lies in the hands of marketers not designers' 'The designer's responsibility ends when the product reaches the shelf'
To gather designers' perceptions of the ethical and operational issues involved in Designing for Behavioural Change.	'Products which surreptitiously control consumer behaviour impede user's ability to regulate their own behaviour'
To test designers ability to engage with Design for Behavioural Change without the introduction of methodologies or approaches. To collect documentary evidence of the design processes and techniques adopted for subsequent analysis.	'Designers don't need methodologies or approaches they need problems to focus on'

Table 4-1: Relationship between Provocations and Objectives

The provocative statements were printed on the A3 templates and distributed between the six groups. In addition, some blank templates were given to each group for them to

create and address their own provocation. The participants were asked to discuss each statement in turn, recording the main points of their discussion on the corresponding template as they went along. They were given 45 minutes to discuss the statements and then one person from each group was asked to feedback on the groups' conclusions. The feedback at the end of the activity was recorded in note form by an observer.

4.3.4 Data Capture & Analysis of Workshop Activity Outputs

A triangulated approach was taken to gathering and analysing data from the workshop activities. The Designing Behaviour groups were observed, to gather impressions of their approach to solving the design challenge. Visual outputs such as sketches, brainstorming sheets and completed templates were collected and reviewed to evaluate the content in relation to the objectives set out for this activity. As is often the case with the analysis of qualitative data, the understanding reached and the conclusions drawn is the result of an intuitive process of analysis which draws heavily on this researcher's interpretation of the data. As discussed above, the analysis of visual outputs can be highly subjective, particularly if conducted without the participant present to clarify points. The researcher may misunderstand the meaning or significance of images, place greater emphasis on certain ideas, or contaminate the findings with their own interpretations (Bruseberg and McDonagh-Philp, 2001, McDonagh et al., 2002, Costa et al., 2003). The inclusion of a feedback session helped in some way to overcome this problem. Each group's presentation was recorded. These recordings were then partially transcribed to extract verbatim descriptions of group concepts. In addition, notes were taken during the presentations. The data collected from this activity was reviewed to extract data on the analysis and design processes used and typologies of design concepts generated. For Provocations the approach was slightly different as the majority of data emerging from this activity was largely verbal or written rather than visual. The templates generated during the discussions were collected and reviewed to evaluate the content. To ensure accuracy, quality and accessibility the notes taken during each presentation were written up directly after the event took place (May, 2001).

Although several software packages are available to fulfil this task, a manual approach was taken to sorting the data. Through continuous reading, re-reading and typing an in-depth familiarity with the content was established. In order to cross reference the

perceptions gathered, a mind map was created. Mind maps *"unravel and clarify situations in a way that reduces complexity"* (Craig, 2000) and are particularly useful when dealing with a range of different information sources. They enable the researcher to cluster or group issues with similar patterns or characteristics together around a series of themes (Craig, 2000, Buzan, 1993). Repackaging the data in this way enables the researcher to identify linkages, evaluate the plausibility of influence, control or causality in relationships and build a logical train of evidence to support theories (Craig, 2000, Robson, 2002).

4.4 'Designing Behaviour' Results

Three groups participated in this exercise and they selected the following cards;

Group	Card One 'Product'	Card Two 'Design Challenge'
Red Stars	Hair Straighteners	Create emotional attachment
Yellow Stars	Handbag	Increase resource efficiency
Green Stars	Hairdryer	Encourage communal use

Table 4-2: Selection of Cards by Groups

The results described below combine observations drawn from the participant's discussions, the written and drawn evidence produced and notes taken on their presentations.

4.4.1 Emotional Attachment to Hair Straighteners

As part of their initial brainstorming session, shown in Figure 4.4, the red stars considered straighteners 'role', questioning their significance and why they exist as a product. They did not use the templates provided to carry out this analysis, preferring to write or draw their notes.

This group considered straighteners to be an essential item linked to the user's sense of self esteem and personal identify. The group made connections to notions of beauty, social pressure, human need and fashion.

Figure 4.4: Red Stars Brainstorming

They went on to discuss that the environmental and social consequences, symbolic or personal value associated with a product are not readily visible to the consumer. They visualised these factors as a *rucksack* which comes with (or sits behind) the product. The group decided that they needed to make more of this relationship between the user and the *rucksack* – to encourage the user to form more of an emotional bond with the product. To this end they began to question how they could encourage the user to relate to the manufacturers or suppliers more directly, to link owners to where their product came from. Other complementary ideas focused on creating an emotional bond between the user and the product through shaping their experience. These included; designing the straighteners for graceful aging and using materials which mould to the users hand.

Two main concepts were presented, each rooted in a specific context of use; *Get your head straight* centred on individual patterns of use (particularly the morning grooming routine). The group described *piggybacking* scenarios in which the straighteners could interact with other products used as part of a morning routine. Figure 4.5 illustrates their concepts for capturing the residual heat from the straighteners, which continues to be produced after use to boil a kettle. This figure also shows how heat could be collected from other appliances to heat the straighteners i.e. inserting them into the toaster slots.

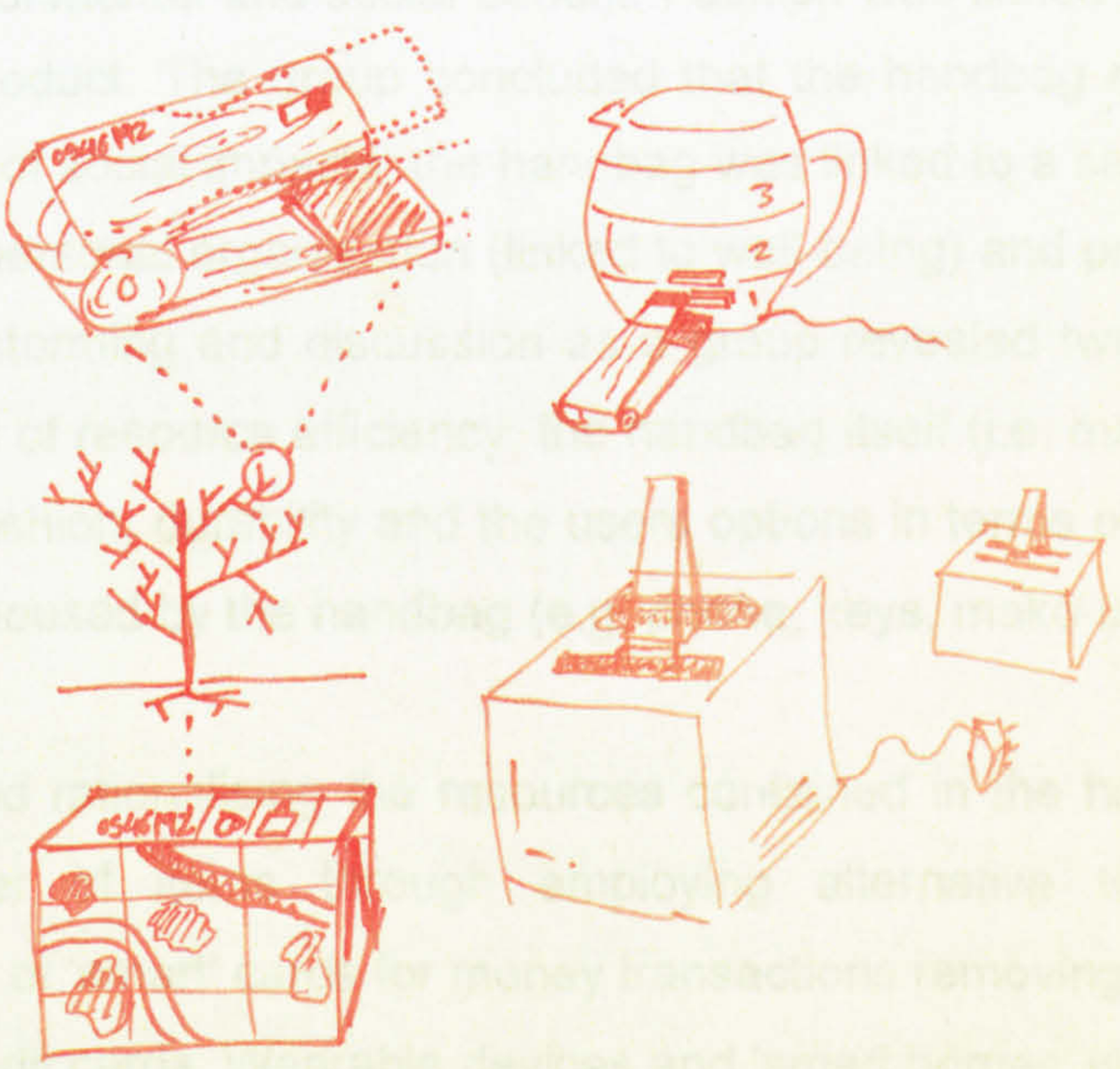


Figure 4.5: Red Stars Conceptual Sketches

Connections to the 'rucksack' were made through providing specific information on the origin of the materials specified; the packaging for the straighteners, for example, was a recycled map which depicted the exact location of the wood specified for the handle. Within the second concept the group attempted to tackle a communal use scenario by creating a DIY hairstyling *shop*. The shop exterior was comprised of several straightener *ports* which were fixed at different heights. These straighteners were to be powered by solar panels set into the shop front.

The red stars group worked predominately in a visual mode, using sketches, diagrams and visual mind maps to relate ideas to one another. Their discussion was animated and they readily bounced ideas off one another to build concepts. They created final visual sketches for the presentation pitch and communicated their concepts using these sketches. They did not use the template provided for the initial task as they found it restrictive in terms of space and process.

4.4.2 Resource Efficiency of a Handbag

As part of their initial brainstorming session, the yellow stars used the template provided to list the environmental and social impacts of use. They considered the role a handbag plays in protecting the contents from damage, theft or loss of privacy; they felt this was both an environmental and social benefit. Fashion was linked to the longevity and lifespan of the product. The group concluded that the handbag may have more than one life. In terms of social impacts; the handbag was linked to a sense of personal identity, self esteem, personal organisation (linked to well-being) and protection (or self defence). Initial brainstorming and discussion as a group revealed two main areas of consideration in terms of resource efficiency; the handbag itself (i.e. materials, lifespan which was linked to fashion, durability and the users options in terms of repair) and the objects or resources housed by the handbag (e.g. phone, keys, make-up etc).

The discussion around rationalising the resources contained in the handbag involved reducing the number of items through employing alternative technologies i.e. biometrics in the form of 'smart' cards for money transactions removing need for money and a multitude of credit cards. Wearable devices and 'smart homes' were also cited as methods of dematerialisation. These technologies, it was felt, could result in there being no bag at all. The final concept, 'Bags of Choice', was a product service system in which the handbag 'chassis' could be retro-fitted each season with the latest

accessories and features which the user could rent from the service provider via the company website. Highly personalised, this handbag would be bespoke to suit the needs of the user. Resource use would be maximised through the rental arrangement and the chassis' lifespan would be elongated. This group worked mostly in written format, using mind maps and lists. Their presentation featured two scenarios which were narrated for the audience. These scenarios depicted how the bag could be updated with new accessories and how the user could access the website to choose and order new components.

4.4.3 Communal Use of a Hairdryer

The green stars group had perhaps one of the most challenging combinations in that the hairdryer is generally perceived to be used individually. The group began by considering the environmental and social impacts of use. The two greatest factors identified as having an environmental impact were energy use and difficulties in disassembling the product to separate out materials for recycling. Repair seemed to be considered as practicable. In terms of societal impacts, the group linked the hairdryer to notions of image and appearance and cited its benefits in terms of convenience.

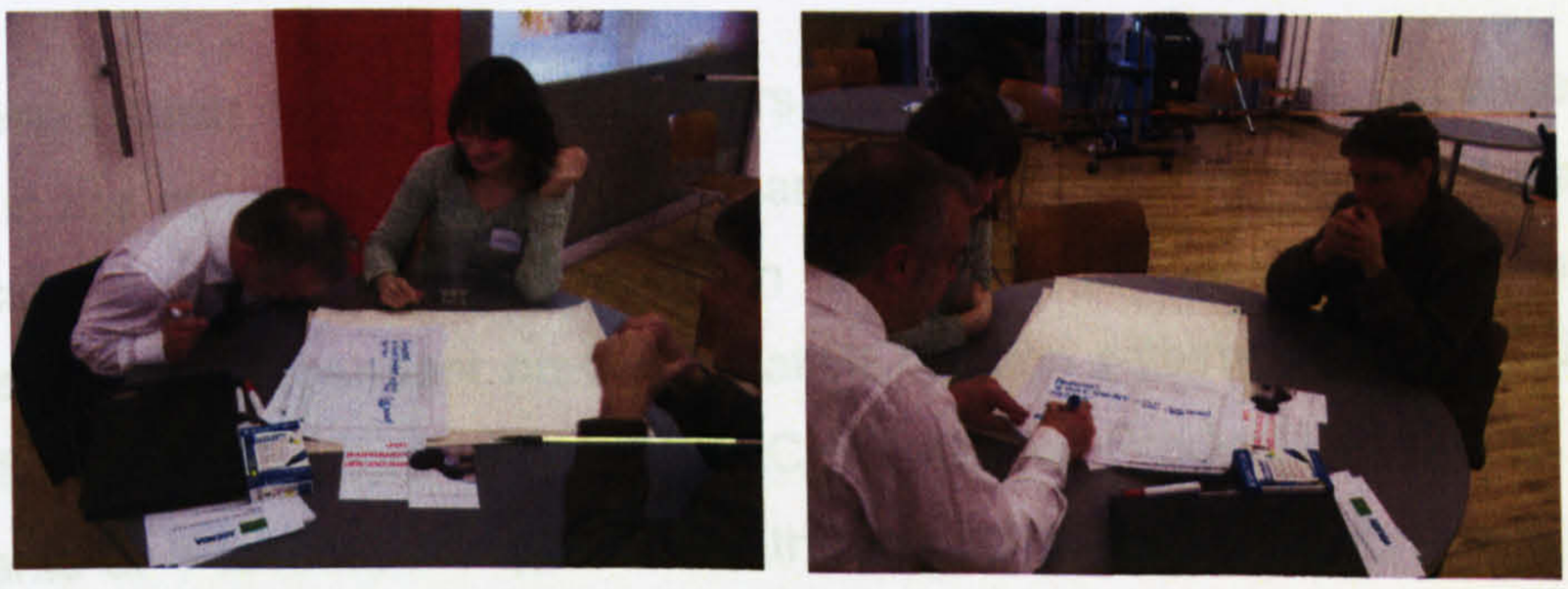


Figure 4.6: Green Stars Brainstorming

The group considered the problem from a difference perspective by considering a parallel communal activity some people may participate in i.e. taking the bus to work. This helped them to re-frame the brief by prioritising the service or commodity produced i.e. drying hair, rather than the product itself. The *'dry and fly clean commuter bus'* features hairdryers which are powered centrally by the bus. These hairdryers, which drop down from the roof, are free for use by individuals. The user saves time by completing two tasks simultaneously (travelling to work and drying their hair), saves

money by reducing energy consumption at home, and benefits from increased social contact.

The group presented this concept using a visual storyboard scenario depicting the daily morning routine of a user who may have woken up late. This user has no time to dry their hair but still wants the convenient service provided by the hairdryer. So they hail the *'dry and fly clean commuter bus'* and use the shared facilities. They reach their workplace on time, with styled hair and enough time for a coffee.

4.5 'Provocations' Results

Analysis of the outcomes of this activity resulted in a collection of responses which were sorted into emergent themes. These included; perceptions of designers' responsibilities for product use, perceptions of the value of designing for behavioural change and whether problems are more or less valuable in motivating idea generation than specific methodologies.

4.5.1 Designers' Responsibility

Some respondents felt that the designers level of influence was dependent on their position in the company, how they work and with whom. This viewpoint was reflected by participants of Design for Durability, an EPSRC workshop, who felt that a designers influence may be dependant on their relative position within the organisation and the level of freedom this affords them (EPSRC Network on Product Life Spans, 2006). The participants of 'Provocations' pointed to the loss of in-house design as a contributing factor in making marketers more influential. In these organisations, they contended, the marketing department sets the brief and determines which projects go forward. They reasoned that in a smaller organisation the designer may have more influence. This viewpoint was reflected by the Design for Durability participants who felt that *"marketing managers often ha[ve] greater power than designers within companies"* (ibid, p. 2).

Respondents felt that designers need to be involved earlier in the project to identify the problem and generate the brief. Indeed, the Design for Durability participants confirmed that *"designers are often not involved in the 'thinking stage' of business strategy (i.e.*

product development) and simply respond to higher level decisions" (ibid, p. 4). If it is not possible to generate the brief from inception, the respondents to 'Provocations' felt that designers need to challenge existing briefs to ensure behavioural concerns are incorporated. User centred research was seen as key in enabling designers to anticipate and respond to issues arising from user behaviour. However many felt that once a product is on the market the designer's *active* contribution ends and from that point on they can only monitor the product and reflect on its use. Those reflections could however be used to inform design decisions made regarding future products. Some respondents felt that designers should monitor and reflect on the use of products they design but not necessarily be *responsible*. Others felt that responsibility for use and disposal should be accounted for within the design remit. They discussed the fact that although there is liability in terms of safety, there is no liability in terms of how the product is used. Manufacturer liability, they concluded, should be extended to include responsibility for finding out how users use their products.

4.5.2 Perceptions of "Designing for Behavioural Change"

Analysis of the group discussions revealed a number of issues concerning the use of products to influence or control user behaviour. The semantics of the terms used to denote the strength of product influence appeared to be an important issue for participants; they seemed to favour *influencing* or *persuading* rather than *controlling*. To *control* behaviour, they felt, would be disempowering, as the users ability to act autonomously would be removed. Regulating behaviour automatically would inevitably increase the user's dependence on the product to make decisions, impairing their ability to function independently and deskilling them in the process. It would also reduce their ability or motivation to learn about the consequences of their actions. Taking control away from the user would perhaps be annoying; users would, they concluded, want to retain some measure of choice and be able to override decisions taken by the product. Conversely, some respondents felt that behaviour influencing products would simplify user's decision making process. They cited examples of particular actions taken by individuals that if automatically regulated, would benefit society; such as the safety benefits inherent in ensuring people wear seatbelts.

The majority of respondents recognised that there is need to educate people, so that they become aware of the consequences of their behaviour. Providing feedback was considered to be a really powerful way to influence user behaviour. Many felt that it

was important for users to receive feedback on the impact of their behaviour, and that primarily this feedback should focus on short term not long term consequences.

4.5.3 Problems versus Methods

Some respondents reasoned that designers are trained to solve problems anyway, and that repeated problem solving is how designers learn. These respondents felt that designers do not necessarily require methodologies design for behavioural change, they just need to be given (or to identify) the right problem. Most designers, they concluded, already have their own approach which is tailored to the particular project. A small group of respondents, however, reasoned that designers need both. The issue, they felt, is in defining the problem and designers could benefit from the use of a methodology to identify the problem, not necessarily to aid the design process.

4.6 Discussion

The discussion that follows reflects on both the design process adopted by the groups and the outcomes generated as a result. Two areas of concern emerged when reflecting on the design process; how did they analyse the product and how were ideas generated and developed. The design outcomes generated were contrasted with the findings of the literature review discussed in Chapter 2 and three areas for discussion emerged; the need to consider the social context in which the product is used, the need to reconnect the user to the realities of the consequences of manufacture and use and the importance of framing the consequences of actions taken in the short term.

4.6.1 Product Analysis

The participants of 'Designing Behaviour' acknowledged the multi-faceted role products play in the life of their owners. They recognised not only the practical utility products provide but also the personal, spiritual and symbolic nature of these artefacts. This knowledge, grounded in the theoretical studies concerning models of consumptions demonstrates their appreciation of the complexity of the relationship between the product and the user.

The importance of user centred research, though not undertaken as part of 'Designing Behaviour', was raised within the 'Provocations' discussions. The designers who took part in 'Designing Behaviour' did not have an opportunity to carry out user centred research so instead relied on their own experiences of using their chosen product coupled with their tacit knowledge and understanding of the environmental and social impacts of its use. Designers are also consumers and can, therefore, offer personal insights, anecdotes and perceptions.

4.6.2 Idea Generation

The participants of 'Designing Behaviour' used several fairly standard techniques to generate designs by linking concepts together. These included; brainstorming, creating visual mind maps and diagrams and sketching. What was particularly interesting was the use of storyboarding to build a context of use or to describe the patterns of use relating to the redesigned product. The second approach which stood out was that taken by the Green Stars, who concentrated on the service or function afforded by their chosen product rather than the product itself. This strategy has obvious links to theories surrounding the benefits of moving towards product-service systems. Yet there is also a link between this approach and research discussed in the literature review which indicates that users are more concerned with the *commodity* afforded by products, than the goods themselves (Taylor et al., 1999, Linscheidt, 1999).

The consensus opinion seems to indicate that any tool or approach to aid designers in designing for behavioural change would fit most appropriately into the process of generating the brief or defining the problem. As many felt that to ensure behavioural concerns were considered, designers would need to be involved earlier in the project to identify the problem and generate the brief. This process would, based on responses, be co-located with user centred research activities to uncover emergent social and environmental issues resulting from user behaviour.

4.6.3 Context Specific

The respondents seemed to acknowledge, through their design concepts, the importance of considering the social context in which a product will be used. Most used mapping and storyboarding techniques to develop a profile or scenario of use associated with their chosen product as inspiration for their design solution. Some of

these participants tailored their concepts to integrate into established social patterns and norms. The Red Stars, for example, envisioned a typical morning routine and used this as a basis for generating complementary functions to fit into established social patterns and norms e.g. using residual heat from a toaster to power the straighteners. The reuse of operational by-products such as 'wasted heat' to power an additional process has also been used in another concept design. The Hot Fridge reuses *wasted heat* released by the condenser unit, which when repositioned at the top of the Hot Fridge, can be used to keep food placed on the top warm (Kim H, 2005). As discussed in the literature review, the individualised pattern of use associated with products is often the result of habits and routines which are reinforced and ingrained over time (Jackson, 2004b, Heiskanen and Pantzar, 1997). Integrating new practices into an established routine is therefore a prudent approach to ensure their acceptance and continued practice.

4.6.4 Reconnecting the User

There were several approaches taken with the aim of reconnecting the user with the environmental and social consequences associated with the manufacture and use of the product. This was dealt with in different ways; one approach was through reducing the use of ICT systems within the product, an approach which one participant felt could encourage more *hands on activity* between user and product. This links to the ideology associated with human powered devices, as discussed in the literature review, Chapter 2. Another approach was to create a connection or association in the users mind to the origin of the materials used to manufacture the product and its packaging. This approach is similar in some ways to the approach taken to advertising and packaging Fair Trade produce.

It was felt that any approach generated should be both context specific and product specific, understanding the user 'type' was also considered vital to ensure interventions are tailored to address specific user behaviours effectively.

4.6.5 Short Term Consequences

Many Design I Behaviour participants felt that feedback on the impacts of user behaviour should focus on short terms consequences not long term. This viewpoint reflects those expressed in the literature who state that localised problems rather than

global issues are more likely to be considered by consumers as within their sphere of influence (Gordon, 2002, ESRC Global Environmental Change Programme, 2000).

4.7 Conclusions

The inference which could be drawn from the discussions which took place during 'Provocations' is that designers *could* take some responsibility for identifying behavioural concerns associated with the use of the products they design. However, the consensus view indicates that respondents do not perceive designers to be solely responsible for how people use the products they design.

One of the benefits of this workshop activity was considered to be motivational value inherent in being encouraged to think about product design in a different way by having a different objective or focus. One respondent felt that these factors *"forced [him] to innovate"*. Respondents felt that although many of the concepts generated would never proceed into full production unchanged, in being free to generate ideas for concepts there was the potential to 'scale-back' and refine these ideas into workable products.

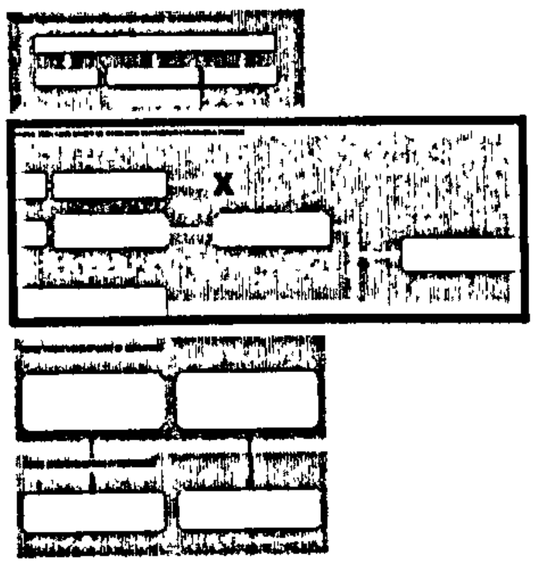
The terms adopted within any tool or approach to describe the strength of product influence should, according to responses, be worded as *influencing* or *persuading* rather than *controlling*. There was strong agreement by participants that 'behaviour changing' product ideas need to be prototyped and that these prototypes need to be tested with consumers.

4.8 Next Steps

Following the Design I Behaviour workshop, it was felt that a more in-depth, product specific study was required to examine the feasibility and applicability of applying Design for Behavioural Change approaches to reduce the *social impacts* of use.

5 MOBILE PHONE CASE STUDY: EXPLORING SOCIAL IMPACTS OF USE

5.1 Introduction



This chapter reports on **Part One** of **Phase Two** of the primary research. It presents the methodology and findings of two preliminary user studies and the main user study exploring perceptions of mobile phone use in public.

The aim of this phase of the research was to explore designing for behavioural change in further depth using a single product type, in this case a mobile phone. It was felt that mobile phones would make an interesting case study as they are not only functional devices, but also have emotional and cultural significance. They are used in a range of contexts (home, work, in public, in private) and by a diverse group of customers.

5.2 Societal Impacts of Mobile Phone Use in Public

The wealth of industrial and academic research dedicated to investigating mobile phone use, coupled with commentary from the media, grass roots consumer groups, the police service, and various government agencies demonstrates that the proliferation of mobile phone use, particularly in public places, is an emotive issue.

In the past, telephone conversations always took place in private in a fixed location, 'mobile' phones by their very design, remove these boundaries. They are free of spatial restrictions and fixed societal constraints, allowing the user unlimited interaction in a range of situations and spaces. The rapid assimilation of mobile phones into everyday life has modified cultural norms and practices altering society's definition of acceptable behaviour within the public domain (Bautsch et al., 2001, Lasen, 2004). Spatial boundaries are constantly being renegotiated to suit individual desires (Burgess, 2004). Despite the abundance of user guides and voluntary codes of conduct for appropriate mobile phone etiquette, society has yet to develop any effective methods by which to deal with emergent impacts incurred from mobile phones presence. A collective agency exists in which capabilities and performances are divided between people and devices (Lasen, 2004). This divide, configured by the designer (Akrich, 1992), creates a interdependent relationship. Mobile phones act as an extension of the user, amplifying

their abilities and projecting their virtual presence whilst signifying status, wealth and lifestyle to others. Inert until activated the mobile phone is *"deaf..., blind and completely depend[ant]... on the user to manage its state"* (DeVaul and Dunn, 2001) yet its autonomy is apparent in its ability to fixate, enrage and pacify its user (Lasen, 2004).

The architecture of the phone box once acted as a physical signifier to others that the caller had moved out of public territory into private space (Locke, 2002). With the proliferation of mobile phones these physical and architectural signifiers have become largely obsolete. For the most part, the obligation is placed on the user to use their phone appropriately (Fulton Suri and IDEO, 2005). Users negotiate their own rules of engagement (Burgess, 2004) and it through this process of *appropriation* and *assimilation* that the impact of the product is enacted to a greater or lesser degree (Humphreys, 2005). Entering into a private conversation in public often requires the user to mentally move out of physical space into virtual space – creating a *"temporary intimate zone"* (Locke, 2002). The zone that Locke describes is not a physical boundary separating the individual from the communal; rather it is a virtual space which moves dynamically with the user impacting on everyone in the vicinity. This could be termed as the user's *consumption space*; the intersection of the user's *consumption space* with physical space is shown in Figure 5.1.

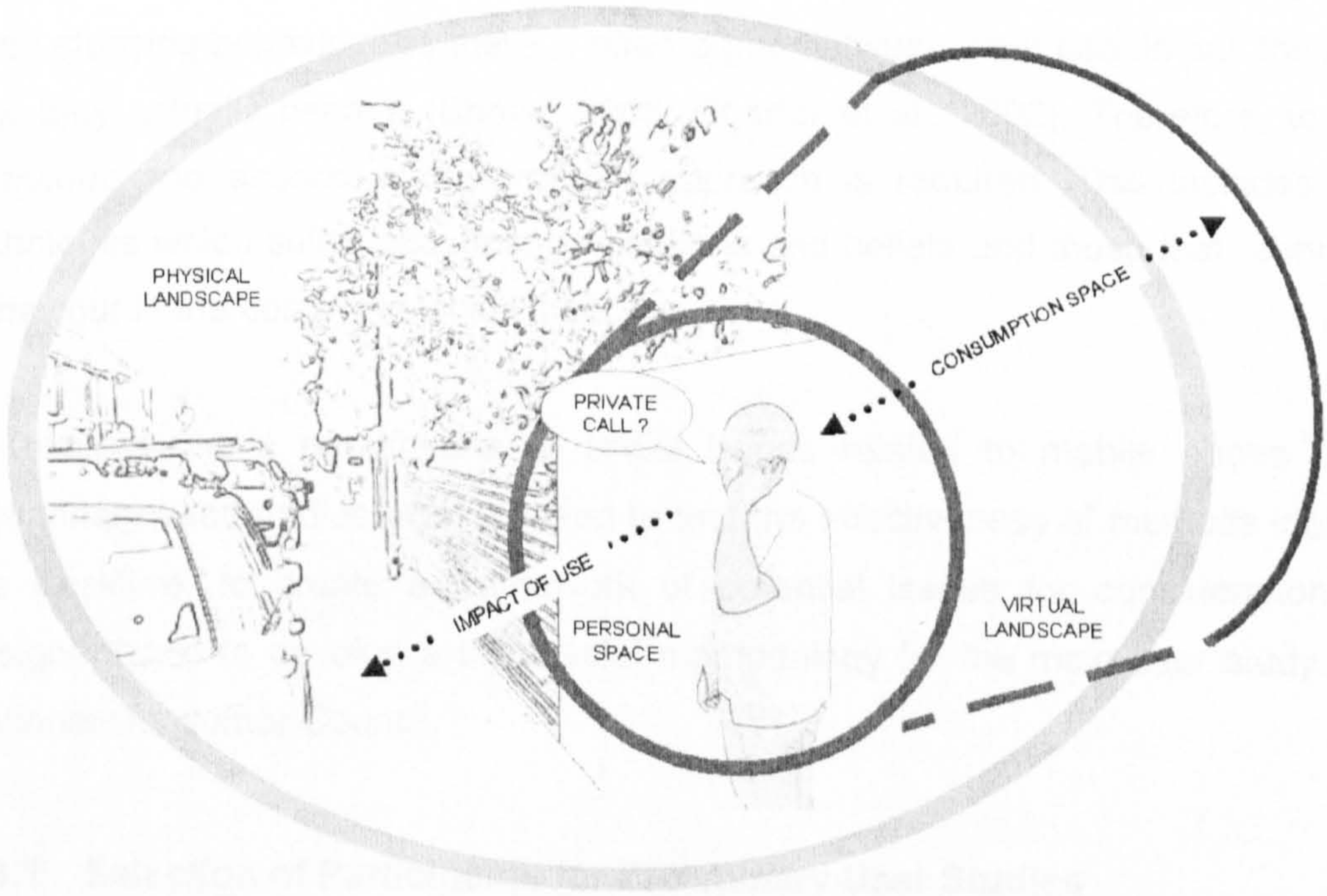


Figure 5.1: "Consumption Space"

A mental shift is required to enable the user to inhabit both 'worlds' simultaneously. Plant points to the emergence of a *"kind of bi-psyche"* a *"new mode in which the human*

mind can operate" (Plant, 2002). Although the user may feel as though they have entered into a private conversation, this interaction is often enacted in the presence of others who are affected by their actions.

5.3 User Research Studies

Literature collected investigating mobile phone use in public places typically involves the use of ethnographic and observational research techniques, such as; in-depth interviews, examination of phone bills, voice mail diaries, observational fieldwork, focus groups and recording discussion via online forums (Palen et al., 2000, Bautsch et al., 2001, Ling, 1997, Lasen, 2002). In some cases these techniques were combined in one study, run either in parallel or consecutively. Reviewed literature indicated that activities run consecutively can provide the researcher with an opportunity to validate and test ideas gathered in the preceding activity with the participants of the next. Ling (1997), for example, converted initial impressions gathered via an online forum discussion into specific questions in subsequent focus groups.

Combining different approaches in a study helps researchers to observe the problem from a range of perspectives (Lofthouse and Lilley, 2006). This is particularly relevant when studying behaviour as there is often a gap between what people say they do and how they actually behave (Shove, 2003, Charter et al., 2002). Therefore, to capture *intentions* and *actions* a two-pronged approach is required. This includes utilising techniques which solicit opinions, perceptions and beliefs and those that record actual behaviour in the context in which it occurs.

To explore user's perceptions of social issues related to mobile phone use, two preliminary user studies were devised to test the effectiveness of methods identified in the literature, to create a framework of potential issues for consideration by the designers and to develop a successful methodology for the main user study with the National Consumer Council.

5.3.1 Selection of Participants for Preliminary User Studies

To meet the requirements of the preliminary user studies, participants needed to be regular mobile phone users, to live or work within easy travelling distance of the researcher and be aged between 21-30 or 51-70. Prior research suggested habitual

mobile phone users and younger users tend to be less concerned about the social impacts of their own use and less judgemental of others than infrequent or older users (Bautsch et al., 2001, Lasen, 2002). Age and usage patterns, therefore, were of particular interest. Table 5-1 illustrates the composition of the participants involved;

	Participant Code	Age	Phone Make & Model
Preliminary User Study A:	User_D-01	51-60	Nokia 3310
	User_D-02	61-70	Motorola T720i
	User_D-03	21-30	Sony Ericsson T68i
	User_D-04	21-30	Motorola V50
	User_D-05	21-30	Sony Ericsson T610
	User_D-06	21-30	Phillips 535
Preliminary User Study B:	User_I-01	21-30	Motorola V300
	User_I-02	21-30	Nokia 3310
	User_I-03	21-30	Siemens C25E
	User_I-04	61-70	Nokia 3310
	User_I-05	51-60	Siemens A55

Table 5-1: Composition of Participants for Preliminary User Studies

5.3.2 Methodology for Preliminary User Study A

Mobile phones are used in a variety of contexts, day and night, for different purposes. This range of variables made the prospect of one researcher manually observing and recording use a challenging proposition. To adequately capture the range of behaviours involved across a cross section of users via observational fieldwork; time, effort and extensive resources would need to be deployed. User diaries are often used in *"situations where researchers find it difficult to observe customers first hand"* (Evans et al., 2002). This method was considered a viable alternative for the purposes of the preliminary user study. User diaries are *"an inexpensive method of gaining an insight into the everyday use of products and the associated habits, behaviours, problems and difficulties"* (Lofthouse and Lilley, 2006). In a typical study users are asked to record activities over an eight to fifteen day period in response to a specified agenda set by the researcher (Maguire, 2001). The reported ways in which people record data include; taking photos, writing accounts, recording video or audio diaries and making drawings or sketches (Evans et al., 2002, Maguire, 2001). To enable the information gathered to be easily compared Maguire (2001) recommends the inclusion of both structured multiple choice questions and open-ended sections.

For this study a diary format was devised, Appendix B. This featured a daily timetable in which users were asked to record their activities. Including a brief description of their behaviour when using the phone, the time it took place and where they were located.

The context in which the behaviour occurs is, as discussed in the literature, an important variable as this can influence the type of behaviour and the consequences of actions taken. An example diary entry was provided to illustrate how to fill out the table and a short user profile questionnaire was also included. The duration of the study was four days, from a Friday to a Monday. The short duration of this study was considered applicable given its role as a preliminary data gathering exercise. If successful, the duration may have been extended in line with Maguire's recommendation of eight to fifteen days.

5.3.3 Methodology for Preliminary User Study B

Typically used to access a wide range of respondents, questionnaires, particularly those self-administered, can be subject to poor response rates. They are however, if correctly constructed and coded, fairly efficient in terms of the time and effort required to distribute, collect and analyse them (Robson, 2002). The questionnaires for this preliminary study were distributed to a small sample group via e-mail a short time before the scheduled interviews. Participants were explicitly informed that their questionnaire responses would form part of the interview questioning. This provided the impetus to complete and return the survey on time.

Questionnaires can feature either open or closed questions, or a combination of both. Robson (2002) sets out the differences between these two types of questions. A set questionnaire featuring mostly closed questions can limit the amount of information that can be gained as discussion is minimal. Additionally, responses may be recorded without reasoning or explanation leaving *"the researcher ....ignorant of the many factors influencing the choice of response to a question"* (Robson, 2002, p. 253). The use of open ended discussion questions can provide respondents with an opportunity to respond to an issue in more detail. However, responses to these types of questions may require more detailed analysis to extract, compare and collate similarities and differences in opinions.

The questionnaire and the interview guide were piloted and went through several iterations to refine the questions, as seen in Appendix C and Appendix D. This ensured that relevant and useful data was obtained and made the questionnaire more user-friendly. The final version, found in Appendix D, was comprised of four pages, featuring 12 questions. The first eight were essentially closed questions with some prompts to

encourage respondents to explain the reasons behind their response. Questions one and two concerned personal information, three concerned the type of phone and payment method e.g. contract versus *"pay as you go"*, questions four through to seven sought to explore users perceptions of adequate lifespan compared to the reported duration of ownership allied with the inclination to prolong life. Questions four to six in the first draft of the survey, as illustrated in Appendix C, were amalgamated into the table featured in question eight in the second iteration, shown in Appendix D. This not only simplified the layout but also enabled feedback to be gained on whether users had a particular feature, how often they used it and the reasons why they didn't use particular functions. The final four questions, concerning perceptions of the environmental and social impacts of mobile phone use, were open ended questions designed to solicit a greater depth of discussion.

Activities run consecutively provide opportunities to validate data gathered in one activity with the participants of the next (Ling, 1997). Following the questionnaire with an in-depth interview would enable data gathered in the questionnaire to be clarified and expanded upon. Running these linked activities consecutively would also enable the participants to consider, and revise, their responses having had some additional time for consideration.

Using a pre-prepared agenda of issues, as a structure for the interviews enables discussions around specific issues to be reproduced with other participants allowing comparisons to be made. A guide also enables the researcher to quickly move on if the discussion is becoming irrelevant or unhelpful. The interviews may be recorded which assists in the analysis of the perceptions gathered and forms a record of the discussions. Interviewing can, however, be time-consuming in terms of preparation, travel, and transcribing audio tapes (Robson, 2002) yet in this case only five individuals were interviewed for between 30-60 minutes, the majority were carried out in the respondents home or at their place of work, limiting their need to travel and the locations of the interviewees were, as discussed above, within a reasonable traveling distance for the researcher. A sample interview transcript can be found in Appendix E.

5.3.4 Main User Study: NCC Questionnaire

The purpose of the main user study was to gain an understanding of mobile phone users' level of awareness of social and environmental impacts of use and to build on and attempt to validate the results of the preliminary user studies.

This study was run in partnership with the National Consumer Council's Consumer Network Panel. The National Consumer Council (NCC) ensures consumer's rights are protected by conducting research and policy analysis into key consumer issues in order to influence relevant organisations and people. It advocates responsible consumption and as such is committed to research in this area. The Sustainable Consumption Roundtable, for example, a collaborative initiative of the NCC and the Sustainable Development Commission (SDC), aims to create a shift in lifestyles by providing practical advice (National Consumer Council, 2005). The National Consumer Council regularly canvas consumer's views through the Consumer Network, a panel of 258 nation-wide volunteers. The panel are canvassed via quarterly postal surveys and are informed of the results of the surveys in Bulletin, a quarterly newsletter.

5.3.5 Selection of Participants

The Consumer Network Panel is comprised of 258 members of the public who reside across the UK. The group is weighted towards females (56%) and is predominantly populated by 56-65 year olds who constitute a quarter of the panel. The proportion of under 35's is significantly lower at 18%. The dominant ethnicity is White/British (91%). Disabled panel members equal 30% of the whole. Although not demographically representative of the UK population, a broad range of responses at this stage of the research was sufficient in order to formulate an understanding of the level of awareness of mobile phone users of the social and environmental impacts of their own and others use.

5.3.6 Methodology for Main User Study

An appropriate research methodology for this survey was negotiated with the National Consumer Council. Face-to-face interviews may have been a preferable option to enable more in-depth investigation. However, cost and time considerations, data protection issues and personal security concerns of traveling to panel member's homes

prohibited this. Focus Groups were also suggested as being a means of accessing a range of opinions, with the added benefit of mixed discussion and debate around the issues. A focus group methodology was quickly discounted however, due to cost constraints and the logistical difficulties involved in transporting members from all over the UK to one venue.

The user diary methodology used in preliminary user study A was not as successful as originally envisaged. Participants recorded banal behaviours with little explanation of their motives or reasons for these behaviours, for example, *"put phone in pocket, got in car, took phone out of pocket, plugged in charger, put phone on car seat"* (User_D-04). Due to the lack of depth in the information provided it was difficult to discern participants' logic for taking a certain course of action. This lack of information prompted more questions than provided answers such as; why put the phone on the seat? is there a hands-free cradle in the car? how will the user answer it if it rings? Other participants were able to discuss their motivation for certain actions for e.g. *"took phone out of back pocket before sitting on seat to avoid breaking it"* (User_D-02). Where an explanation was provided the data was significantly richer, but these instances were few. In hindsight, it may have been more productive to combine the user diary, with Product-in-Use and in-depth interviews, as this would have enabled the 'automatisms', i.e. automatic behaviours to be captured and would also have provided an understanding of the participants motive. This data could then be compared with participant's diaries to discern conscious from unconscious behaviour. For these reasons, the user diary methodology used in the preliminary study A was discounted as a potential approach for the main user study.

A self completion postal questionnaire was selected as the most appropriate methodology for the main study, because it is an efficient, cost effective method of gaining a large set of data (Robson, 2002). The NCC Consumer Network members are familiar with this technique as the primary means of providing feedback via quarterly postal surveys. Concerns regarding the depth and quality of responses to the questionnaire were raised. Completing unsolicited postal surveys can be seen as *"a tedious chore to be completed in a perfunctory manner"* (Robson, 2002, p. 253). The panel members, however, volunteer to be involved in contributing to surveys and therefore tend to think more deeply about their responses. Additionally, despite the typically low response rates associated with postal surveys (Robson, 2002) previous NCC Consumer Network Panel surveys have garnered reasonable response rates,

37% on average. Response rates to previous surveys conducted by the National Consumer Council are detailed in Table 5-2 below;

Title of Survey	No. of surveys distributed	No. Returned	Response Rate (%)
Sustainable Living	258	111	43%
Water Metering	258	93	36%
Child Trust Fund	258	85	32%

Table 5-2: Reported Response Rate to Previous NCC Studies

To increase the potential response rate, the questionnaires were distributed to all 258 members by the National Consumer Council with an introductory covering letter. This letter outlined the aim of the survey, indicating the intentions of the researcher to publish the findings as part of the research and conveying its importance to the investigation (Robson, 2002). Distribution was handled by the NCC to avoid sharing sensitive personal data and ensure adherence to the Data Protection Act. Members were given four weeks to complete and return the questionnaire in the self-addressed envelope provided. A full copy of the questionnaire and covering letter can be found in Appendix F.

129 of 258 questionnaires were returned equalling a 50% response rate. 80% of all those who responded were aged over 40. Network panel membership of under 35's is 18% which explains the lower proportion of under 30's responding to this survey, just 9%.

5.3.6.1 Questionnaire Composition

Pre-testing is an essential step in developing a well constructed, careful worded, clear and concise questionnaire (Robson, 2002). The questionnaire developed as part of preliminary user study B was tested several times. This was an iterative process, during which several revisions were made, culminating in the final version which was used for this main survey.

The NCC questionnaire was formed of four pages containing eleven questions. The first seven questions were essentially quantitative but with some qualitative elements to encourage participants to explain their answers. The latter four were entirely qualitative, open-ended questions which sought to encourage participants to discuss the question at length.

The first two questions were simple tick boxes designed to elicit basic statistical information. Question 3b, again a tick box, was included as a means of investigating whether the method of payment informs consumer's value judgements e.g. the importance placed on the phone or length of ownership for example. Question four aimed to establish data on reported length of ownership and to investigate if there is a correlation between ownership and type of payment. On reflection, it may have been interesting to ask why the previous phone was discarded. Question five investigated the rate of and reasons for upgrading various phone accessories or services. This question had quantitative and qualitative elements e.g. *number of additions made* and *reasons for doing so*. The inclusion of this question was to investigate if users are concerned with extending the life of their handset. Tied to this question is that of question six which concerned user's expectations of the longevity of the mobile phone. This enabled a comparison to be made between expectation (Q6) and action (Q4). Question seven sought to provide some indications of social usage patterns; offer an insight into respondent's level of technical competence and investigate whether additional "value-added" features are sought after. Finally, questions eight to eleven asked users to discuss their perceptions of socially and environmentally responsible behaviour when using mobile phones and any negative social and environment impacts.

Due to the extensive testing of the questionnaire format prior to the inception of this study, few problems were experienced. The exception to this being Question 5a which asked if respondents had purchased protective covers or cases. This question yielded a reasonable response rate (27%) in which reasons for purchase were overwhelmingly due to a desire to protect the phone from damage. On reflection, it is now clear that this question was, without prior intention, biased towards gaining answers which centred on issues of protection, due to the use of the term *"protective"* in the question itself. As Robson (2002) states *"small changes in wording can have large effects on the answers of many respondents"* (p. 249). This was not picked up in the preliminary user study as it was only in this iteration of the questionnaire for the NCC that the reasons why respondents had taken a particular course of action were requested.

5.3.7 Analysis Techniques for Preliminary and Main User Studies

The questionnaires for both studies contained qualitative and quantitative elements, each requiring its own tailored analysis process. Two analysis techniques were selected. Analysis of the quantitative elements of the questionnaires was carried out using Excel spreadsheets. The qualitative questions were analysed using coding and clustering.

Coding and clustering allows the researcher to elicit meaning from phrases and build theory from data (Miles and Huberman, 1994) by organising, quantifying and analysing responses (Robson, 2002). A code, usually in the form of a sequence of letters or numbers, is applied to a group of objects that have similar characteristics in order to sort or classify them (Robson, 2002, Miles and Huberman, 1994). Each code exists within a *family* of other similar codes, thereby creating *primary*, *secondary* and *tertiary* levels, allowing the researcher to draw out and illustrate the intricacies of each macro or primary theme. To prepare the raw qualitative data for analysis, responses to questions were transferred from the hand written questionnaires into typed format. Although software packages such as Nudist or N-Vivo were available to automatically sort and cluster data of this nature, a manual approach was taken. As discussed above, manual sorting allows the researcher to *"feel"* the data and through continuous reading, re-reading and typing, to gain an in-depth familiarity with the content. In this manner, the data was labelled with broad macro-codes which represented a particular theme or issue. The data was then sorted in more detail and labelled with micro-codes.

Use which minimises the risks to public health **[SOC-HEA]** and also minimises the visual impact by not requiring a continual, massive increase in the number of phone masts. **[ENV-MAST-BLOT]** The number of phone masts. This means people should ideally keep mobile use to a minimum **[ENV-ESS]** using it primarily to communicate where there isn't another convenient means available **[SOC-ESS-LAND-NO]**, rather than at every available opportunity. **[SOC-CC-BEH]**

Table 5-3: Example of Coded Response to Q10

For example, SOC-CRI-VIC, Table 5-4, is comprised of *"society"*, which is the primary level, *"crime"* a secondary level and *"victim of crime"* which is a tertiary factor. The full coding system can be seen in full in Appendix G.

SOC	Issues identified by respondents relating to societal concerns
SOC-CRI	Relationship between mobile phone use &criminal activity
SOC-CRI-VIC	Being a victim of crime

Table 5-4: Example of Hierarchical Coding System

A process of triangulation, *"using multiple and different sources (e.g. informants), methods...or theories"* (Robson, 2002, p. 290) was undertaken to justify the validity of the main study findings. Results were compared with those of the literature review and the preliminary user studies.

5.3.8 Findings of Preliminary and Main User Studies

Analysis of the findings from both preliminary studies and the main user study indicated that mobile phone users regard mobile phones to be an enabling technology which affords flexible, convenient communication, yet the use of mobile phones in public contributes to the creation of many social problems. The results discussed below can therefore be understood as a series of gains and losses associated with mobile phone use.

5.3.8.1 Changing Cultural Expectations

Mobile phones have enabled instant continuous contact. The physical affordance to switch off or screen calls is present yet users feel compelled, sometimes duty bound, to remain connected. Mobile technology is free of spatial restrictions affording instant connection, subject to the settings selected and network coverage, wherever the recipient is located, regardless of their context. Some respondents felt that there is an unspoken assumption that the mobile phone user should be available at all times, which has contributed to a loss of privacy and quiet time *"they can contact you wherever you are at any time, there's no escaping from people"* (User_I-05). Some considered that mobile phones have changed societal expectations of what constitutes work hours *"people expect to contact you at any time – there is no longer a 9 to 5 attitude to availability"* (NCC_62). This is certainly confirmed by observations of the extensive business use of mobile phones on evening commuter trains.

Two distinct groups of places or circumstances in which users felt the need to switch off their phones emerged. The first group constituted public places designated as 'mobile free' zones where use is strictly prohibited. These included; trains, hospitals,

doctor's surgeries, airplanes, cinemas, libraries and theatres. The second group seemed to be based on self-imposed 'rules of conduct' which governed when and where individuals switched off their phone, this included in interviews, in shared office space and during meetings.

Yet many users felt obliged to respond to calls, sometimes regardless of their context *"you always answer doesn't matter where you are"* (NCC_32). Some respondents cited the benefits of being contactable at all times; parents, for example, can monitor where their children are. Some believed that mobile phones enhanced children's safety by providing parents with the means to 'keep tabs' on their children by maintaining contact. Instant contact, they felt, reassures and comforts parents whilst providing children with a sense of security and independence. Others thought this to be 'parent paranoia' and suggested that mobile phones propagate a false sense of security in the child.

An emerging psychological dependence on the phone was observed by some respondents; *"psychologically one feels a need to be near a mobile in case one is missing out"* (NCC_101). Respondents also reported their observations of how an obvious lack of interaction can also contribute to increased anxiety on the part of the user waiting for a response. Anxiety was also noted in terms of answering the phone when in a shared space, one diary respondent reported that he keeps his mobile phone *"on the side in case someone calls me back so I can pounce it"* (User_D-05).

5.3.8.2 Changing Communication Practices

The ways in which people communicate with each other has rapidly changed with the introduction of mobile communications technology. Changes have occurred not only in terms of practices and norms but also in the physical landscape around us. Mobile phone use has increased in relation to a decline in public phone boxes. The methods of communication have also changed. According to some respondents, increased mobile phone use has reduced social skills and contributed to the demise of letter writing and face-to-face conversation. The transfer from slow and arguably longer forms of conversing via letters to faster and more succinct communication via e-mail and text has been noted as a symptom of wider social change, *"our lives [are] all speeding up"* (NCC_09).

SMS or text messaging offers users the ability to communicate instantly and relatively cheaply, it is a fast form of conversing, a factor which some respondents felt has contributed to *"instant, knee-jerk reactions to situations rather than considered responses"* (NCC_65). Some argued that the inference and emphasis of words or phases and visual cues are lost in text messages, a factor which, they felt, contributes to a diminished quality of interaction *"when texting messages there are no expressions or emotions involved ... these are ... important when interacting"* (NCC_45). The use of SMS messaging to convey sensitive or personal information was also observed; one respondent reported that her *"friend lost her baby and let me know by TXT message"* (NCC_69), although this was not viewed by the recipient as upsetting, it does raise some concerns as to the appropriateness of such a medium to convey such a sensitive message.

The increase in text messaging was considered by some to be directly responsible for the continued erosion of spelling, grammar and punctuation rules, the abbreviation of words and the resulting effects on the English language. *"The singular largest impact of the mobile phone must surely be texting ....it has simultaneously enabled an entire generation to grow up with a lackadaisical approach to grammar and punctuation"* (User_I-03). Others, who did not necessarily welcome the erosion of the English language, did acknowledge that texting could be seen as an evolution of language (User_I-05). This language, they acknowledged, would perhaps not readily be understood by parents or those of an older generation immediately, prompting the need for guides to 'texting language' or even lessons for parents on how to communicate with their children via text message.

Some respondents pointed to the apparent correlation between the increase in mobile phone use in public and the decline in interaction between strangers *"[there are] fewer conversations at the bus stop, on the bus or train in parks etc"* (NCC_54). Whereas in the past people may have engaged in conversations with others at the bus stop, on the train or in a waiting room, nowadays people are more than likely to be found texting, playing games or listening to music; *"People [are] not interacting as much with others on the street because they are talking on the mobile"* (NCC_60). Some respondents felt that mobile phone use whilst waiting or travelling relieves boredom.

5.3.8.3 Private Interactions in Public Space?

The prioritisation of 'virtual' over 'real' conversations was raised by respondents in terms of the physical and psychological effect on both users and their 'audience'. Respondents felt that the topic of conversation and language used should be appropriate for the 'audience' within earshot in order to limit disturbance or offence. There were negative perceptions of individuals who use foul language and conduct inappropriate, personal or offensive conversations. There was a consensus view that users should regulate the volume of their voice and consciously select appropriate alert noises and ring tone settings to suit their location. Many had observed that people tend to raise their voices when speaking on a mobile phone which results in annoyance to those nearby. Respondents observed that many users seem to think that all calls are private when in reality often the recipient at the other end of the line is audible, as is the user. In some cases, as reported by a diary respondent, (User_D-03) the limitations of phone volume settings may affect user behaviour. On two separate occasions this user reported not being able to hear the person on the other end of the phone call due to peripheral noise. On one occasion she reports that the *"volume [is] not loud enough at loudest"* (User_D-03). Though not directly reported as a consequence in this case, inadequate receiver volume can cause users to shout to be heard and in return irritate surrounding people.

Some respondents contended that when users step out of the real into the virtual world through interacting with the phone, they fail to recognise the effects of their interaction on others. This, when coupled with their ability to converse whenever and wherever contributes, they felt, to a lack of recognition regarding personal versus public space. *"People tend to forget that they are in a public place and they need to have discretion when they use their phone"* (User_I-01). The implications of being party to others calls were discussed and the majority of respondents reported feeling angry, annoyed or embarrassed when 'forced' to listen to others calls. Despite many respondents professed annoyance, some, though they may not admit it, may actually relish listening in on others conversations especially if the content is particularly 'juicy' *"it's very embarrassing when you're listening to a conversation...well, trying not to listen to a conversation!"* (User_I-05). Connected to this issue was a common scenario described by respondents; *"when people speak extra loudly so we can all hear"* (NCC_101) and *"make a big play of "just a minute I'll go somewhere private..."* (NCC_97). However, many respondents reported that most conversations they overheard in public were boring and the content inane.

5.3.8.4 Crime, Bullying & Anti-Social Use

The potential infringement of privacy was a concern for some respondents, particularly, for those who were aware of them, the use of cameras on phones to take inappropriate or intrusive photographs of others without their consent. This was linked to concerns related to the use of mobile phones as a means of bullying others physically and mentally through so called 'happy slapping' attacks where a victim is filmed whilst being beaten or abused and that footage is then distributed. A further area of concern was 'peer pressure' in response to a young adult having either no mobile phone or an outdated model.

The rise of mobile phone theft, particularly the targeting of younger users, was raised as an area of concern, *"in some areas, visible phones are incitement to theft or attack"* (NCC_75). Fear of being mugged has, according to some respondents, led them to actively find ways to conceal their mobile phone and in some cases prompted them to avoid using their mobile phone whilst out in public. There were also links made to the use of mobile phones, particularly pay-as-you-go phones, to facilitate untraceable contact between individuals involved in organised crime to *"get some anonymity and... plan crimes more easily, conveniently [and] covertly"* (NCC_47). Some respondents felt that mobile phones *"mak[e] it easy for people to group en masse"* (NCC_34). Despite some concerns regarding the ability to track user's locations via their mobile phone signal, and the potential risks of hacking associated with Bluetooth technology in particular (which emerged as a lesser concern) some respondents cited the benefits of utilising this technology to trace the movements of protagonists involved in organised crime or terrorism.

5.3.8.5 Body Language, Movement & Gesture

A lack of concentration on the part of users who walk and text or talk was observed by respondents. Respondents felt that the degree of control in direction and movement, level of awareness, ability to recognise hazards and consideration for others could be inhibited or reduced by using a mobile phone. When texting and walking for example, the line of vision is directed towards the handset display, only by taking intermittent glances up can the user observe their physical surroundings. This has led to a tendency to slow down or stop dead in the street or to block walkways, corridors or entrances; *"kids blocking walkways, shopping aisles etc while they text their mates"* for

example (NCC_60). To successfully manage the physical and psychological aspects of moving between physical and virtual space, users must become adept at navigating around physical hazards, utilising their peripheral vision and continuously toggling between physical conversations and virtual interactions. It was suggested by one respondent that *"when using the phone in public, you tacitly expect others to look out for your safety, walk around you etc"* (NCC_109). It is interesting that, in this user's opinion, the onus of responsibility is placed not on the user but on those in the vicinity of use.

A lack of concentration when driving and talking on a mobile phone, both with and without the use of a hands-free kit, was also raised as an area of concern. Many respondents felt that even whilst using a hands-free device, drivers may fail to give adequate attention to potential hazards. Despite the introduction of a ban on mobile phone use whilst driving (enacted 1st December 2003) several respondents recounted instances where they had observed mobile phone use by drivers without the use of a hands-free device. Indeed, four out of six diary respondents recorded using their mobile phones whilst driving. Of these, two had designated car hands free sets, the remaining two reportedly used the 'can holder' as an impromptu hands free holder (User_D-03) or put the phone on the dashboard (User_D-02). Some diary respondents felt that the hands-free device was, in their case, not conducive to safe driving due to difficulties in locating the handset or the connecting wires. One reportedly "*make[s] phone call[s] whilst driving despite having hands free*" because it "*seems more dangerous... to try and find the cable*" (User_D-06).

Some respondents recommended certain movements or body language to reduce the social impact of using the mobile phone; such as moving away from others, leaving the room, positioning oneself away from corridors or walkways, and cupping ones hand around the receiver to limit disturbance.

5.3.8.6 Suggested Design Concepts

A few respondents even suggested some design features which could assist in reducing the disturbance to others such as the inclusion of *"a button you can press to let them know you are moving to a discreet place and you will talk to them shortly"* (NCC_44). Some respondents speculated on the ability of manufacturers to create phones that were sensitive to their surroundings and regulated features accordingly i.e.

the ring tone volume for example, *"could you...design the phone so that it would not ring in certain situations"* (User_I-05).

Incessant mobile phone ringing caused by the user not hearing the phone ring and consequently failing to answer it, could be overcome by having a small node attached to the phone or by wireless connection which vibrates at different frequencies for a text message or a call, thereby notifying the user that the phone is ringing without disturbing others, whilst the phone is safely carried in a secure place to avoid theft. This node could be fastened to the users clothing or worn around the wrist in bracelet form (User_I-01).

Design to avoid breakage and unnecessary replacement was also raised; one user (User_I-04) bought a cover as she felt the plastic coating on the phone made the surface slippery and she was concerned that it would slip through her hand and she would drop it. The cover would, she felt, prevent this and avoid breakage. In addition, manufacturers could design the phone case to have a better grip, mould the shape in a way to avoid it slipping and choose appropriate materials or surface textures. The phone or phone cover could also feature bright colours as a visual aid for locating the ringing phone in a bag or briefcase to avoid missing calls (User_I-04). A robust cover may also prevent accidental use; as experienced by one user who reported that his *"phone... turned itself off [causing him to] ...miss a call and 2 texts as a result"* this, he felt, was probably caused by him sitting on the phone, which was in his back pocket, and activating the buttons (User_D-06). Accidental use has, as reported in the literature, often resulted in calls to the emergency services. This has arguably prompted the emergence of so called *shell* or *clam* shaped handsets and keypad locking mechanisms.

5.4 Discussion

The results of the preliminary and main user studies presented in the preceding sections clearly illustrate the divisive nature of the debate around the use of mobile phones in public. Many of the actions or values respondents cited when asked to describe examples of negative social impacts of mobile phone use could be seen to support the working definition of negative societal impacts of product use presented in Chapter 1 which was *any action enacted or facilitated by the product or resulting from*

the behaviour of the user in the use of the product which diminishes the health, wellbeing, social equity or quality of life of others affected by the use of the product.

- The connections to *health, wellbeing and happiness*, incorporate arguments around the implications of prolonged mobile phone use on health, the observed increase in psychological dependence on the mobile phone, the use of mobile phones as a method of 'opting out' of social engagement in public places and the loss of quiet time and privacy.
- *Social equity*, or lack thereof, can be observed in the rising occurrences of mobile phone theft and in arguments surrounding around the exclusive or unwillingly inclusive nature of democratic participation in conversations, for example, can be observed in descriptions of those *forced* to listen to a conversation on a crowded train and those excluded from conversations when their companion's mobile phone rings and they decide to answer it.
- *Quality of life* can, based on the majority of responses, be degraded by undesirable mobile phone behaviour in public and in turn by changes in societal expectations and norms. Some of the respondents, however, argued that mobile phones have increased their quality of life by improving their sense of personal safety, allowing communication with loved ones who cannot access a landline and promoting a sense of independence in younger users.

These examples clearly illustrate that, depending on the viewpoint of the respondent, the issues raised could be seen as having a positive or negative impact. In some cases, around particular issues, there was a perception that while the user may gain an advantage by using a mobile phone, there was inevitably a price to pay for that gain. For example, many respondents cited the benefits of being contactable at all times, but also saw disadvantages in that there is an unspoken assumption that they should be available at all times. What was particularly interesting here is that the physical affordance to switch off or screen calls is provided, yet users feel compelled, sometimes duty bound, to remain connected. It is interesting to reflect upon the contributory factors which may cause the sense of loss and discomfort described by users compelled to leave their mobile phones switched on constantly. In some sense this behaviour, and the resulting consequences, is self-inflicted, driven by the user's inherent sense of duty or perhaps their paranoia that they *may* be wanted or needed. The driver may equally, however, be an external factor such as the changing social norms concerning working hours.

5.5 Conclusions

What is clear from the discussion of the findings of the user research studies is that the behaviour of mobile phone users is complex and informed by a wide range of internal and external factors, of which the product is one. One of the outcomes of the preliminary and main user research studies reported on this chapter is that some respondents have begun to identify connections between the design of the mobile phone, the actions it affords the user (whether these are intended or unintended) and the resulting impacts on society. Interestingly, respondents (or from the perspective of the manufacturer, customers) are also beginning to propose solutions to the problems caused by changing the design of the product. In terms of this research, this suggests that some consumers see the design of the product as a contributory factor in how that product is, or can, be used. This represents both a challenge and an opportunity for designers as there is clearly a role for the product design to contribute to reducing social impacts of use, however, the product sits alongside a whole host of other contributory factors which must be acknowledged within the design.

The goalposts which define "acceptable behaviour" are constantly changing. There can never be an absolute definition of the factors which contribute to negative social impacts of product use as the relative effect of the behaviours is largely subjective and dependant on a wide remit of contributory values, knowledge and norms. Behaviours which may be deemed by some to be socially unacceptable may in fact be considered the norm by others. In addition, norms are constantly evolving as the boundaries of acceptable behaviour change. The results of the studies presented in this thesis are indicative of the current perceptions of those interviewed and of those represented in the literature reviewed. The correlation between the findings of the user research studies and the literature, however, does reinforce the notion that the behaviours outlined by participants of the main and preliminary user studies are indicative of wider perceptions in contemporary society.

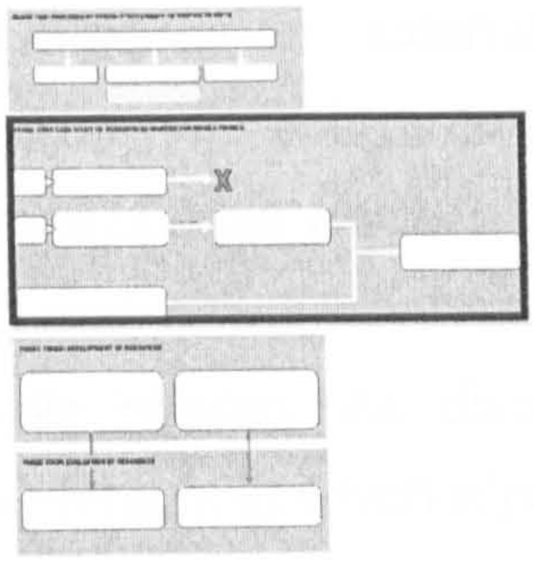
5.6 Next Steps

To explore the internal and external drivers and their relative effects on behaviour more fully and the role design could play in informing mobile phone user behaviour, designers must be engaged in the process. The next stage of the research process is to initiate primary research in the form of a design study and consult secondary

literature to extract examples of the ways in which mobile phone use is regulated by a range of factors, including design.

6 MOBILE PHONE CASE STUDY: DESIGNING BEHAVIOURAL CHANGE

6.1 Introduction



This chapter reports on **Part Two** of **Phase Two** of the research. It investigates the methods employed to reduce *social impacts* of mobile phone use in *public space* and explores how mobile phones could be designed to moderate consumer behaviour.

It presents existing design concepts from the literature and reports on the findings of the main design study carried out by Industrial Design MSc students at Loughborough University. The outcomes of this design study are discussed and the chapter concludes by providing an outline of factors to explore in a more detailed design project.

6.2 Methods Employed to Reduce the Social Impacts of Mobile Phone Use

Use behaviour is influenced and regulated by a range of human and non-human actors. Users, products, government, affordances and constraints within the physical environment and social conventions all attempt to regulate behaviour in different ways. Figure 6.1 adapted from van de Velden (2003) describes how the actions of various parties are filtered through the user's awareness level which dictates the extent to which these external and internal influences affect behaviour. For the purposes of this research, the actors of significant interest are; *the user*, *the product* and *the physical environment* in which the product is used.

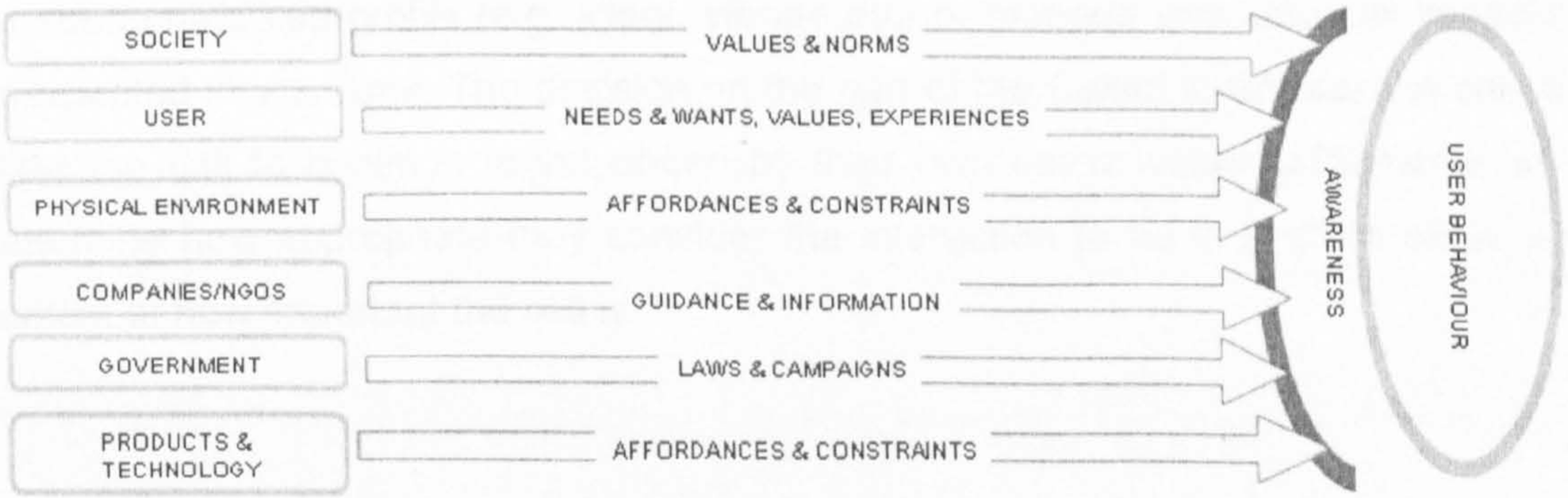


Figure 6.1: Influence, Adapted from Van de Velden (2003)

6.2.1 The User

The user is guided by a sense of what is appropriate behaviour in a given context or setting. These judgements can be informed by internal influences (morals or values) or regulated by an external party through rules, norms or guides. Their ability or opportunity to behave in an appropriate manner is, to some extent dependent on the actions of other parties. These are both human actors (the recipient or instigator of the call) and non-human actors (the physical environment, the network service, and the mobile phone). As discussed in Chapter 2, the importance of considering the environment in which a product is used cannot be underestimated as the environment within which people consume often facilitates or impedes certain consumption patterns (Mȯisander, 1997, Lindén and Thelander, 1997, Jackson, 2004b). Several studies have concluded that the context in which the interaction takes place can determine how the user will respond (Green, 2005, Palen et al., 2000). In some cases *"the behaviour of many mobile users is affected by the tacit, understated details of their environment"* (Plant, 2002, p. 38).

6.2.2 Caller Hegemony

With any mobile phone interaction there are at least two parties involved; the Caller (instigator) and the Called (recipient). Caller hegemony (Hopper, 1992) explores the dominance of the Caller over the Called. When viewed in terms of caller hegemony the balance of power in this relationship becomes clear; the Caller always knows when a conversation is going to take place, who is calling, the purpose and urgency of the call. Yet the Caller often does not know the situation, location or availability of the Called until contact is made. The mobile phone *"can be remotely and unpredictably activated"* (Palen et al., 2000) and as such, the onus is often placed on the Called to either select an appropriate use profile (e.g. silent, vibrate etc) or manage any potential impacts of unexpected interactions. The decision on the part of the Called to answer the call, and allow the call to continue is influenced by their own set of value judgements which determine how appropriate they consider the interaction to be in a given situation or context or how important the call is.

6.2.3 Physical Environment

It is important in this context to acknowledge the wider field of research into the design and planning of public space; particularly the use of affordances and constraints within public spaces to change behaviour. Although the relevance of this area of research is clear, especially given the importance of the context of use; it is too large to consider fully. Therefore this discussion is restricted to observations concerning mobile phone user's use of architecture, street furniture and body language to facilitate privacy and what these observations can tell designers about user's practices and needs.

6.2.3.1 Movement & Gestures

Mobile phone users regularly trade privacy for convenience (Burgess, 2004) when conversing in public. Those who are conscious of the private nature of their interactions use gestures and movement to indicate the private nature of their call. The evolution of *"new stances, gestures and bodily movements"* (Plant, 2002, p. 51) has been acknowledged by Plant (2002) who observed the ways in which people use their bodies to demarcate 'private' space and to communicate this intention to others. Two of her classifications of the behaviour she observed are of particular interest; the speakeasy and the space maker. The speakeasy stance is assertive and unapologetic; the head is back, the neck extended and the body language denotes an open, self-assured demeanour. Conversely, the space maker is withdrawn and almost apologetic; often the head is bowed, the eyes directed downwards, the body turned inward into a corner or wall and the hands cupped around the mouthpiece forming a shield – the intention being to erect barriers and signal their intent for privacy to others. The space maker may be prone to pacing, or walking in continuous circles. This is consistent with Lasen's observations of users who *"walk slowly in circles or .... pace a short distance back and forth"* (Lasen, 2002, p. 22).

Fulton-Suri observed two callers, shown in Figure 6.2 below, attempting to limit the interference and distraction caused by the visual and aural qualities of the call environment. Using Plants definitions we can see that both callers are displaying space maker traits. In the image on the left the caller is using her posture to signal the private nature of her call to others, whereas the caller on the right is facing inward into a corner to create an enclosure with her body and shield her interaction from others.

Figure 6.2: 'Space Makers' (Fulton-Suri and IDEO, 2005, pp. 29-30)

6.2.3.2 Affordances & Constraints

Affordances and constraints within the physical environment enable or impede certain kinds of behaviour. Two avenues of intervention have been observed within physical space; deliberate, orchestrated interventions (often implemented by official actors e.g. the train company, council etc) and more organic interventions which have been developed and implemented by mobile phone users themselves in response to their specific needs. In many contexts, the physical environment has been deliberately reshaped to restrict use activities and address problems caused by mobile phone use. The responsibility for 'policing' use has in most cases been delegated to non-human actor's e.g. quiet carriage on a train, 'mobile-free zones' and signage, see Figure 6.3 below.

Figure 6.3: Quiet Zone on a Train

"Signage in public venues… is an overt attempt to regulate behaviour" (Palen et al., 2000). Yet the problem with these interventions is that in many cases these devices have become part of the visual norm and as such are neutralised, going unnoticed by

some and consciously ignored by others. Despite the numerous notices in cinemas, in 'mobile free' zones on trains, see Figure 6.3 above, or even in hospitals or on airplanes asking for mobile phones to be switched off there are still those users who do not comply. Those people observed using their phone in a quiet zone are rarely challenged by other passengers; usually any requests to stop using the phone come from train staff. Those who challenge inappropriate mobile phone use directly appear to be in a minority.

The layout of roads, pavements, open spaces and buildings is carefully orchestrated by urban planners to shape the movements of pedestrians and drivers. These implicit directions are, however, not always adhered to by the public. When confronted with a path which requires them to walk around a 90 degree corner many pedestrians will cut across the grass taking the corner out of the equation. This new path is soon established as a viable alternative as more people choose to take it. Only those who have an inbuilt resistance to walking across the grass continue to take what has now become the long route. The adaptation and reshaping of public spaces by mobile phone users demonstrates their need for privacy. Their use of architecture and street furniture to create *'temporary intimate zones'* (Locke, 2002) in the form of *"improvised open-air wireless phone booth[s]"* (Lasen, 2002, p. 7) has effectively superseded the designated phone booths provided. Users have, with the aid of architecture, gestures and body language, created their own private spaces in public and evolved visual signage to communicate these boundaries to others.

6.2.4 Product-led Intervention

Findings indicate that in terms of specifically tackling use related impacts, excluding energy use, few manufacturers have consciously singled out and addressed the social impacts of use within the design of the phone. Indeed, the impact of unrestricted use in public space has yet to be addressed commercially in the design of the mobile phone or formally within society at large. There are some examples of conceptual mobile phone designs which attempt to address the repercussions of mobile phone use and, in contrast to the more general product design examples presented in Chapter 2, quite a few of the product design concepts for mobile phone designs presented below specifically consider social, rather than purely environmental, issues.

6.2.4.1 Existing Design Concepts

Context Aware Technology, which originated in computing systems design, has more recently been applied to the design of mobile communications. The Massachusetts Institute of Technology (MIT) Media Lab's are at the forefront of developing socially-aware mobile technologies (DeVaul and Dunn, 2001, Madan and Pentland, 2006). Informed by user centred research investigating individual and group interaction dynamics, the MIT researchers continue to develop and apply innovative new technologies for mobile communication devices. The *Jerk-O-Meter* (Madan and Pentland, 2005) for example analyses the tone of voice and speaking style of the user to measure stress (and eventually empathy) levels, to determine if the user is fully engaged in the conversation. Real time feedback on the user's behaviour is provided via messages displayed on the screen.

SenSay (Siewiorek et al., 2003) is a another interesting example of a context aware mobile phone. Sensay utlises light, motion and microphone sensors located on various parts of the user's body, to collect sensory data which is channelled into a central hub. Based on this data SenSay determines the most appropriate *state* or *profile* for the phone i.e. Uninterruptible, Active, Idle and Normal. Selection of the uninterruptible state, for example, is prompted by two factors; the user's schedule, which is determined by accessing the in-built electronic calendar, and the users speech patterns i.e. if the user is engaged in a conversation. If the called is unavailable an automatic message is relayed to the caller asking them to call again in three minutes if the call is urgent. Urgent calls override the uninterruptible mode and the called is alerted to the importance of the call by a high volume ring tone.

Norman suggests the possibility of refining mobile technology *"so that it better affords politeness to others"* (Norman, 2005). Early telephones incorporated a mechanism for feeding back a small amount of a person's voice into the receiver. This feedback enabled the user to adjust the loudness of their voice to an appropriate level. Mobile phones have eradicated auditory feedback. This, Norman argues, has reduced the user's ability to mediate the volume of their voice. To assist in reducing noise disturbance Norman suggests a number of possibilities; noise-cancelling technology could be used to minimise the level of the speakers voice whilst still capturing and directing the sound, this could be combined with the reintroduction of feedback. In addition, voice cups could be developed to mask and diffuse the speaker's voice to avoid disturbing others. Norman's concepts span both product-led and technological

intervention approaches. He suggests providing feedback to the user to enable them to change their behaviour, yet through the introduction of noise-cancelling technology and voice cups, he also advocates taking a technological approach.

Based on technology developed for military applications, the Jawbone™ (Aliph, 2004) headset constantly adjusts and enhances audio quality for clearer communications. Utilising intelligent sensors, software and ergonomic features, it gathers information about the user's speech and acoustic environment. It detects the user's speech patterns via a voice activity sensor located adjacent to the cheek and enhances audio quality by subtracting background noise from this speech signal.

Taylor redesigned a mobile phone to *"encourage people to exercise polite mobile phone manners"* (Taylor, 2000). Taylor's concepts are in the most part designed to automatically mitigate, control or block unsustainable or inappropriate behaviour by users. The exception to this approach is 'too-loud talking' which provides eco-feedback as a means of encouraging the user to lower the volume of their voice. Taylor has, through design features, embodied the phone with a sense of self. It becomes indignant when the user behaves in an improper manner; it reprimands the owner by 'shouting back', it panics when left unanswered and scrambles messages and caller ID's to discourage use in inappropriate places. Figure 6.4 below depicts the process instigated when the phone is left unanswered. The phone begins to panic; the ring volume increases and the caller identification display becomes confused. Its continued distress causes the battery to run down and eventually, exhausted by its panicked state, it 'passes out'. When recovered, the phone reprimands the owner, informing them of the consequences of their actions.

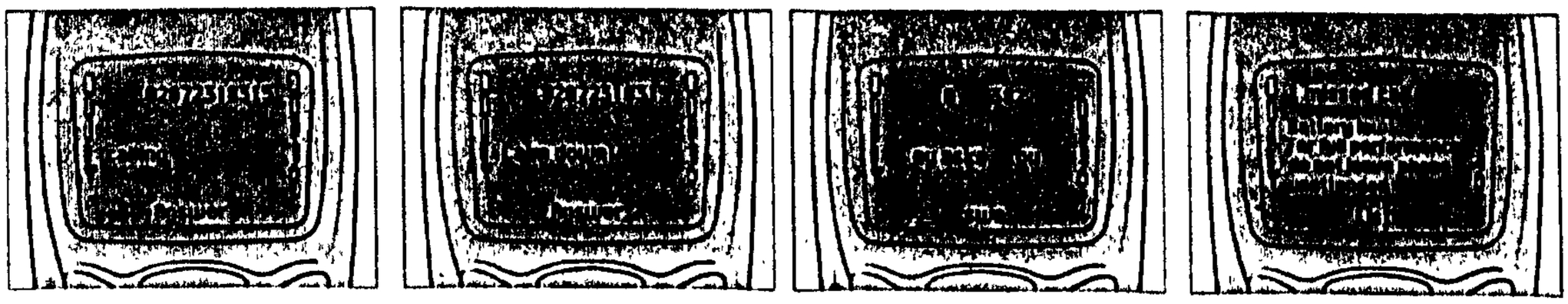


Figure 6.4: Leaving the Phone Unattended (Taylor, 2000)

IDEO's Social Mobiles project presents five exploratory and arguably controversial prototypes that *"modify their users behaviour to make it less disruptive"* (IDEO, 2002) through design features which discourage socially unacceptable conduct. IDEO use a variety of different approaches in the design of their Social Mobiles range; the *catapult*

phone allows the user to disrupt other people's conversations if they deem them to be inappropriate or offensive by launching sounds designed to interrupt their call. Further concepts in the Social Mobiles project include; the *speaking mobile* which affords silent communication by enabling the user to respond using simple expressive sounds. The *knocking mobile* which enables the caller to indicate the urgency of their call by knocking on the phone thereby enabling the recipient to determine an appropriate response and the *musical mobile* which constrains inappropriate use by forcing the user *"to play the tune of the phone number they wish to call"* (IDEO, 2002). The *electric shock mobile*, Figure 6.5, determines an acceptable speaking volume and delivers an extreme form of eco-feedback in the form of an electric shock if the user exceeds this level.

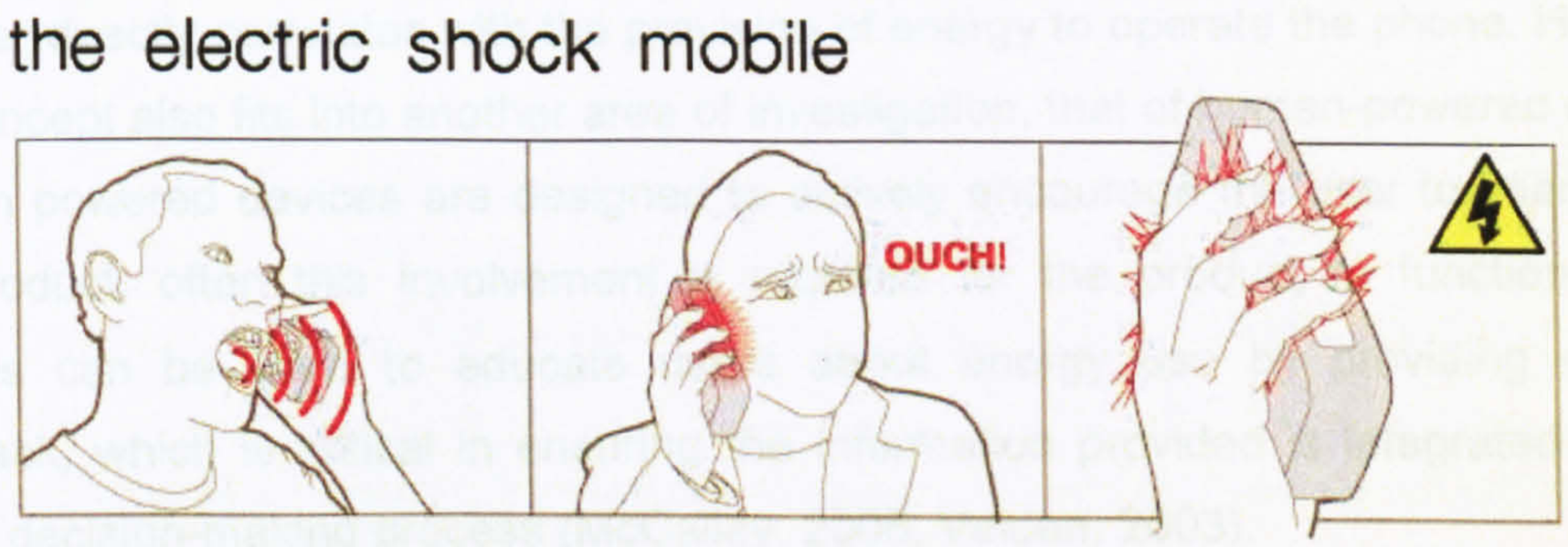


Figure 6.5: IDEO Electric Shock Mobile (2002)

IDEO's *catapult phone* concept is similar in essence to the facility offered by a jammer. Jammers are a technological response to the inappropriate or unauthorised use of mobile phones - a policing device that restricts mobile phone use without the owner's permission. Jammers disrupt mobile phone use *"by transmitting signals on the frequencies at which GSM and UMTS operations are conducted.....mak[ing] it impossible ... to make or receive calls and messages"* (Ofcom, 2005). Although prohibited in the UK, the prohibition of jammers and the risk of fines or imprisonment have reportedly not deterred their use. Online purchase of personal jammers and those for use in private establishments has continued, despite clear guidance on such retailers websites as to the legal restrictions. There is an ongoing debate over whether to legalise the use of jammers in the UK. Arguably the use of jammers is an effective way of curtailing the use of mobile phones in the absence of the user's cooperation in switching off voluntarily. On the other hand, personal jammers enable the unrestricted ability of consumers to judge and control other people's use of mobile phones in public places and that presents some difficult ethical questions.

As discussed previously, mobile phones are inert until activated by the user and are dependent on the user for survival, yet users often become psychologically dependent on their mobile phone (Lasen, 2004). Using DeVaul and Dunns work as inspiration, Durrant exploited this co-dependency, exploring the possibilities of developing a mobile phone which is charged *"by energy created by exaggerated body gestures made in effort to use them"* (Durrant, 2004). Potential activities to generate energy may include; gestures, hand movements, body heat or breathing. Scenario-based testing, using an adapted self-charging dynamo torch, revealed that the user has to continuously move to maintain a viable connection. The user is forced to negotiate his or her level of need to be connected versus the effort required to do so. This approach can be classified as a physical form of eco-feedback, as the level and duration of movement on the part of the user directly correlates with the provision of energy to operate the phone. However, this concept also fits into another area of investigation, that of human-powered devices. Human powered devices are designed to actively encourage the user to interact with the product, often this involvement is required for the product to function. These devices can be used to educate users about energy use by providing *real-time* feedback, which is critical in ensuring the information provided is integrated into the user's decision-making process (McCalley, 2006, Velden, 2003).

6.2.4.2 Analysis of Existing Design Concepts

The design concepts discussed above informed the research by providing examples of *design-led approaches* for behavioural change within the context of mobile phones. They serve to illustrate the varying levels of intervention on the part of the product and the division of responsibility between product and user. Through analysing these examples, the approach taken by the designer[s] can be correlated with one or a combination of the *design-led approaches* identified in Chapter 2. According to Cross *"designers do not typically proceed by first attempting to define their problems rigorously"* and in many instances *"problems are often defined only in relation to ideas for their solution"* (Cross, 2001, p. 81). In this investigation, few design case studies extracted from the literature establish a comprehensive research context for their concepts and it has not been possible from examining published work by these designers to determine their design process. Additionally, most have yet to be robustly tested with users to produce conclusive results as to their effectiveness in influencing consumer behaviour.

In order to successfully integrate behavioural concerns into design practice and develop appropriate tools or approaches for designers, it is essential for this research that designers are observed and that their motivations, research methods and design practices recorded. This realisation prompted the need to instigate a product specific design study.

6.3 Main Design Study

The preliminary design study, Chapter 4, provided a group of designers with a range of products but no approaches or methods for designing behavioural change. The main study, reported on below, sought to test the application of the design-led approaches identified in the literature using a single product type. To this end, a group of nine MSc Industrial Design students at Loughborough University were set the challenge of identifying and addressing a social issue resulting from the use of mobile phones in public space using one of the *design-led approaches* for behavioural change provided.

The aim of this study was to observe the designers response to social issues identified, test the application of the approaches provided and record the research and design processes adopted. This aim was broken down into a series of objectives which were;

1. To determine their understanding of *design-led approaches,*
2. To discover if, how and at what point in the design process these approaches were applied,
3. To explore their perceptions of the effectiveness of these approaches in changing user behaviour,
4. To record and analyse their design outcomes.

6.3.1 Methodology for Main Design Study

This study was more comprehensive than the preliminary design study undertaken in Phase One. Nine designers worked individually, over a longer period to deliver more complex, considered solutions in response to a product specific brief. In this study, the subjects benefited from exposure to the findings of the literature review and user centred research to enhance their understanding of the issue. To inform the development of a brief for a design study, a series of pertinent societal issues resulting from mobile phone use were extracted from the composite findings of the preliminary

and main user research studies described in Chapter 5 and the literature presented in this and the preceding chapter. This process can be seen in Figure 6.6 below.

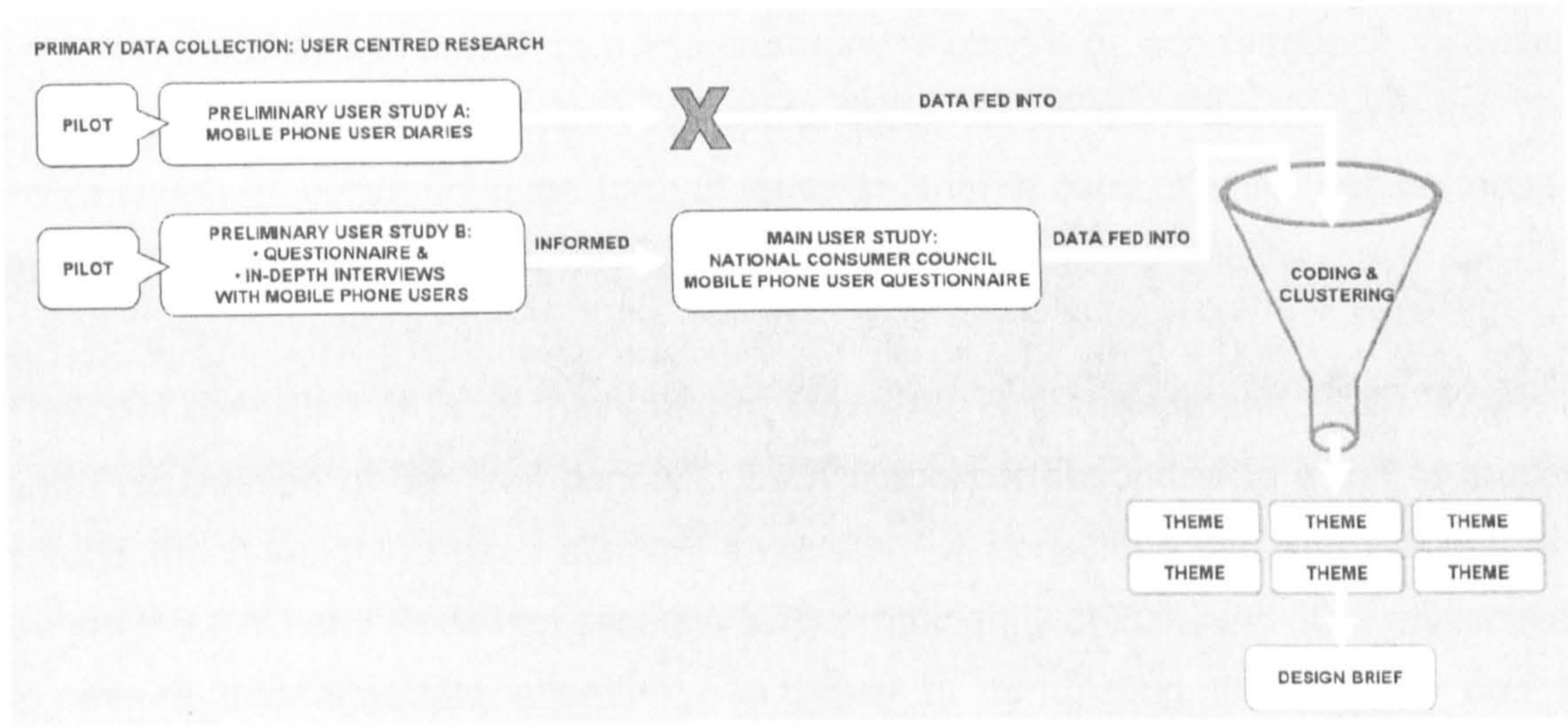


Figure 6.6: Process of Developing Brief for Main Design Study

They were also introduced to design-led approaches for behavioural change identified in the literature.

There are a number of methods for evaluating the thought processes of designers. Typical methods cited by Cross (2001) include;

- *Performance Tests* where subjects are asked to fulfil specialised tasks under laboratory conditions, whilst their actions are recorded and analysed.
- *Protocol Studies* in which the researcher records the *"thinking aloud and associated actions of subjects"* while they perform a specified design activity.
- *Case Studies*, which in a design context, typically involves simultaneous or post-hoc observation of the process and development of a specific design project.

For the purposes of this research a *[design] case study* methodology was selected as being the most appropriate as the intent was to capture the processes used to develop the design concepts without interfering with the student's working practices. Additionally, due to the constraints of the project the researcher was unable to personally observe the student's working practices first-hand, which is why they were asked to keep design logbooks and provide an aural presentation outlining why they chose a particular approach.

6.3.1.1 Setting the Brief

As part of the module the design students were given a specific product, problem and some approaches, gathered from the literature review, e.g. *eco-feedback, behaviour steering* and *intelligence* which they could apply within their design process. This information was delivered in the form of a design brief, a copy of which can be found in Appendix H.

The brief consisted of three main stages; Research & Development (R&D), Redesign and Presentation of the final concept. Each stage corresponded to a set of marking criteria which weighted each element separately. A conscious decision was made to weight the R&D and Redesign sections fairly prominently at 20% and 50% respectively, to ensure that adequate attention was given to completing these tasks and the composite elements involved, as these were considered to be of particular significance for the research. Each element of the marking criteria was specified to inform the objectives and to provide a structure or framework for analysis. Table 6-1 illustrates how the individual marking criterion for the Redesign links to the objectives.

Marking criteria	Objective[s]
Applied research results to product designs generated	2
Demonstrated good understanding of approach chosen	3,4
Applied this understanding in product design ideas	1,2,3,4
Demonstrated iterative designing process	1

Table 6-1: Redesign Marking Criteria linked to Objectives

6.3.1.2 Data Collection Techniques

As part of the brief, each student was required to keep a design logbook in which they were expected to record their ideas, thoughts and analysis. In addition each student was tasked with producing and delivering a 15 minute PowerPoint presentation detailing their final idea. Following completion of the project the logbooks were submitted alongside a CD-Rom containing a copy of the presentation given.

Additionally, each student was questioned following their presentation to further clarify any outstanding issues relating to their concept and to explore their perceptions of the effectiveness of these approaches. Notes were taken during these question and

answer sessions and these were written up directly after the presentation. In addition, a discussion session was held following the presentations during which the students talked about issues which had arisen throughout the project and the preceding presentations. The discussion was by no means *stage managed* by the researcher, but some topics were introduced in the form of prompt questions to elicit responses to particular issues. During the question and answer session and group discussion two or three students appeared to dominate. As discussed by Robson one of the potential drawbacks of group forums is that *"group dynamics or power hierarchies affect who speaks and what they say"* (2002, p284). Although the size of the group was appropriate for this type of interaction (May, 2001) some students were noticeably quiet, some found it difficult to discuss their perceptions *on the spot* and some preferred to listen to others rather than express their own opinion. To effectively capture as many different responses as possible, consideration was given to establishing a slower, more individualised feedback mechanism. A short e-mail survey was devised for this purpose. This format not only gave the students time to consider their responses before replying, but also provided an individualised and largely unbiased way to communicate directly with the researcher. This survey was comprised of three discussion questions relating to the objectives;

1. Did you find the approaches e.g. eco-feedback, behaviour steering, intelligent products easy to understand?
2. At which point during the design process were the approaches most helpful? e.g. research, idea generation, design development, etc and why?
3. Which approach or approaches do you think would be most effective in reducing the social impacts of mobile phone use and why?

The first question was essentially closed. The second had closed and open ended elements to encourage the students to elaborate on their reasons for their initial response. The last question was open, encouraging the student to respond in some depth.

6.3.1.3 Analysis of Design Activity Outputs

A two tiered approach was taken to analyse the design work generated and the perceptions of the corresponding designer as part of this study, as seen in Figure 6.7 below.

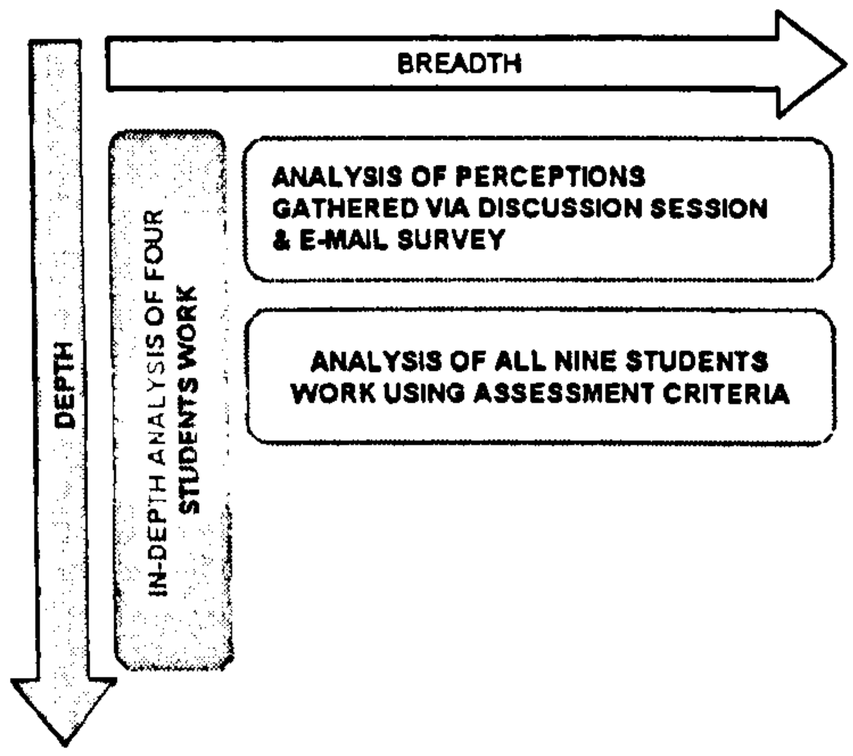


Figure 6.7: Analysis of Design Study Outcomes

Responses to the question and answer session, discussion and e-mail survey were collated and analysed to extract similar and opposing perceptions in relation to the research questions. All nine students work was assessed using the assessment criteria devised prior to the inception of the project, supporting evidence was collated in support of the findings made and these were included in the resulting write-up. The bulk of the analysis was in the detailed examination of the work of four students whose work was selected on the basis of the initial assessment. The logbooks and presentations given by these students were examined and the content analysed to extract relevant data. The analysis criteria relating to each stage of the project development is represented in Table 6-2.

Design Stage	Analysis Criteria
Research & Development	▪ Evidence of reframing the original brief, ▪ Process of scoping the research task. ▪ Research methods used (e.g. observational UCR, literature review). ▪ Depth, quality and method of analysis of research.
Re-Design	▪ Design process (e.g. reflective, iterative and/or solutions-focused). ▪ If and how findings of User Centred Research has been applied within designing process. ▪ If, how and at what point in the design process approaches applied
Final Design Solution	▪ Relative success in overcoming issues associated with user behaviour identified in research. ▪ Evidence of evaluation & reflection on outcome[s] generated.

Table 6-2: Criteria for Analysing Design Work

6.3.2 Results of Main Design Study

In this section, the results of the main design study will be discussed in detail. Quotations from individual students will be referred to using code i.e. STU_01 to denote Student 1.

6.3.2.1 Research Methods & Application of Research

Analysis of the student's logbooks and presentations revealed that most combined primary research such as product analysis, interviews with users and observational studies with secondary literature on the social impacts of mobile phone use. Few students actively sought out additional product design case studies as inspiration for their own concepts. Of those students who undertook observational studies, most co-located their photographs with explanatory notes, scenarios and stories as seen in Figure 6.8 to illustrate the different types of behaviour observed in different contexts.

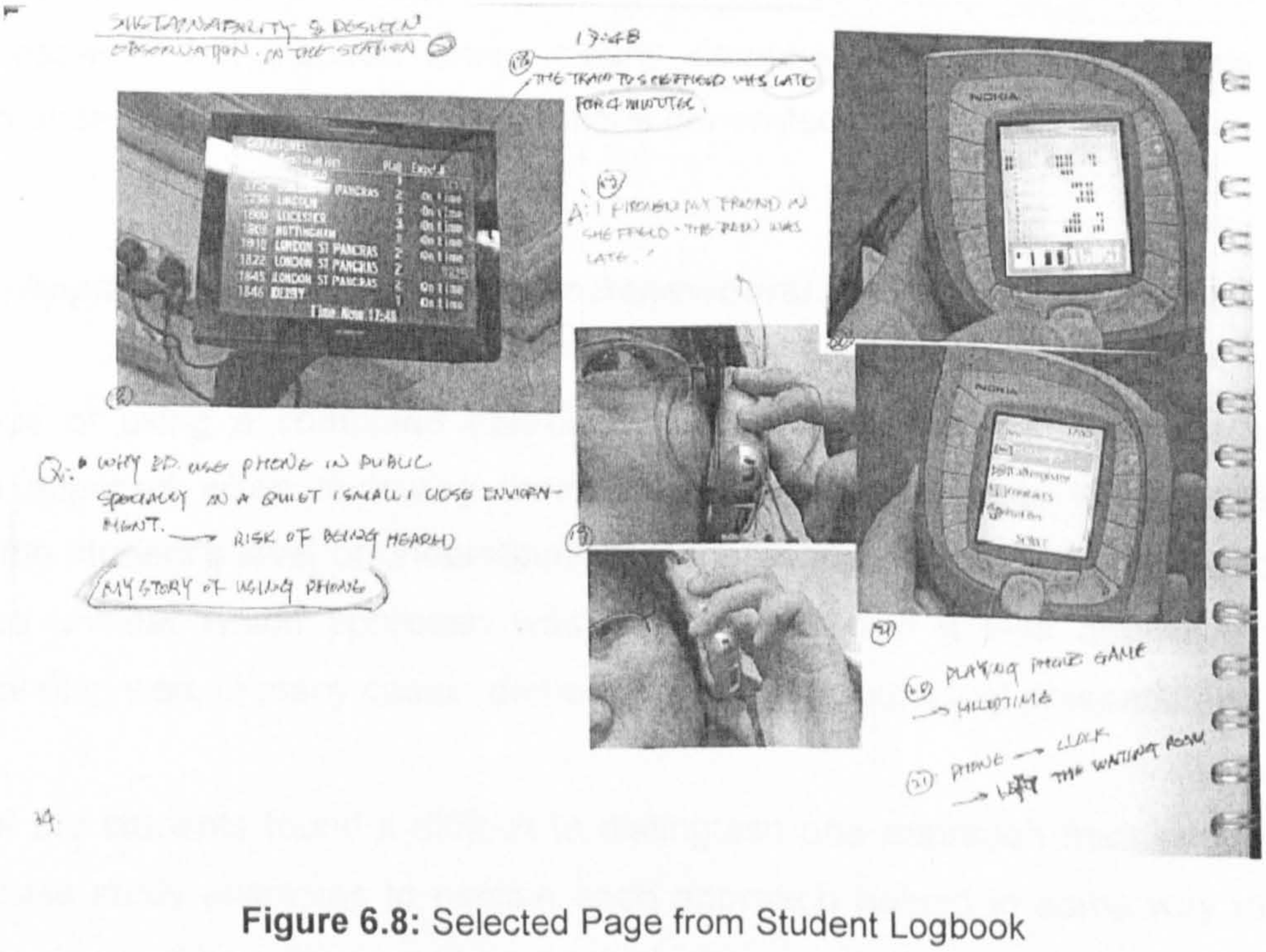


Figure 6.8: Selected Page from Student Logbook

Points of analysis included; body language, type of function carried out (e.g. texting, listening to voicemail), the location of the user in relation to others, the characteristics of the user (e.g. proficiency, age etc) and other people's response to behaviour displayed. Some students captured user behaviour using sequential photographs

which were particularly useful in illustrating the series of actions taken by the subjects observed.

Some students, who did not carry out observational studies of their own, sourced pictures depicting mobile phone use and attempted to analyse the situations and behaviours portrayed. This was not as effective as observing and recording behaviour in-situ, as their analysis was an interpretation of what was happening in the picture, not what they had observed first-hand.

Most students analysed and reflected upon the information gathered from the literature and combined this understanding with their own user centred research findings to frame their chosen design problem. Some students, having established a direction for their design, redefined the brief to clarify the problem identified and to communicate their design intention e.g. how they intended to solve the problem. For the most part, evidence of how the research findings related to conceptual ideas generated was not explicitly recorded in the logbooks yet it was, in some cases, articulated in the verbal presentation. An exception to this was Student 5 who co-located his design ideas next to the research that inspired them, clearly demonstrating the links between the research undertaken and the design solutions generated.

6.3.2.2 Application of Approaches for Behavioural Change

The value of using a combined approach to analyse the students design process became apparent when reviewing their logbooks. In most cases it was difficult to assess the student's level of understanding of these approaches from the logbooks. It was also unclear which approach was chosen and how it was applied. Yet this understanding was, in many cases, demonstrated in the individual presentations.

Some of the students found it difficult to distinguish one approach from another. The use of case study examples to explain each approach helped in some way to clarify their meaning and how they could be applied; *"The examples such as [the] Kambrook 'Axis' Kettle explain these concepts very clearly"* (STU_03). Most found eco-feedback easy to understand, but found behaviour steering hard to define. To some, the boundary between behaviour steering and intelligence was undefined and this made distinguishing one from the other quite difficult. Student 3 created a matrix to classify the user behaviour and solutions according to the three approaches in order to find the

best way to solve the social impacts she had identified. This matrix, which can be seen Table 6-3, was used to draw out and compare the practical, moral and ethical dimensions of applying these approaches against a specific set of criteria which was; her perceptions of the resulting effect on user behaviour, the degree to which the user would feel controlled, the design work space and compatibility with existing technology. Each criterion was rated against each approach on a scale of impact from weak to strong.

Criteria	Eco-Feedback	Behaviour Steering	Intelligent Products
Effect on the user behaviour directly	1	2	3
Feeling of being controlled	3	2	1
Design work space	2	3	1
[Will] work with [existing] technology	1	2	3
TOTAL	6	9	8
CHOICE	x	✓	x

SCALE: 1 = weak 3 = strong

Table 6-3: Comparative Matrix

In terms of applying these approaches, most of the students advocated a 'mixed' approach, combining two or more approaches. Few students used the approaches as a starting point, preferring instead to apply one or more approach as part of their idea generation process to provide *"a direction to think about the problems"* (STU_05), as inspiration for concepts or as a means to develop design ideas. *"They are not only the lamps to my feet during the idea generation but they are helpful to understand what kind of solution can effect what kind of user behaviour during design development"* (STU_03).

6.3.2.3 Perceived Effectiveness of Design-led Approaches

Eco-feedback would, some felt, not be as effective in changing ingrained anti-social behaviours. Intelligent products were seen as having greater potential for effecting change. However, some students felt that the balance of control may be weighted more heavily on the side of the product; therefore, users may feel controlled or restricted. It was felt that the consumers should be given the choice to behave in the 'right' way, only if they failed to do so should the product take action to prevent their behaviour. The students concluded that preventing choices straight away would annoy the customer and possibly cause a reduction in sales. Interestingly, only one student

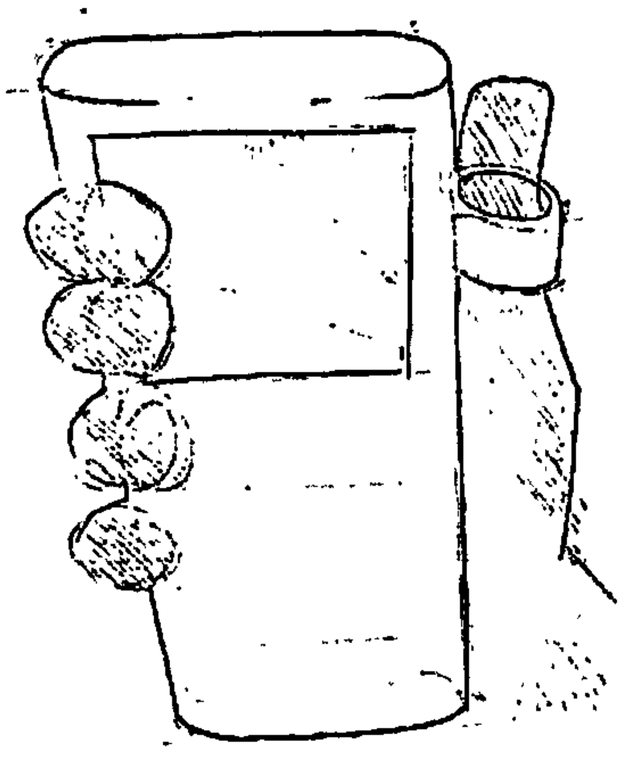
sought to analyse of downstream effects which may arise through the use of his redesigned mobile phone. His work is discussed below in Case Study 1.

6.3.2.4 Design Outcomes

Analysis of all ideas generated in sketch form and those detailed as final solutions revealed a range of approaches to solving the various social issues identified, however some commonalities could be observed in the *type* of solution proposed. The following commentary offers a brief overview of those typologies identified. A more detailed analysis of individual design case studies produced then follows.

1. Constraining or Affording Actions through the Product Form;

The examples below, extracted from two different students logbooks, illustrate the way in which the product form can be used to constrain or afford certain methods of use or behaviours. Student 1 observed users lack of concentration when using their mobile phone in public places and the resulting neglect of 'real conversations' to prioritise virtual ones.



In the concept illustrated in Figure 6.9, the mobile phone creates a physical sensation to provoke a response from the user. The hole sporadically tightens around the users thumb to remind them of where they are and to ground them in the 'real world', thereby attempting to address the problems caused by user's lack of attention when engaged in virtual interactions.

Figure 6.9: "Thumb Squeeze" Concept

Student 2 used his observational studies as inspiration for one of his design concepts, shown in Figure 6.10. Having observed some discreet users cupping their hands around the mouthpiece of the handset to mask the noise of their voice, he designed a mobile phone featuring four pressure points. These points must all be continuously depressed by the user to maintain the connection. The location of the four pressure points deliberately encourages the user to adopt a specific arrangement using both hands to shield the phone and conceal their mouth.

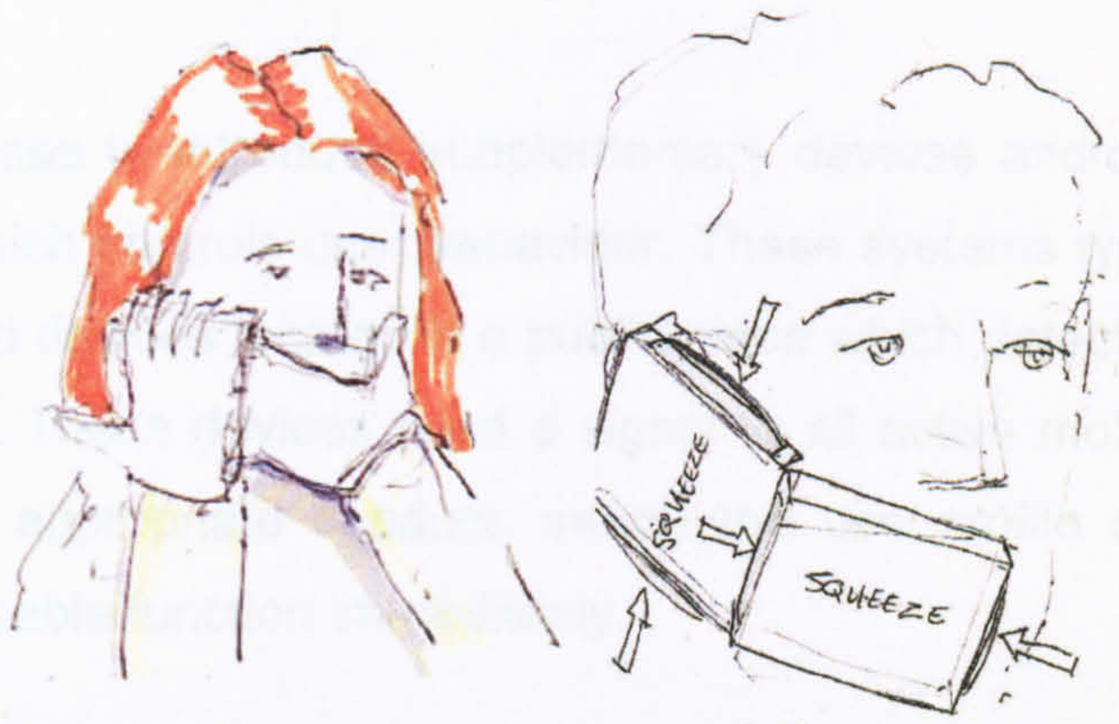


Figure 6.10: Four Point Squeeze

2. Constraining or Affording Actions through the Product Function

Some of the design concepts featured limited functions represented as quick keys or shortcuts to enable rapid access. Student 3 designed 'fast keys' which are displayed in a simple keypad to enable fast and efficient use of basic functions such as listening to voicemail and sending texts. One of the 'fast keys' enables the mobile phone to respond to incoming messages or calls with a pre-prepared text message if it is in silent mode. This function also enables the user to press the button to indicate that they are busy.

3. Eco-feedback Strategies

Several design concepts which attempted to educate the user or influence their decision-making process through the provision of information were identified. The type of information provided typically included; the 'calleds' status, location, and proximity to others. In many cases this was realised through the introduction of a supportive technology e.g. Bluetooth or a Global Positioning System (GPS). A good example of this system is detailed below in Case Study 1. The information provided to the caller or called was, in many design concepts, depicted as a scale or symbols which illustrated the level of appropriateness or suitability of the call according to the environment. In some cases the composition and content of the scale or symbol system was similar in nature to existing communication systems such as MSN Messenger. In most cases an over-ride facility was included for emergency situations.

4. Supporting Devices and Systems

Some students chose to introduce supplementary devices and/or locate the product within a system which controls user behaviour. These systems typically consisted of a series of networked devices located in a public place which detect all mobile phones in a designated area. These devices send a signal to all active mobile phones to either; notify the user of appropriate conduct, switch the use profile of all mobile phones automatically or disable function immediately.

5. Wearable Devices

Wearable devices were designed to address problems arising from incessant ringing of mobile phones left by their owners, situations in which users neglect to turn the phone off in public places, or instances where the ring tone is set too loud.

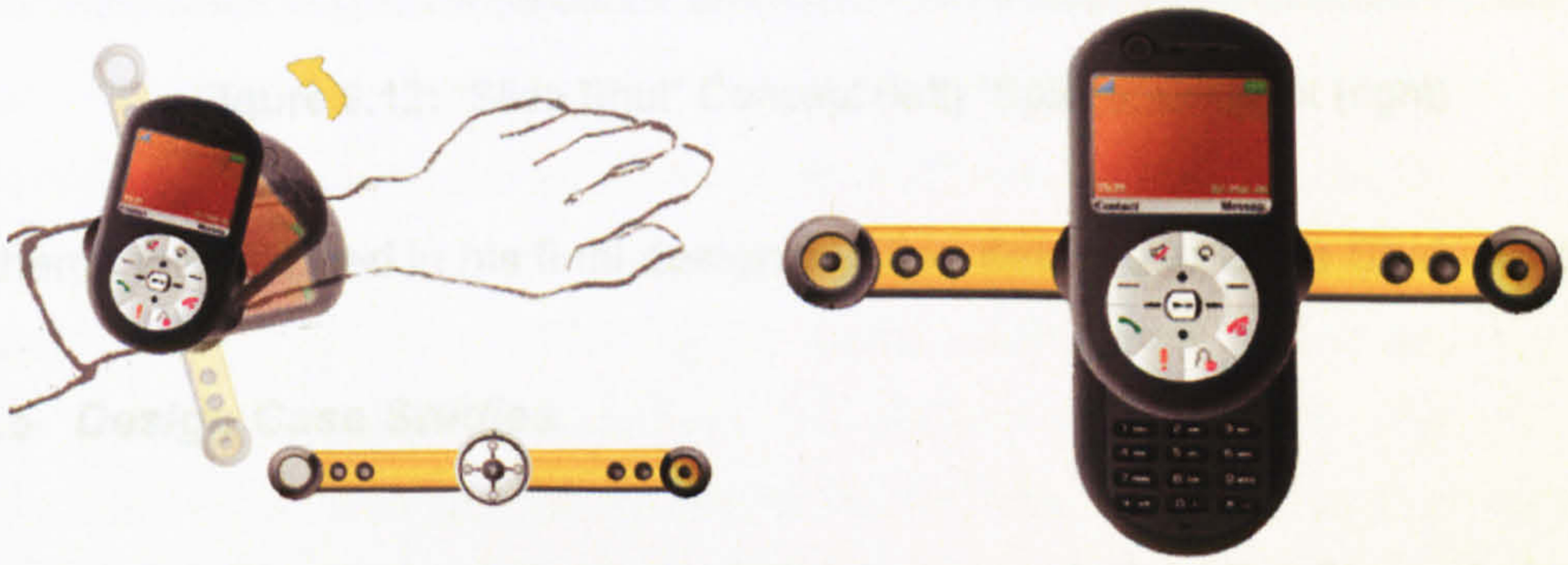


Figure 6.11: Wearable Mobile Phone Concept

The rationale described by some students who had devised wearable mobile phones was that by wearing the device the user's ability to hear the phone ringing would be increased and this would hasten their response reducing annoyance to others. It was also felt that wearable devices would allow the silent vibration mode to be used more effectively as an alert mechanism. Student 3 designed a mobile phone which the user wears on their wrist. The screen interface and keypad pivot on a fixed base attached to the wrist strap.

6. Emotional Response

One student developed a series of sketches exploring the potential for the mobile phone to produce an emotionally driven physical response to actions taken by the user. Two of these concepts are shown below in Figure 6.12. 'Slide Shut' is a concept for a

mobile phone which would automatically close should the user's voice or the duration of the call exceed an acceptable level, terminating the offensive conversation for a predetermined length of time. Development of this concept led to the inclusion of an indicator to show the user the length of time left until the phone became operational. The concept on the right contains spikes which protrude when activated by an excessively loud speaking voice; this is a particularly aggressive tactic on the part of the mobile phone.

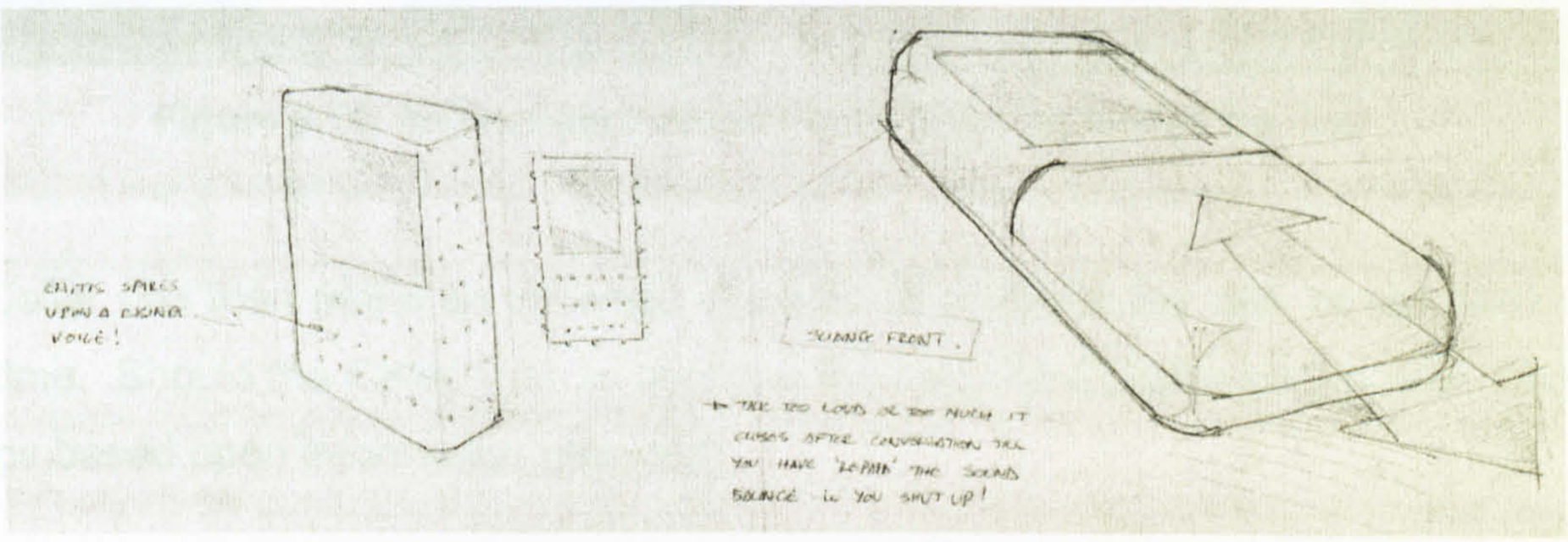


Figure 6.12: "Slide Shut" Concept (left) "Spikes" Concept (right)

This theme is continued in his final design solution detailed in Case Study 1 below.

6.3.2.5 Design Case Studies

In this section the work of three students is presented in the form of design case studies to illustrate the diversity in approaches taken in response to the design brief and variety of solutions generated.

Case Study 1: Caller Hegemony

Student 1 took the concept of Caller Hegemony (Hopper, 1992) as his starting point. Having recognised the current imbalance of power between the Caller and the Called, this student sought to generate a solution to inform and guide the Caller and Called as to appropriate action to be taken in different social and environmental contexts. This concept is based on a combination of two *design-led approaches* for behavioural change; eco-feedback and intelligence. When placing a call, the Callers mobile phone uses Bluetooth and GPS technology to inform the Caller as to the Called's current location, proximity to other users and volume of company, Figure 6.13.

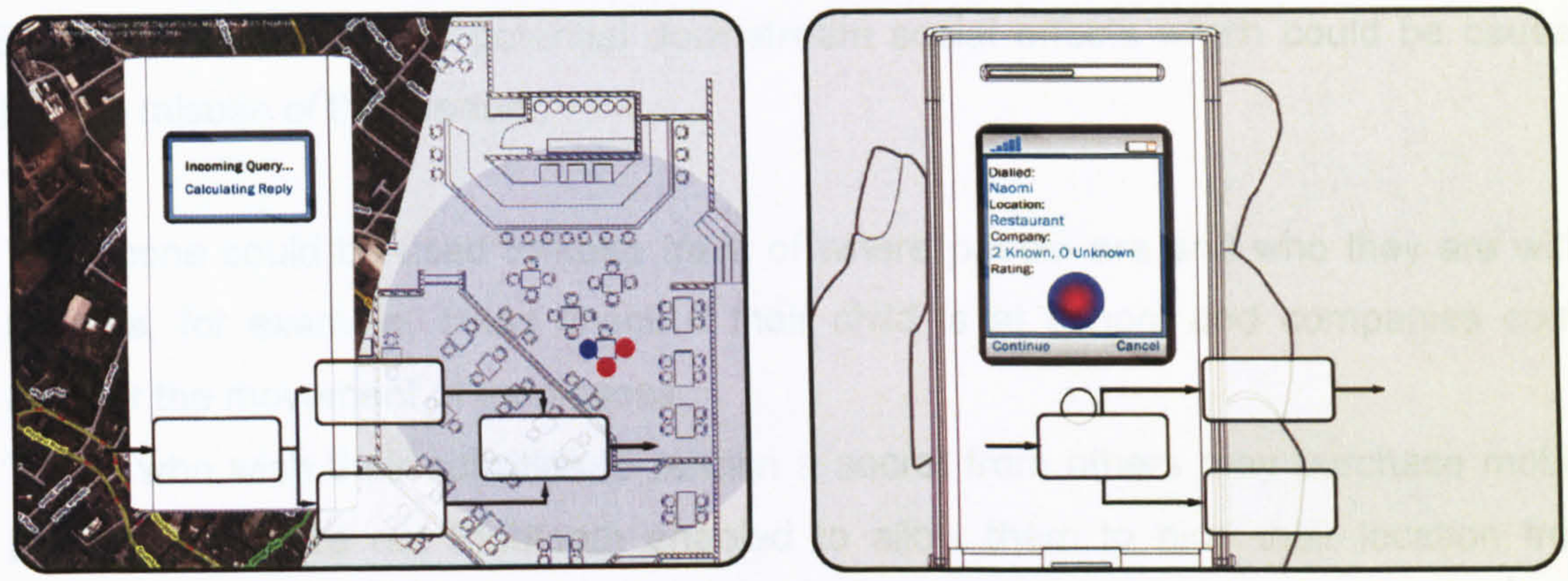


Figure 6.13: An Intelligent Mobile Phone that Can Advise the User

The Caller can then make an informed decision to continue the call, or call back at a later time. Should the Caller wish to continue the call, the Called's phone then vibrates or rings based upon information provided.

As a secondary layer of complexity the mobile phone makes a decision as to the appropriateness of the call based on its context of use. Should the Caller or the Called continue the call despite information provided to indicate the call is inadvisable; both handsets display their embarrassment at being made to behave in an inappropriate way. As part of his design development the student explored the ways in which the mobile phone could indicate its emotional state. The ideas generated ranged from highly disruptive actions e.g. deleting content, switching to speaker phone, delaying downloads in progress, or terminating the call to slightly less confrontational ideas e.g. shaking, stammering or vibrating. In the final design the phone displays its embarrassment by emitting a red light which disables functionality for a fixed period enabling the phone to calm down, Figure 6.14.

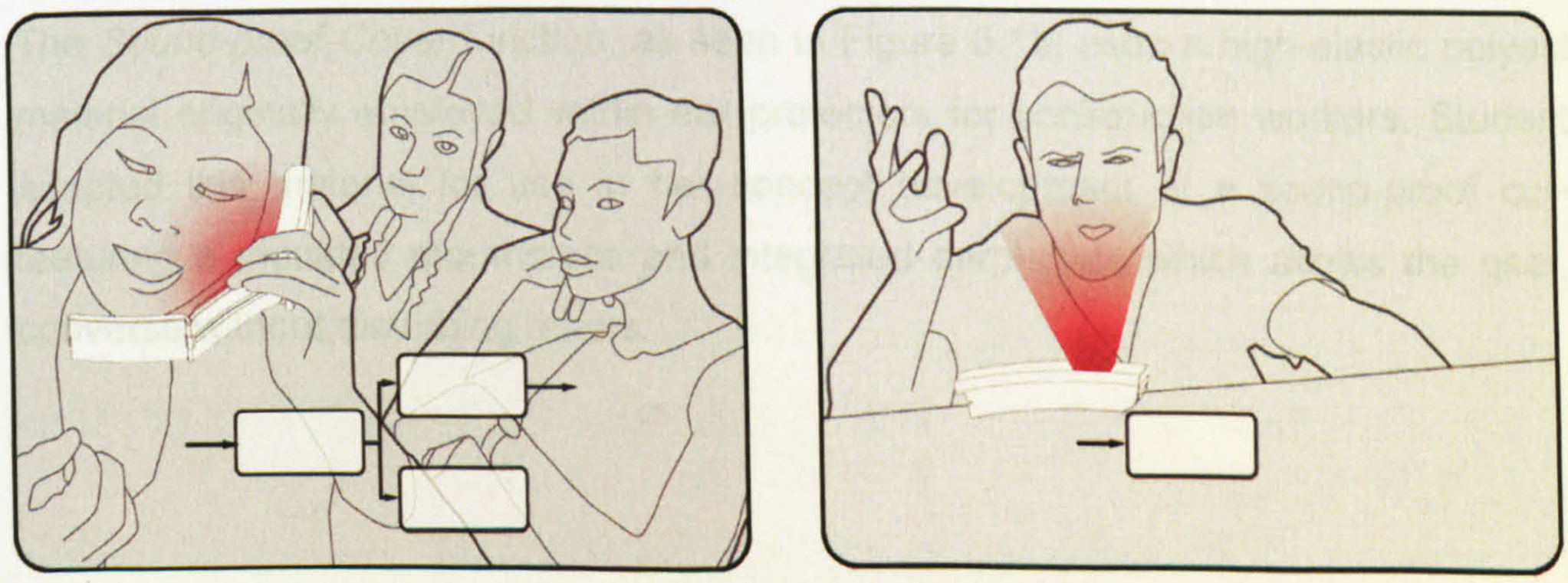


Figure 6.14: The Mobile Phone Can Display its Embarrassment

Student 1 acknowledged potential downstream social effects which could be caused through misuse of the product;

- The phone could be used to keep track of where people are and who they are with. Parents, for example, could check if their child is at school and companies could monitor the movement of employees.
- Those who wish their activities to remain a secret from others may purchase mobile phones which are not Bluetooth enabled to allow them to hide their location from others.
- Finally, it may be possible for someone to purposefully disable another user's phone by deliberately raising their voice to trigger a shutdown.

Case Study 2: Quiet Mobile Phone

Student 4's research into the social problems caused by mobile phone use in public led to the identification of the need to talk quietly or softly; to restrict the use of ring-tones in certain public places and to provide private space in which to interact. The mobile phone must, she concluded, afford clear conversation and restrict noise pollution by incorporating adequate sound insulation. To investigate how to provide these features, she drew inspiration from two seemingly unrelated activities; the communication practices adopted within the deaf community and the sound-proofing properties of ear protectors used by contractors on building sites. Using this research as inspiration, she related her findings to solving the social problems identified and translated the technology, materials and principles of use to her design ideas. Her final concept consists of two distinct features; a *Text to speech* function and a *Sound-proof Cover.*

The *Sound-proof Cover* function, as seen in Figure 6.15, uses a high-elastic polyester material originally employed within ear protectors for construction workers. Student 4 adapted this material for use in her concept development of a sound-proof cover, featuring a moulded mouthpiece and integrated earphones which allows the user to converse without disturbing others.

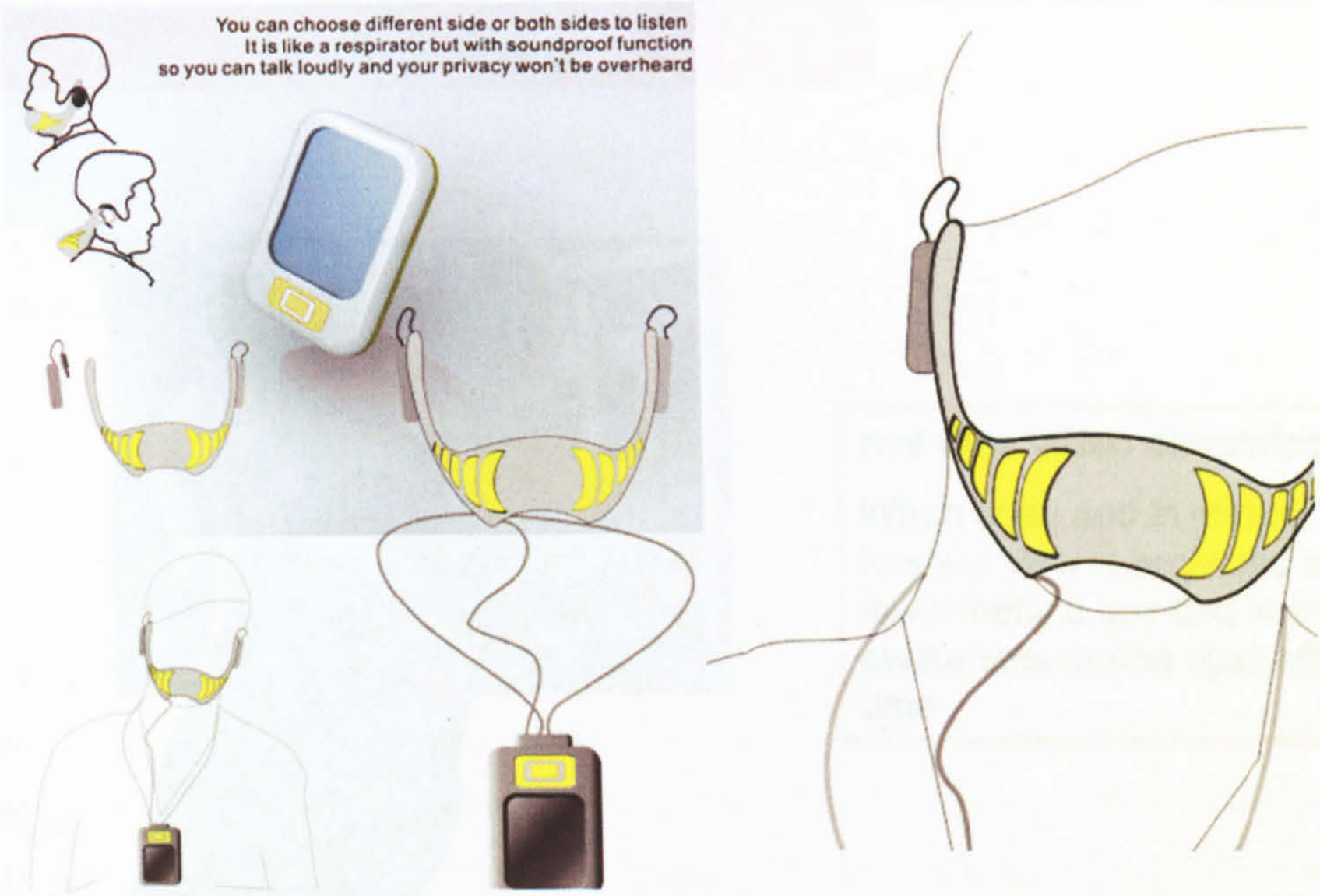


Figure 6.15: Quiet Mobile Phone Sound Proof Cover Concept

The 'text to speech' concept developed allows the sender to type an SMS message which the recipient can then hear as spoken word. This feature was developed in response to the student's research into the communication practices of deaf mobile phone users who tend to use the SMS function as a means to communicate via text instead of speech.

Case Study 3: 'Eyes off Road' Time

Student 2 explored problems caused by 'eyes off road' time, such as when users walk whilst texting. His observational studies showed that when texting, the user's line of vision is directed towards the handset display; this makes it more difficult to avoid physical hazards. This, he observed, often resulted in people traversing the pavement in a haphazard manner; slowing down the flow of pedestrians and blocking the path of others. To solve this problem, he devised a handset featuring real time video streaming, Figure 6.16. When the handset is open and in motion the forward view is projected as a screen saver behind any text, improving awareness during eyes off road time. By providing eco-feedback the user is made aware of their surroundings and encouraged to change their behaviour accordingly.

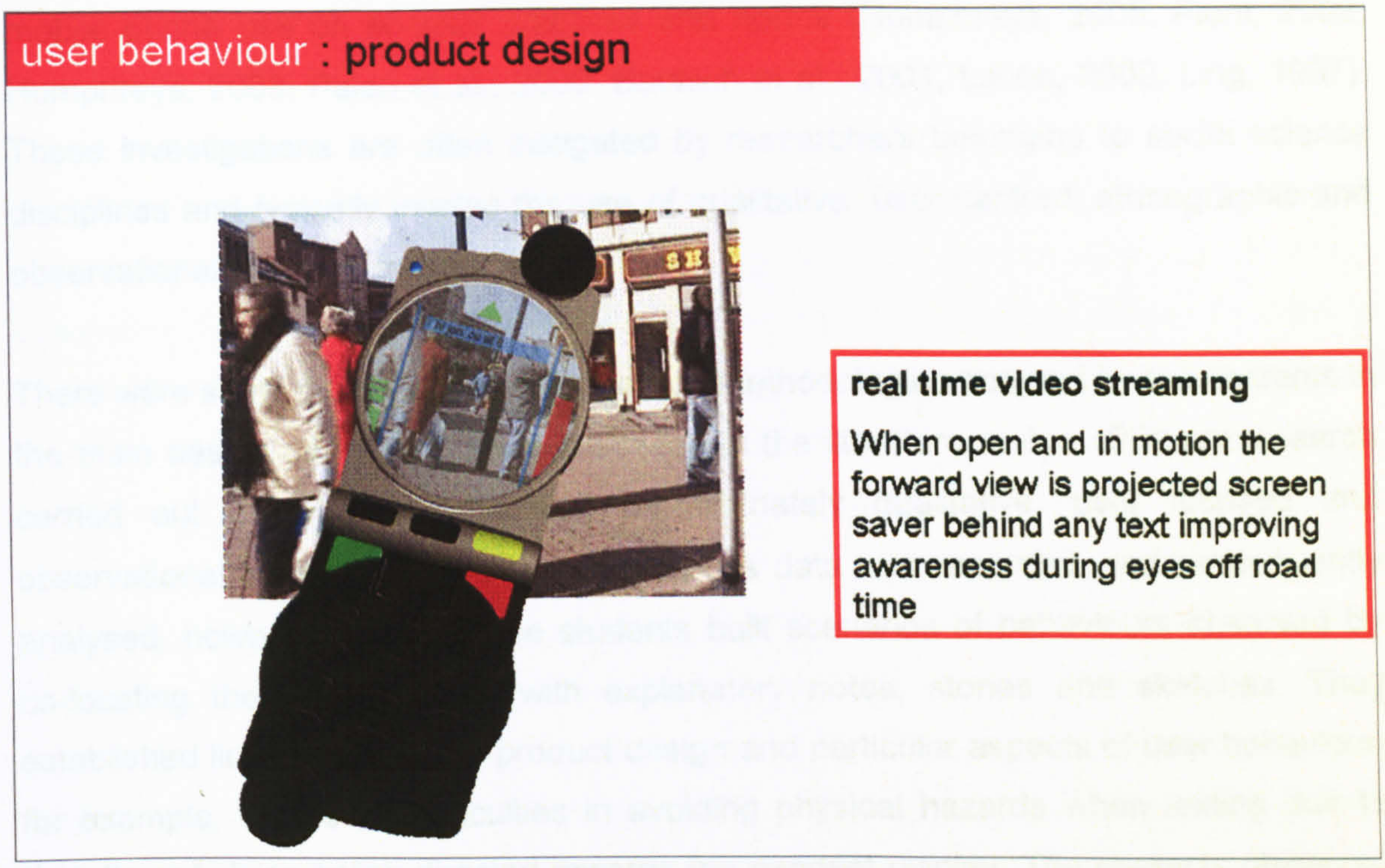


Figure 6.16: Handset featuring Real-Time Video Streaming

This student not only considered the product itself but took the brief a step further by discussing the design implications for the environment in which the product could be used. Having observed people's impromptu use of street furniture to create temporary zones in which to use their phones, he built on this observation by designing booths for mobile phone use which boost the signal of the phone. The intelligent mobile phone choreographs the movement of user, directing them to the nearest available booth through pedestrian traffic.

6.4 Discussion

In this section, emergent areas of concern from the main design study will be contrasted where appropriate with the literature concerning mobile phone use; the results from Chapters 4 and 5 and analysis of existing mobile phone design concepts discussed in this chapter.

6.4.1 Reflections on Research Approaches Used

Academic research dedicated to investigating mobile phone use in public places tends to focus predominantly on social issues regarding use, in particular the impact of

mobile phone use on societal practices and norms (Humphreys, 2005, Plant, 2002, Humphreys, 2003, Palen et al., 2000, Bautsch et al., 2001, Lasen, 2002, Ling, 1997). These investigations are often instigated by researchers belonging to social science disciplines and typically involve the use of qualitative, user centred, ethnographic and observational research techniques.

There were some similarities in the research methodologies adopted by the students in the main design study and those described in the literature review. Primary research carried out by the students was predominately qualitative, user focused and observational in nature. The way in which this data was recorded, and subsequently analysed, however, differed. The students built scenarios of behaviours observed by co-locating their photographs with explanatory notes, stories and sketches. They established links between the product design and particular aspects of user behaviour, for example, the user's difficulties in avoiding physical hazards when texting due to their line of vision being directed towards the handset display. The students displayed an ability to see things differently and through combining different elements together generated novel solutions to the problems identified.

As part of the main design study the students were provided with the product *i.e. a mobile phone*, a specific problem *i.e. private communication in public space* and some approaches they could apply within their design process *i.e. eco-feedback, behaviour steering and intelligence*. Part of their brief involved undertaking their own user centred research. In contrast, the participants of 'Designing Behaviour', as discussed in Chapter 4, were only given a product and a challenge; there was no period of research built into the designing process and no provision of potential approaches they could apply. The availability or absence of approaches in each activity has enabled some conclusions to be drawn regarding their relevance in aiding the design process. The difference in the duration of 'Designing Behaviour' versus the main design study should be considered, however, when viewing the following points.

Unable to undertake user centred research in the time given, the participants of 'Designing Behaviour' drew on their own tacit understanding and knowledge of the complexity of the relationship between the product and the user and the impacts associated with product use. The benefits of undertaking user centred research to gain an insight into the impacts of user behaviour were recognised in 'Provocations'; however the groups in 'Designing Behaviour' did not have an opportunity to develop this kind of reference material. The masters' students on the other hand were required

to include a period of user centred research and encouraged to reflect on how their findings could inform their design solutions.

Drawing on tacit knowledge of user behaviour, which often reflects designers own experiences, can sometimes lead to the development of design concepts which do not adequately address the consequences of actual user behaviour. There is often a distinct divide between user's actual behaviour and designers projected understanding of user activities. User centred research techniques enable designers to gain insights into *actual* rather than *assumed* behaviours (Lofthouse and Lilley, 2006).

In the absence of prescribed approaches, the multi-disciplinary groups taking part in 'Designing Behaviour' drew inspiration from a range of alternative theories and ideas originating from different disciplines to develop their design ideas. There were some similarities in the research and design approaches taken by participants of this study and those of the masters students. Both acknowledged the importance of considering the social context in which a product will be used; both used scenario building to consider use patterns within a specific context and storyboarding techniques to illustrate revised use patterns.

The design concepts discussed in section 6.2.4.1 were instigated by designers actively seeking to address social and environmental issues associated with mobile phone use. These concepts were mostly presented as isolated solutions with little or no supporting contextual research. Those who set out a brief context to the design problem did so without indicating how they had arrived at these conclusions. Most tended to focus on the solution, not necessarily how the solution was developed. Without this information it was difficult, from a research perspective, to identify and analyse design intentions, methodologies or processes adopted.

The masters students engaged in this design study drew together empirical research findings from the literature and combined these with the results of their own user centred research. They used this information to construct a *problem space* in which to engage. In some instances, the students actively redefined the original brief. Redefining the problem space is, according Cross, part of the design process *"designing involves 'finding' appropriate problems..... rather than merely accepting the 'problem as given'"* (Cross, 2001, p. 81).

The students applied, developed and refined approaches for designing for behavioural change appropriated from other disciplines through engaging with these approaches in their design practice. Their reflections, difficulties, thought processes and design decisions were, in most cases, recorded in their design logbooks. The range of design case studies generated as part of this research take existing knowledge an important step further; by observing the designers it was possible to record their responses to social issues arising from mobile phone use in public; how and when they applied *design-led approaches* and their perceptions of the effectiveness of these approaches in changing user behaviour.

6.4.2 Discussion of Societal Impacts Identified

There was a strong correlation between the results of the student's research findings in the main design study, those of the literature and the preliminary and main user studies presented in Chapter 5.

The main discrepancy between the literature review findings and the viewpoints expressed within the user research studies related to the impact of texting on language, spelling and punctuation. The respondents to the main user study held fairly negative views on how text messaging has impacted upon the way in which we communicate and the quality of our interactions with others in society. They pointed to the loss of emphasis in words and phrases, the reduction in emotion or expression and some considered the instantaneous nature of texting to be a contributing factor in the rise of *"knee-jerk"* reactions displayed by users. Lasen (2004), however, argues that in some cases texting can enable users to reflect and consider replies and neutralise emotional responses (Lasen, 2004). The increase in texting as an alternative to face-to-face conversation has, according to some respondents, led to reduced social interaction and a reduction in the quality of interaction; *"people often substitute texting for phoning – this impacts on the quality..."* (NCC_21). According to Bontoft however, texting allows discontinuous contact and although some messages may have a low content they have a high value (Bontoft, 2005). 'Miss you' for example is a low content, high value message. Indeed, emotionally significant text messages and voicemails are often stored in the memory of the mobile phone which then becomes a vessel for carrying these memories (Lasen, 2004, Plant, 2002).

Although these particular concerns have been discussed within the public domain via newspapers, magazines and television programs, there was little reference to this

issue within academic papers reviewed. This is not to say that the effects of texting on language, spelling and punctuation have not been examined in academic studies elsewhere. It is interesting that this particular area of concern was not explicitly raised within the student's research in the main design study. It is possible to speculate that this is due in part to the demographic of the masters group in comparison to the majority age group of participants to the main user study. The masters group was comprised of 20 to 30 year olds, whereas respondents to the main user study were significantly older. It is also possible to conclude that the lack of reference to this perception may be due to the student's use of secondary literature emanating from largely academic sources, which as discussed, also lack explicit discussion of this issue.

The notion that mobile phones have prompted the emergence of increased dependency and anxiety is supported by Lasen (2004) who also points to user's almost obsessive psychological need to be near the phone. In these cases, the individual's psychological ability to disconnect from others is reduced and they wait anxiously for the gratification of being contacted. This need is exemplified through observations of users who hold their phone in their hand whilst outside, regularly glancing at the screen to check for messages or missed calls (Humphreys, 2005) an activity also noted by respondents to the main user study *"people....become obsessed by mobiles.....constantly checking them [or] having them in front of them"* (NCC_21). Respondents also observed the increased use of mobile phones as a means to avoid contact with others, relieve boredom or pass the time, particularly when in waiting rooms, at bus stops or on public transport. This, they felt had contributed to reduced contact and interaction between strangers. The literature confirmed and elaborated on this assertion indicating that the increased use of mobile phones as a form of elected isolation can be attributed to a desire to protect ones self from unwanted attention or legitimise being alone (Plant, 2002).

Some respondents to the main user study reported an increased awareness of instances of theft of mobile phones; this is confirmed within the mobile phone literature. Lasen, for example, observed a greater concern amongst mobile phone users in London regarding theft, due to the increased coverage of mobile phone theft in the UK. The effects of this fear on user behaviour were clear, in that mobile phone user's in London *"avoid showing their phones in public places"* (Lasen, 2002, p. 18).

The dual nature of mobile phone interactions where users toggle between the 'real' world and the 'virtual' world simultaneously has been discussed in the literature review as has the implications of these interactions for others within the vicinity. Some of the main user study respondents reported feeling angry, annoyed or embarrassed when 'forced' to listen to others calls. Plant (2002) acknowledges the difficulties of being party to one side of a conversation conducted in this 'other world'; *"to overhear... one side... is to be neither fully admitted nor completely excluded"* (p. 47). Being 'forced' to listen to the phone call made by someone who seems to enjoy being overheard was a scenario described by many respondents to the user studies. The type of user they described is an exhibitionist, someone who enjoys having an audience to affirm their status or importance *"as if [the mobile phone] is an instrument of self-validation"* (NCC_03). This type of user has also been recognised in the literature; Plant (2002), for example, describes this type of user as a Flashy Peacock.

Using a similar approach to Lasen (2002), Student 3 chose to make a comparison between the etiquette of mobile phone users within two different countries, in this case the UK and Japan. Her findings indicated that in Japanese society there are overt attempts to limit mobile phone use in public, particularly on public transport, through the use of public announcements and signage. This is consistent with the UK situation. The evolution of societal norms to deal with the impacts of mobile phone use in Japan, however, appears to be more advanced than those in the UK. For example, people in Japan predominately use non-voice functions, *"there are limited instances of people receiving voice calls, but the calls are generally ended quickly"*. In Japan the silent mode is generally referred to as the *"manner mode"* (STU_03). This contrasts with the reported instances of disturbance to other people in UK public places caused by excessive ringing, loud and annoying ring tones, long conversations and inappropriate content. In a UK context, the masters students research uncovered the problems caused by the users tendency to speaking in a louder voice than normal when on their mobile phone and the resulting situation in which those in the surrounding area are subjected to 'forced eavesdropping'. This is consistent with the findings of other studies reported on in the mobile phone literature review.

The reduction in the quality of interaction was raised by the masters students research; particularly the reduction in face-to-face conversations, instances of being interrupted and interrupting others at any place any time and the decline in availability of public phone boxes. First hand observations of users engaged in an exclusive interaction and the resulting reaction of their companions revealed an obvious awkwardness on the

part of the physical partner who is suddenly excluded from the conversation, if only temporarily.

The interplay of 'control' between the instigator of the call and the recipient was raised by several masters' students in their initial research. This was mostly observed in a general sense via secondary literature; these observations were particularly directed towards the pressure placed on the recipient who often has little control, over and above prescribing the phone settings, as to the potential interruptions the phone may cause. One student however investigated this issue in a more formal sense by drawing on Hoppers theory of Caller Hegemony. Although the notion of control was raised in the literature, this was not really explicitly discussed by respondents to user centred research studies. They did, however, raise this issue in connection to the blurring of boundaries between working time and leisure time coupled with the expectation of being contactable at all times. This, if viewed in terms of control, could signify control enacted through changes in societal norms and expectations.

Some students discussed the problems associated with the potential for mobile phones to interfere with medical devices or air communications. This issue, though not discussed in detail in this chapter, was raised in both the literature reviewed and by respondents to the user centred research studies.

Personal and public safety featured within the student's research, particularly the risks associated with mobile phone use when driving and the distracted behaviour of pedestrians interacting with the phone when walking. The pedestrian's behaviour when interacting with a mobile phone, described by Student 2 as the *"walki-talki"* or *"eyes off road"* syndrome, was characterised by a lack of concentration on the surrounding environment due to a continued focus on the 'virtual' interaction. This behaviour, observed directly by some students, led to haphazard movements which visibly inconvenienced others. These findings were consistent with commentary in the literature reviewed and the reported observations of respondents to the user centred research studies.

The use of camera phones was raised in both a negative and arguably positive sense. Some students pointed to the potential infringement of other peoples privacy caused by users filming or taking of photographs or others without their consent. On the other hand, the use of a mobile phone to capture 'memories' of events was noted by Student 3 particularly within the context of Japanese society where there has been an

increasing trend in the use of camera phones to capture footage of cremations at funerals. This observation fits with those made by Lasen (2004) and Plant (2002) in the preceding section who point to the role of mobile phones as vessels for carrying and preserving memories.

The potential for mobile phones to be used as a means of abusing others was raised within the context of 'happy slapping'. Happy Slapping is the term used to describe *"the phenomenon of an individual or group slapping or striking a stranger while an accomplice films the assault using a camera phone"* (Wikipedia, 2007). This practice was recognised by respondents to the user centred research studies but not overtly discussed in the literature. The emergence of 'happy slapping' is a relatively new phenomenon which has often been discussed within the media, particularly following a high profile case, and as such has become an issue for concern amongst the respondents to the user research studies and some of the masters students in the main design study.

6.4.3 Comparison of Design Concepts Generated

There were some similarities between the design concepts generated in the 'Designing Behaviour' activity, those suggested by respondents to the user centred research studies, those identified in the literature and those developed by the masters students;

- In analysing the *'four point squeeze'* concept developed by Student 2, similarities can be drawn between this concept and Durrant's described in section 6.2.4.1. It is also possible see how this design responds to and builds upon the observations of bodily gestures and movements observed by both Plant (2002) and the respondents to the NCC study.
- Student 4 drew inspiration for her concept from two seemingly unrelated activities which were communication modes adopted by deaf-blind people and the ear protection devices used on building sites. She then applied these ideas in the context of her design concept. This is similar to the approach taken by the Green Stars in 'Designing Behaviour', who also looked horizontally at alternative activities to inform their concept.
- The wearable devices developed by some master's students are similar to the ideas expressed by one of the respondents to the preliminary user study reported on in section 5.3.8.6.

- Designs developed by the master's students which provide eco-feedback to inform users of the 'calleds' status, location, and proximity to others through the introduction of a supportive technology e.g. Bluetooth or a Global Positioning System (GPS) are similar to the Context Aware mobile phone concepts discussed in section 6.2.4.1. The student's concepts mostly focused on developing a user interface to provide information based on an assumption of technological capability. The examples discussed in section 6.2.4.1, however, almost certainly benefited from a longer development period allowing a more in-depth investigation into establishing viable technological systems to enable this process to operate.
- Norman's notion of designing voice cups to mask and diffuse the speaker's voice, to reduce disturbance to others is realised in Student 4's *'Sound-proof Cover'* which allows the user to converse without disturbing others.

It is interesting to reflect on the student's perceptions of user's acceptance of products which attempt to effect behavioural change in light of the similarities between the some of the concepts offered by users responding to the user centred research studies and the concepts the students proposed.

6.5 Conclusions

6.5.1 Reflections on Design-led Approaches

In this section, conclusions will be drawn from the student's debate concerning the moral and ethical issues inherent in designing for behavioural change; the effectiveness of *design-led approaches* in changing user behaviour and the level of *control* or *influence* which designers or manufacturers should ethically integrate into the product design process. The comments made by the students in this chapter will be contrasted with those from participants of Provocations, Chapter 4. As demonstrated below, there were significant commonalities in responses gathered;

6.5.1.1 Eco-Feedback

Eco-feedback was understood by most students and was arguably the easiest approach to apply within the product design. However, the students questioned its effectiveness in changing ingrained user behaviours due to the potential for the user to

ignore the feedback provided. The Design I Behaviour participants were aware of eco-feedback strategies and rated their potential in changing behaviour. These respondents felt it was vital to ensure that feedback focused on short term consequences not long term. Analysis of the literature revealed that although eco-feedback provide users with information to enable them to change their behaviour, this information does not necessarily lead to action as the consumer must make sense of the feedback and relate it to their own actions before committing to change their behaviour (Velden, 2003). This fits with the student's assertion that users should be told why they need to change. Provision of an explanation would, they felt, increase the likelihood of consumers making the *right* decision next time.

6.5.1.2 Behaviour Steering

Behaviour steering was the least understood approach by the students. This may be due in some respects to the lack of tangible examples of how this approach could be applied within product design. Behaviour steering approaches were not explicitly referred to or discussed within Provocations, though this in itself cannot determine the extent of knowledge concerning this approach within the design community.

6.5.1.3 Intelligence

The research findings indicated that intelligence can be displayed mechanistically, by limiting or prescribing functionality, for example, or emotionally via an embodied sense of self and ability to produce an emotional or physical response to actions taken by the user. Intelligence approaches ranged from highly disruptive actions e.g. deleting content, switching to speaker phone, delaying downloads in progress, or terminating the call, to slightly less confrontational ideas e.g. shaking, stammering or vibrating. In Student 1's concept, the mobile phone was able to convey its embarrassment by emitting a red light which disabled functionality for a fixed period enabling the phone to calm down.

Intelligent products were seen by the students as having the greatest potential for effecting change as they override any decision making by the user. However, some felt that if the product continuously regulated behaviour it would not encourage people to learn and would reduce their ability to recognise the consequences of their actions. This viewpoint was shared by the respondents to Provocations. Both the students and

the Provocations participants felt that *controlling* the user could result in a feeling of being restricted or policed by the product. The Provocations respondents seemed to favour *influencing* or *persuading* rather than *controlling*. This was confirmed by the students, many of whom felt that *persuasion* rather than *force* was more acceptable. Both agreed that reducing the user's ability to act autonomously would be annoying and that users would want to retain some measure of choice and be able to override decisions taken by the product. Users should, the students felt, be given the choice to act in a proper manner and that the product should only take action to prevent their behaviour if they failed to behave appropriately.

6.5.1.4 A Combined Tailored Approach

By comparing the design concepts proposed by respondents to the user centred research studies, those found in the literature discussed in this chapter and those designed by the masters students it has been possible to identify the following design strategies;

1. Constraining or affording actions through the product form *e.g. Student 2's 'four point squeeze' concept or User_I-02's concept for design to avoid breakage where the phone case is designed to have a better grip, the phone itself is shaped or moulded in textured surface materials to avoid it slipping.*
2. Constraining or affording actions through the product function *e.g. 'quick key concepts', IDEO's musical mobile and Durrant's mobile phone concept.*
3. Using eco-feedback to inform users of the 'calleds' status, location, and proximity to others through the introduction of a supportive technology e.g. Bluetooth or a Global Positioning System (GPS).
4. Creating wearable devices to bring user in direct contact with mobile phone and actions/repercussions associated with its use.
5. Regulating the type of communication to ensure it is appropriate to the context *e.g. Student 4's text to speech function, concepts which 'switch' profiles e.g. context aware cell phones (Siewiorek et al., 2003, Madan and Pentland, 2006, DeVaul and Dunn, 2001) and IDEO's speaking mobile which affords silent communication by enabling the user to respond using simple expressive sounds.*
6. Emotional Intelligence *e.g. Taylor's intelligent mobile or Student 1's conceptual designs.*

It is clear from the list above that most students appeared to favour a combined approach which is a particularly interesting development especially as the brief originally stipulated that only one approach be used. The blurred boundaries between the theories discussed in the literature review reinforce the assertion that techniques drawn from different fields of enquiry, and indeed different theories, can and should be used in combination. Indeed, the use of various persuasive techniques in combination may increase the effectiveness of the device (Fogg, 2003). One of the outcomes of this study has been to inform the research by identifying potential ways in which *design-led approaches* may effectively be configured to maximise their effectiveness in addressing user behaviour. For maximum effectiveness it is possible to conclude that due to the different scales of impact associated with different use behaviours there is a requirement for a tailored strategy of product intervention using a combination of approaches.

6.5.2 The Way Forward: An Initial Framework

The findings of the literature review, Chapter 2, coupled with those of this chapter have assisted in developing an initial framework of attributes which could increase the likelihood of changing user behaviour. These attributes are not specific to products aiming to reduce the social impacts of use, but can be considered applicable to all products aiming to change user behaviour. Table 6-4 below summarises the overall framework and in the following section each attribute is described in detail.

Summary of Attributes for 'Behaviour Changing' Devices	
Based on the evidence, 'behaviour changing' devices should;	
1	make resource use and resulting waste visible,
2	be coupled with eco-efficiency improvements,
3	provide tangible incentives and measurable outcomes,
4	use predominately positive, rather than negative, reinforcements,
5	avoid competing with other values,
6	provide feedback in real-time,
7	ensure reinforcements are varied in frequency and modality,
8	adjust to respond to changes in user behaviour
9	not compete with, but be supported by, and support, the context of use
10	be, as far as possible, ethical in their intent and predicated outcomes

Table 6-4: Summary of Attributes for 'Behaviour Changing' Devices

Evidence suggests that consumers are willing to change their behaviour but feel unwilling to do so unless they can see that others are taking similar steps to change (Sustainable Consumption Roundtable, 2006a). Those observed taking a *free-ride* by

deferring responsibility to others diminish the majorities inclination to act (Moisander, 1997). Therefore a logical principle may be to ensure interventions are *applicable to all users.* However, this premise is not necessarily practicable as users have different capabilities, experiences, behaviours and needs. Therefore, a more appropriate guiding principle may be to *encourage users to reflect upon and take responsibility for reducing the impacts resulting from their actions.* It is also clear that interventions should be tailored to target a particular customer segment who may share a similar profile. Based on the evidence 'behaviour changing' devices should;

1. Make resource use and resulting waste visible;

The invisible nature of resources like energy and water contributes to consumer's lack of consideration for their provision or use. Making resource use visible encourages conscious reflection on use patterns (Interactive Institute, 2004, DIY Kyoto, 2005). The visibility of the device may be enhanced if it promotes interaction, is visually appealing and therefore warrants prominent display, relies on regular input of data or provides a reward.

2. Be coupled with eco-efficiency improvements;

As discussed previously, appropriate eco-efficiency strategies applied in the early stages of a project can be incredibly effective in reducing environmental impacts. Yet the success of technological innovations to increase energy efficiency is often dependent on consumer compliance, and unexpected behaviour can often reduce intended eco-efficiency gains. Several concepts discussed in the literature review, Chapter 2, highlighted the importance of ensuring the device is optimised to increase its environmental performance in addition to introducing interventions to direct user behaviour.

3. Provide tangible incentives and measurable outcomes;

The provision of tangible incentives and measure outcomes assists in motivating behavioural change as consumers are able to link their actions to noticeable differences (ESRC Global Environmental Change Programme, 2000). This may be more effective if improvements are located in their local environment (Holdsworth, 2003, Gordon, 2002).

4. Use predominately positive rather than negative reinforcement;

Operant conditioning advocates the use of interventions that reinforce target behaviours through positive and negative feedback (Fogg, 2003); the combination of affordances and constraints in product design guides user behaviour by prescribing a course of action (Norman, 1998). Equally, scripts employ incentives and rules to encourage desirable behaviours whilst blocking undesirable ones (Jelsma, 2003). The literature suggests that the provision of positive feedback can be *more beneficial* in motivating consumers to continue practicing new behaviours (Scott, 2004) as consumers have been shown to respond more favourably to incentives than penalties (Holdsworth, 2003). Consumer acceptance of a device which uses a *persuasive approach* that seeks to achieve a voluntary change in behaviour and *a coercive technology* which forces behavioural change could be significant (Fogg, 2003). Indeed, research seems to indicate that *forcing* change in behaviour by constraining actions may even be counterproductive if it causes users to try to counteract unfavourable impositions (Lockton, 2005, Jelsma and Knot, 2002).

5. Avoid competing with other values;

Evidence indicates that existing values, or commitments can inform the consumers willingness to change (Cialdini, 2007). Information which challenges existing values or beliefs may be less likely to be accepted, when it is judged alongside competing values (Dembkowski and Hanmer-Lloyd, 1994). The importance of understanding the complex set of values underlying consumer behaviour should not be underestimated as only by understanding these factors can effective strategies be devised to change behaviour (Market Transformation Programme, 2007). Wherever possible, interventions made should avoid competing with deep-set values held by the user, unless these values seriously undermine the possibility for positive changes towards environmental protection or social well-being. In these cases, perhaps provision of an incentive or associated benefit may be applicable. The *Trojan Horse* approach posited by Edahiro (2004) in which sustainable values are concealed inside attributes considered more desirable or acceptable, may be of use here. Unilever took this approach by choosing to market tablet detergents not on an environmental platform i.e. reducing resource use, but on convenience (Unilever, 2000).

6. Provide feedback in real-time;

The literature and product design concepts both support the notion that real-time feedback makes more tangible the links between action and consequence and can enhance the effectiveness of the device in directing behaviour (McCalley and Midden, 2002, McCalley, 2006, Arroyo et al., 2005).

7. Be varied in frequency and modality;

Evidence suggests that to maintain changes in behaviour regular reinforcement must be provided (Scott, 2004). Repetitive reinforcement, particularly in respect to behaviours already adopted by the user, may over time become annoying. Arroyo et al. (2005) suggest varying the frequency and type of intervention to ensure spontaneity and reduce irritation. This may also assist in reducing the potential for users to circumvent interventions by anticipating actions taken by the device. Increasing the level of interaction, play and game playing may also help to create and sustain a lasting relationship between the product and the user (Chapman, 2005).

8. Adjust to respond to changes in user behaviour;

The challenge for designers is to imbue products not only with the capacity to recognise and respond to changes in the users behaviour but also to develop an embedded guide, or set of principles which the device can draw on to mediate, persuade or control behaviour accordingly. The problem with this is that user behaviour and its resulting impacts are influenced by a number of internal and external factors; behaviour therefore is often continuously changing. In addition, the environmental and social issues or impacts considered to be of significant importance today may not be the same in years to come. The range of variables present in any device designed to change behaviour are many, the useful life of such devices unable to adapt to deal with these variables would be fairly limited.

9. Not compete with, but be supported by, and support, the context of use;

The literature suggests that the user is guided by a sense of what is appropriate behaviour in a given context or setting. It is widely agreed that factors related to the physical environment and social context in which a product is used can facilitate or impede certain practices taking place (Jackson, 2004b, Sanne, 2002, Sustainable

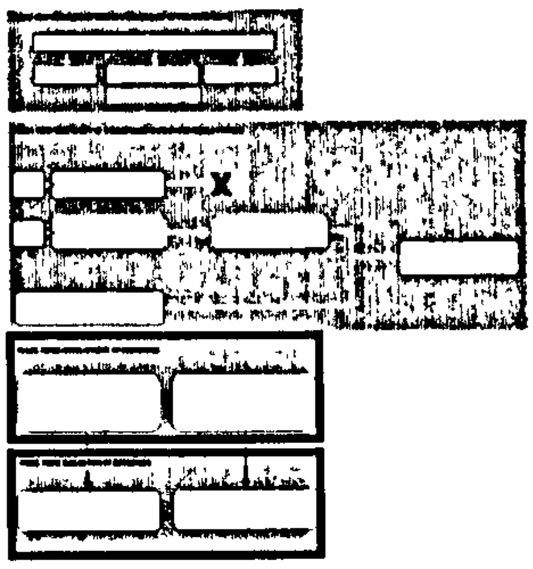
Consumption Roundtable, 2006a). Several studies of mobile phones, for example, have concluded that the context in which the interaction takes place can determine how the user will respond (Green, 2005, Palen et al., 2000, Plant, 2002). Prior research suggests that in order to be effective, interventions integrated into the product architecture must be supported, and not contradicted by, the system in which it operates. Consideration must therefore be given to the context in which the device may be used to ensure that the interventions are not undermined by external agents, rules, norms or guides.

10. Be, as far as possible, ethical in their intent and predicted outcomes.

In light of the absence of guidelines for 'Designing Behaviour' changing products, reference should be made to those resources emerging from other disciplines, most notably the Ethical Principles of Persuasive Technology as developed by Berdichevsky and Neuenschwander (1999). These principles should be applied in the design concept generation stage as a measure to evaluate the ethical dimensions of any product design concepts proposed.

7 DESIGNING FOR BEHAVIOURAL CHANGE: RESPONSIBILITY, ETHICS & THE DEVELOPMENT OF APPROPRIATE RESOURCES

7.1 Introduction



This chapter reports on the development of a collaborative design project and short film in **Phase Three** of the primary research and their evaluation by design professionals in **Phase Four**.

The findings of Chapters 4, 5 and 6 provided an initial insight into the type and format of information required to consider behavioural change when designing. The participants of these studies wanted to understand the problems caused by user behaviour and to be challenged to address these problems. Tools developed to assist in designing for behavioural change should, they felt, provide insights to help construct a problem space to engage in, rather than act as prescriptive methodologies for, generating solutions. Additionally, tools should be implemented early in the design process ideally at the "ideation" stage.

In response to these findings a collaborative design project and a short film were produced. The intention was that these could be developed further to become resources for designers to use when considering behavioural change. In order to validate previous findings and test the effectiveness of these proposed resources, a series of one-to-one interviews with design professionals were conducted and a film screening arranged. The results are presented and discussed in this chapter and conclusions drawn.

7.2 Methodology for Collaborative Design Project

To build on prior design work produced as part of this research, a more in-depth design activity was carried out in partnership with a designer. Ecodesign case studies can be extremely beneficial in educating, encouraging and inspiring designers, particularly during idea generation (Lofthouse, 2006). The provision of existing design case studies as part of the masters brief, reportedly acted as stimulus for problem solving and

helped students clarify the "design-led" approaches introduced. A case study format was therefore seen as a valuable and appropriate outcome for this research.

The chosen designer was a graduating MSc student from Loughborough University who also took part in the main design study described in Chapter 6. He therefore had some prior understanding of, and interest in, designing for behavioural change. Drawing on the findings of previous studies, particularly the framework proposed in Chapter 6, the brief was co-defined through informal discussions with the designer drawing on the research outlined in earlier chapters.

In order to evaluate the effectiveness of the collaborative design project as a resource for designers, it was necessary to speak to a range of design professionals and present this project to them in person. Semi-structured interviews were considered the most appropriate methodology as this enabled the researcher to present the product in use scenario using printed presentation boards and solicit views on this which were of a sufficient quality and depth. As discussed previously with respect to the preliminary user studies, one-to-one interviews provide opportunities to clarify questions and avoid non-responses which may occur in postal surveys. There is also the *"possibility of modifying one's enquiry, following up interesting responses and investigating underlying motives"* (Robson, 2002, p. 272). Interviews may be recorded, which assists in the analysis of the perceptions gathered and forms a record of the discussions. Literature suggests that to ensure interviews are focused, structured and comparable the researcher should prepare an agenda of issues for discussion as a guide. This *"is not a tightly structured set of questions to be asked as verbatim as written.....rather, it is a list of things to be sure to ask about when talking to the person being interviewed"* (Robson, 2002, p281). It assists the researcher to expand on interesting points and quickly move on when the discussion is becoming irrelevant or unhelpful. Additionally, when sent in advance, it allows participants to consider their responses carefully prior to the interview. Each respondent was sent a brief e-mail requesting their assistance in evaluating the outcomes of the Collaborative Design Project, and referring them to the following issues to be discussed;

I. Designers' responsibilities for the impacts of product use,
II. The ethics of persuasive product design for sustainability,
III. The types of tools or materials which may assist in the design of products which encourage behavioural change.

Table 7-1: Issues for Discussion in Interviews with Design Professionals

Eight respondents from various design professions were interviewed for approximately one hour. Each interviewee was assigned a code to ensure their anonymity whilst allowing their perceptions to be quoted as part of the findings. A description of each interviewee and their corresponding code can be seen in Table 7-2.

Participant Description	Code
A Freelance Eco-Fashion Designer	DPI-01
A Product Design Lecturer & owner of a small product design consultancy	DPI-02
Four individuals working in a large design consultancy whose roles include; ▪ Packaging, ▪ User Centered Research, ▪ Product Engineering, ▪ Industrial Design.	 DPI-03 DPI-04 DPI-05 DPI-06
The founder of an Eco-Design Centre working to integrate eco-design in SMEs	DPI-07
A Consultant working as part of the Business Innovation team for a sustainability focused NGO.	DPI-08

Table 7-2: Design Professionals: by Type

The responses were recorded and analysed using a mind mapping technique to build up detailed issues or concerns relating to the collaborative design project outcome and designing for behavioural change in general. An example of this mapping technique can be seen in Figure 7.1 below which shows the full map on the left and a detailed close up view of one section on the right.

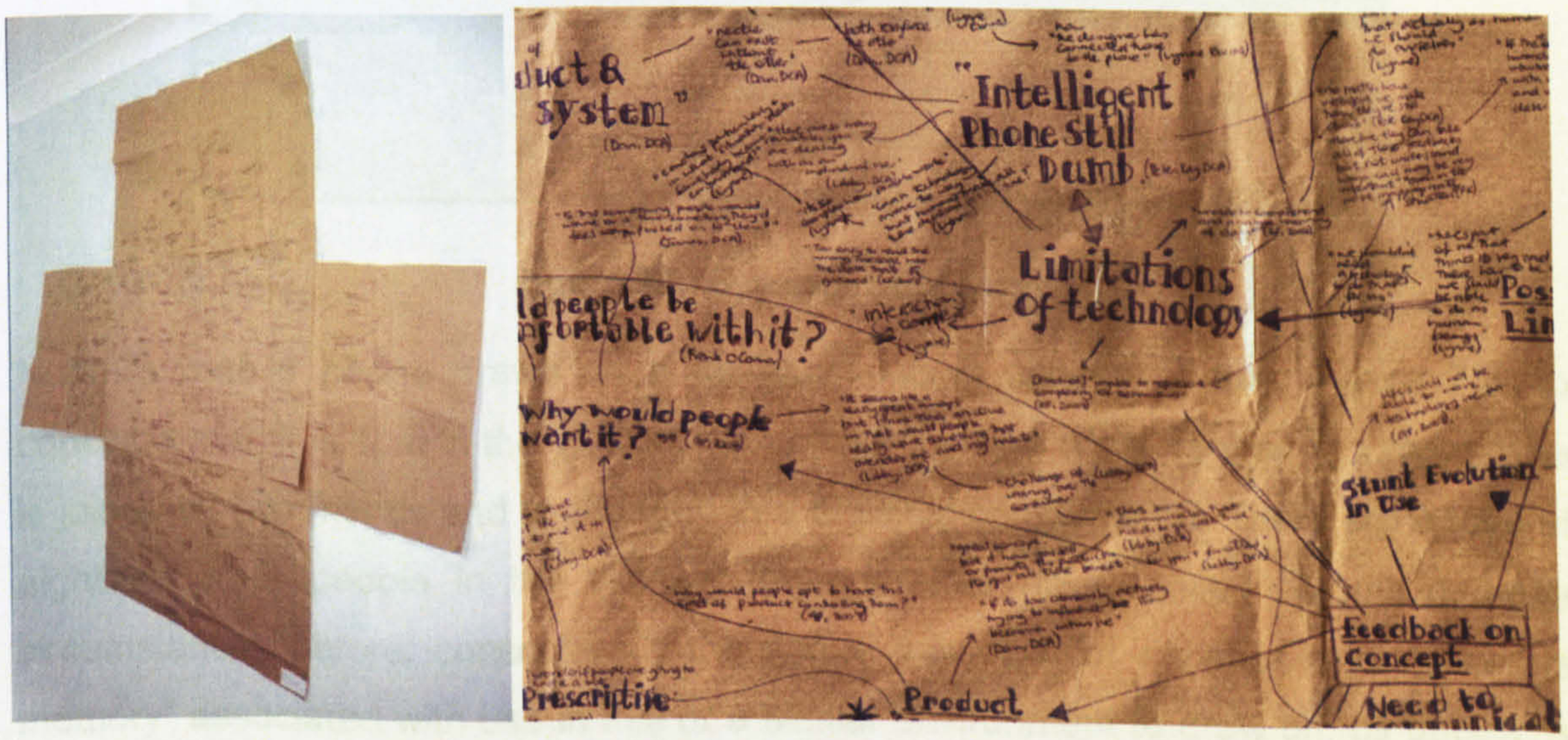


Figure 7.1: Mind Map of Design Professionals' evaluation (left) detail (right)

As depicted in Figure 7.1 each interviewee's perceptions were mapped one over another around corresponding issues and concerns to build a complete picture of their collective viewpoints.

7.3 Scenario of Use

A scenario of use was created to illustrate how this product would respond to different types of user behaviour enacted in a specific context. This scenario maps the process of interaction between two individuals; Naomi (the "Called") and Seymour (the "Caller"). As demonstrated in Chapters 4, 5 and 6 scenarios are often used by designers as tools to convey the effects of product use. Therefore, the use of a scenario to present this concept was considered appropriate. A full set of presentation boards from this project can be found in Appendix K.

Using the tactile pressure sensitive control membrane located at the base of the handset, Figure 7.2, *Seymour* dials *Naomi's* number.

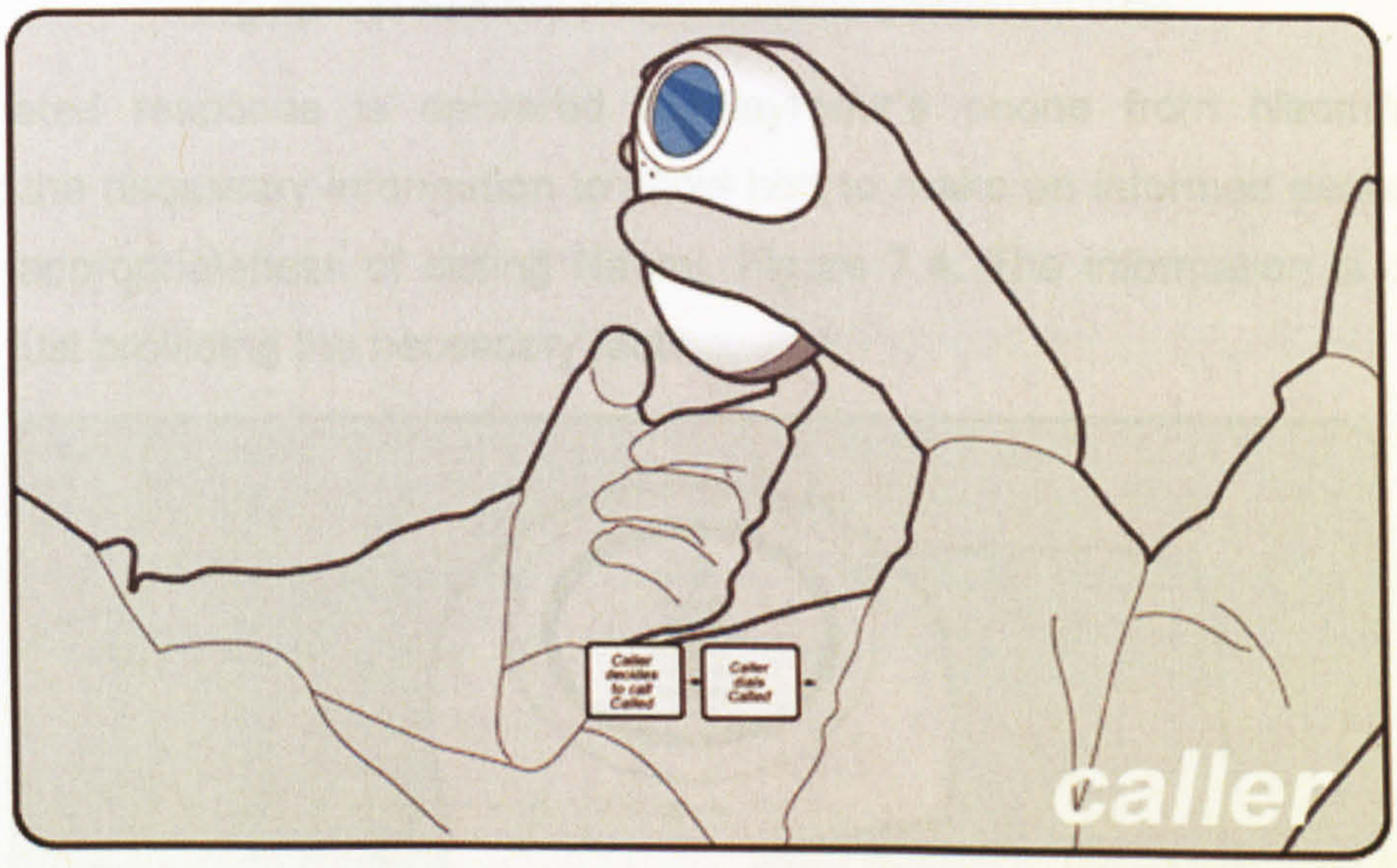


Figure 7.2: Seymour Calls Naomi

Naomi's mobile phone draws on a series of inbuilt sensory inputs, Figure 7.3, to conclude that; it is 1pm in the afternoon and Naomi is in a restaurant environment. She is joined by two friends and is engaged in a physical conversation. There are a total of eighteen other people in the vicinity. Seymour has never called Naomi in these circumstances before; consequently the phone has no prior experience or "previous memory" associated with use in this or a similar environment to draw on. Its decisions therefore are based on the "inherent memory" protocols assigned by the central network, section 7.4.6.

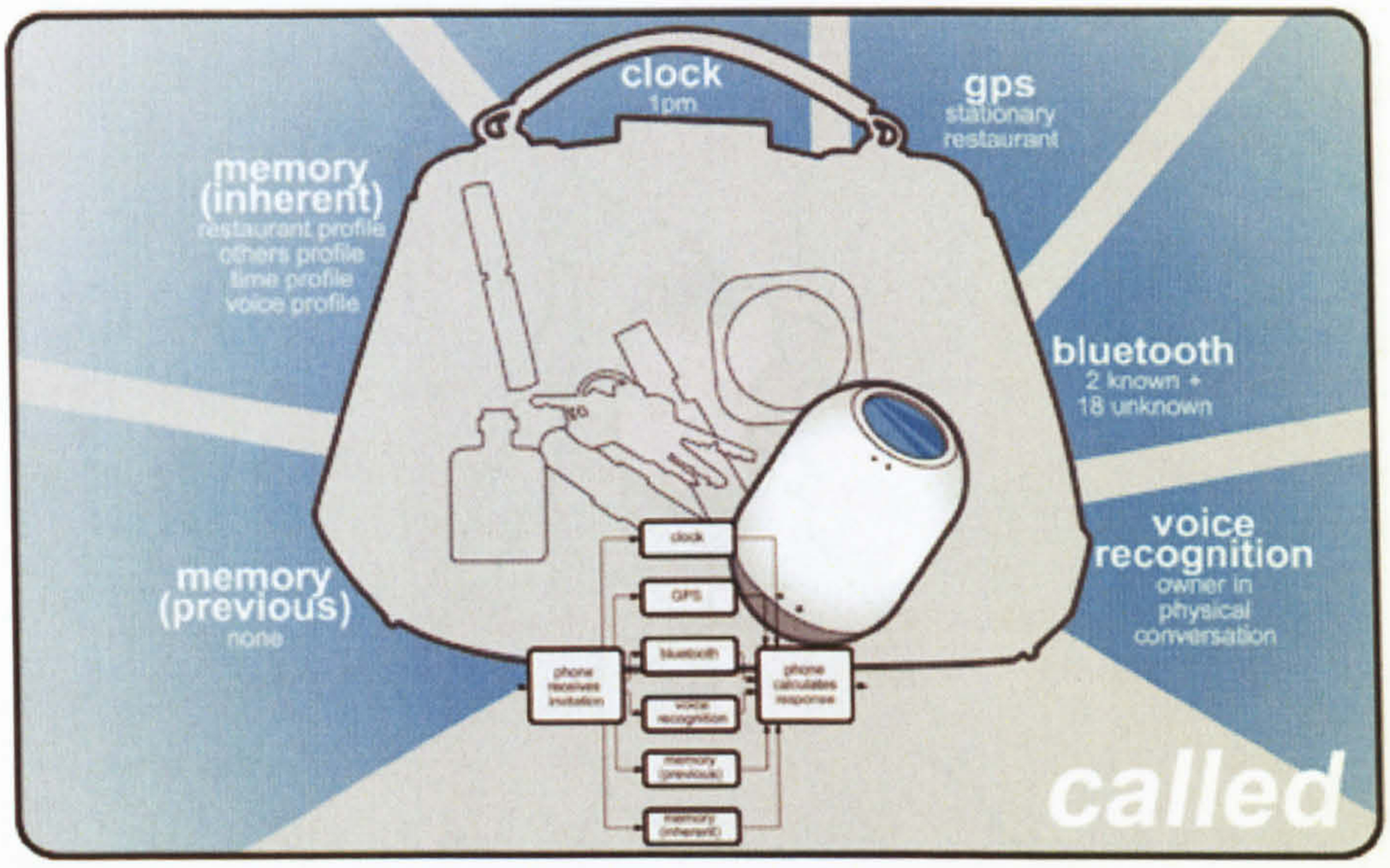


Figure 7.3: Naomi's Phone Collects Contextual Data

An automated response is delivered to Seymour's phone from Naomi's phone containing the necessary information to allow him to make an informed decision as to the social appropriateness of calling Naomi, Figure 7.4. The information is clear and unbiased, just providing the necessary facts.

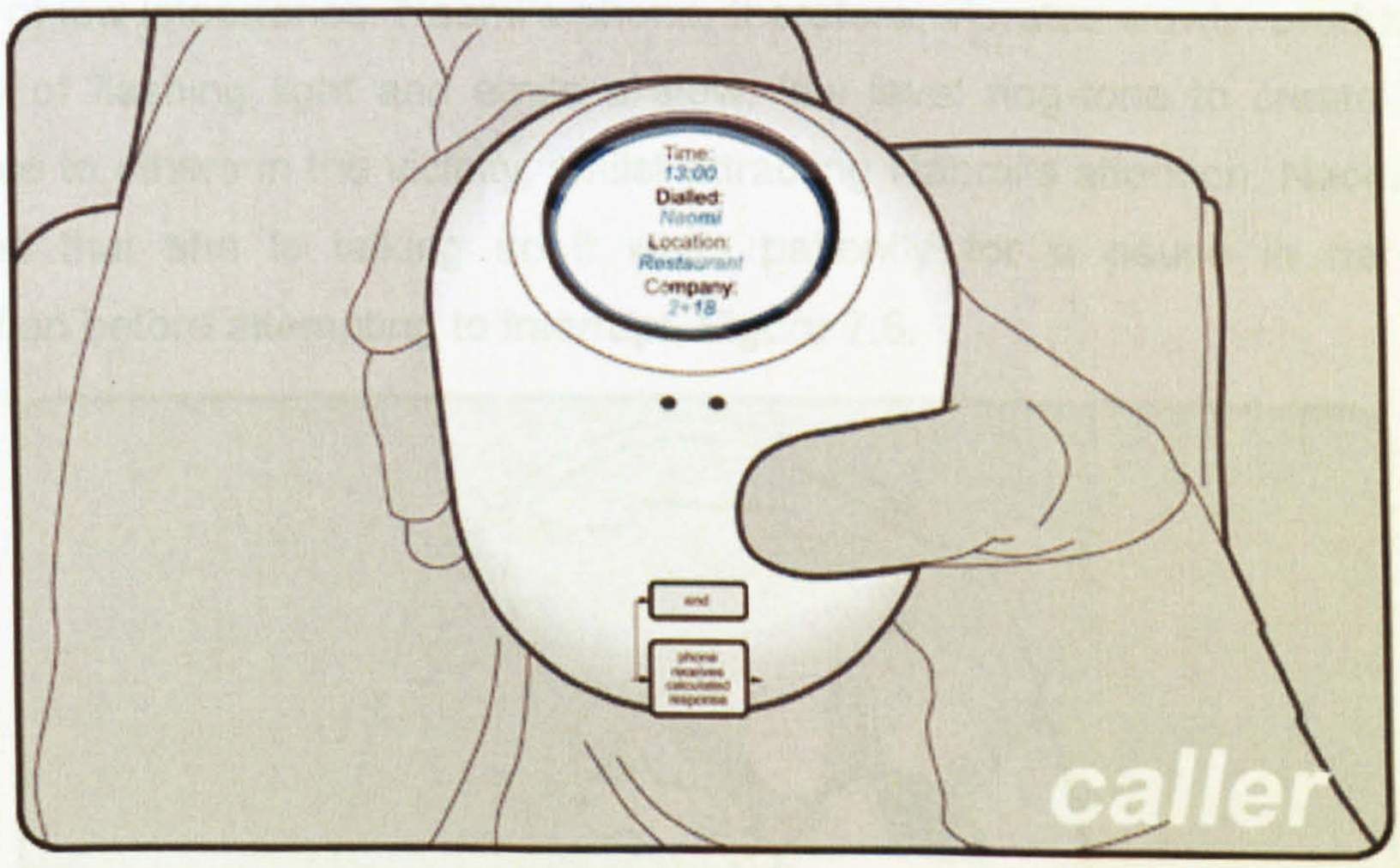


Figure 7.4: Seymour's Phone tells him Naomi's Context

Seymour uses this information to decide whether he wants to continue the call and on reflection he decides to proceed. He communicates the urgency of his call by squeezing the pressure pads located either side of the handset, Figure 7.5.

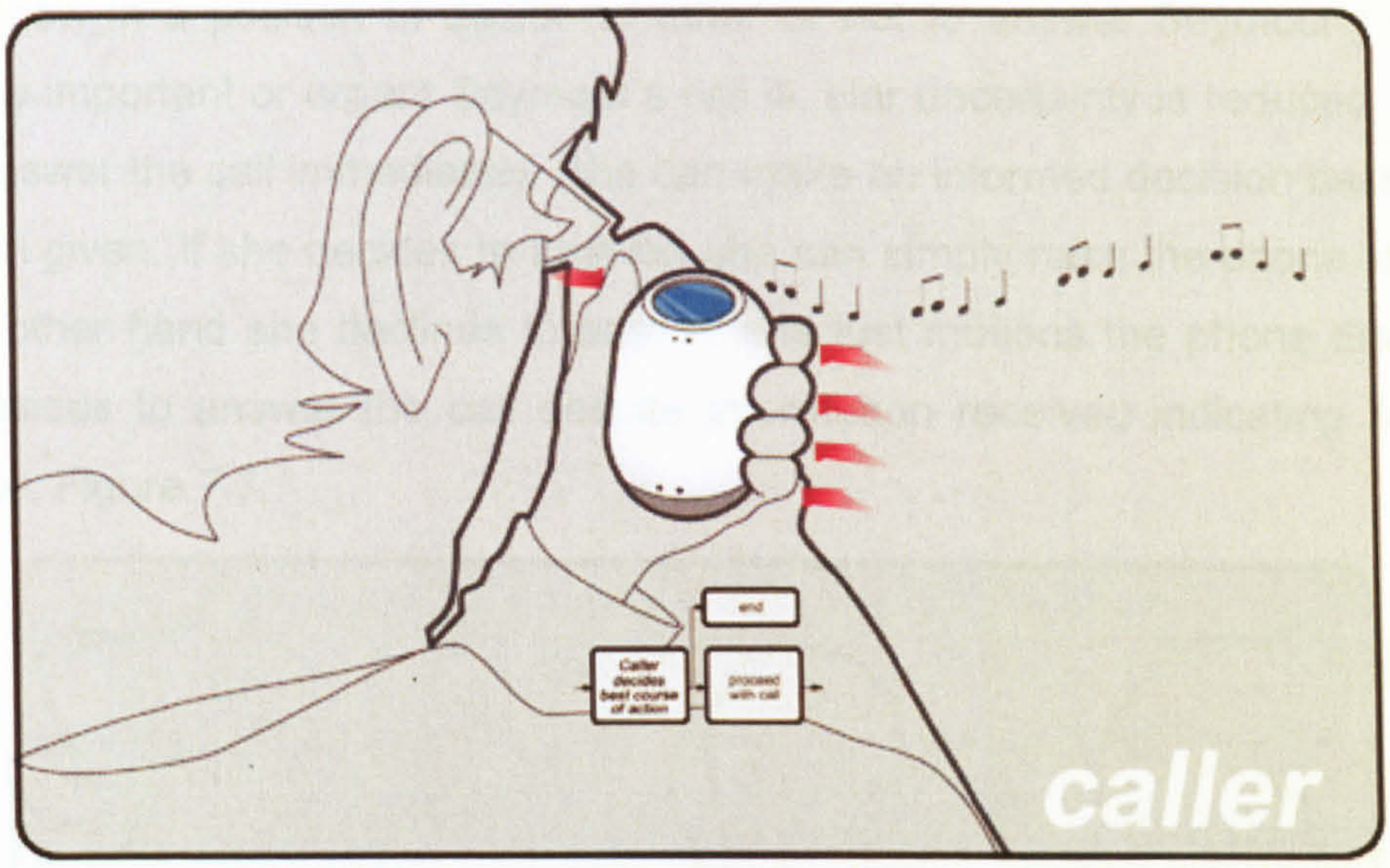


Figure 7.5: Seymour Indicates the Urgency of the Call

The pressure he exerts relates directly to the speed and intensity at which Naomi's phone will perform its method of indication e.g. ring-tone, light signal, vibration etc. The best method of call indication is based on the level of urgency indicated by Seymour's phone and the information gathered about Naomi's context. Seymour designated the call to be of low importance. Naomi's phone, therefore, vibrates slowly, produces a dull luminosity of flashing light and emits a slow, low level ring-tone to create minimum disturbance to others in the vicinity, whilst attracting Naomi's attention. Naomi's phone recognises that she is talking so it waits patiently for a pause in her physical conversation before attempting to interrupt, Figure 7.6.

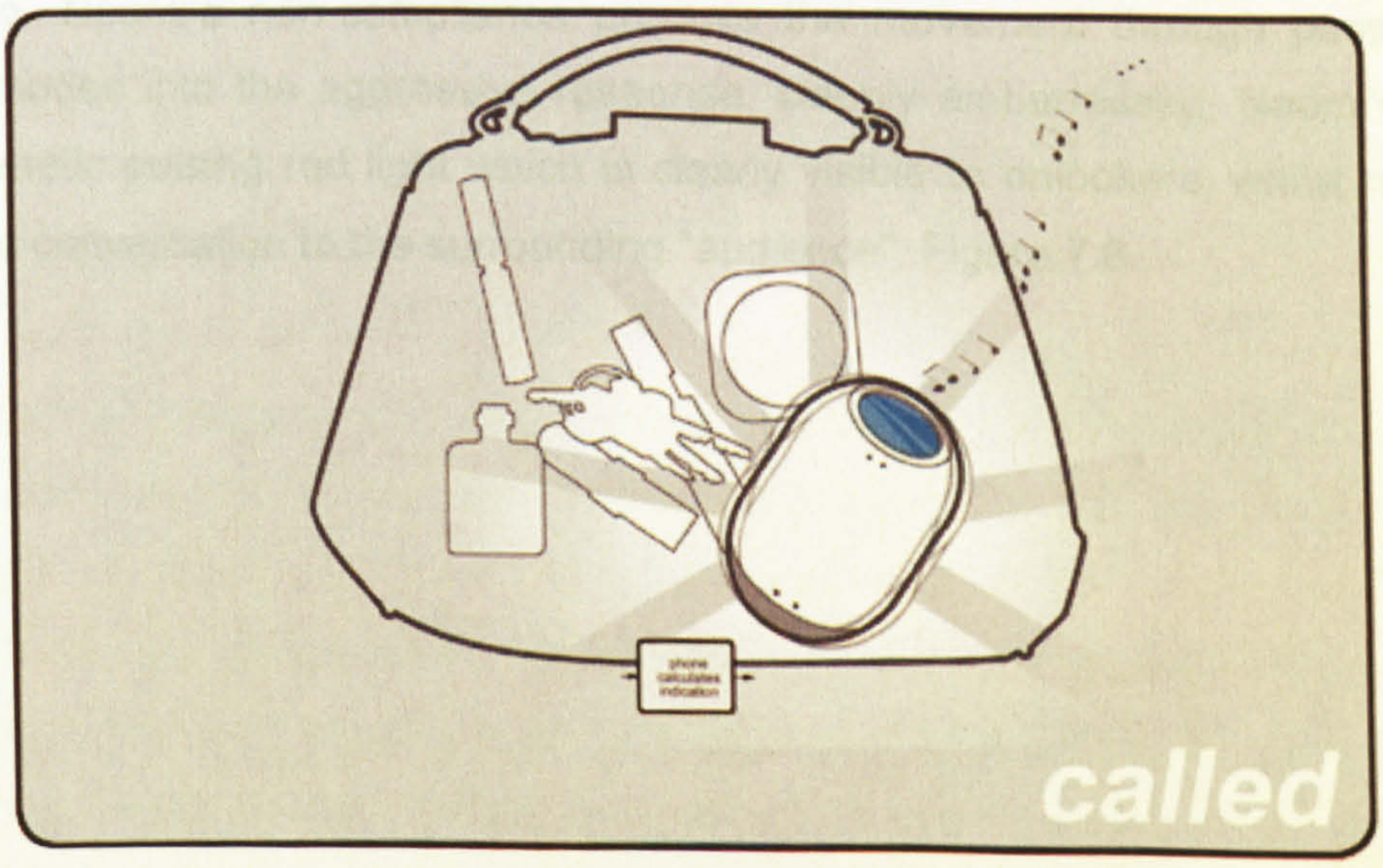


Figure 7.6: Naomi's Phone Alerts her to Seymour's Call

Naomi is now in a position to decide whether or not to answer Seymour's call. She knows how important or urgent Seymour's call is. Her uncertainty is reduced, as is the need to answer the call immediately. She can make an informed decision based on the information given. If she decides to answer, she can simply raise the phone to her ear, if, on the other hand she declines to answer she just motions the phone downwards. Naomi decides to answer the call despite information received indicating its lack of importance, Figure 7.7.

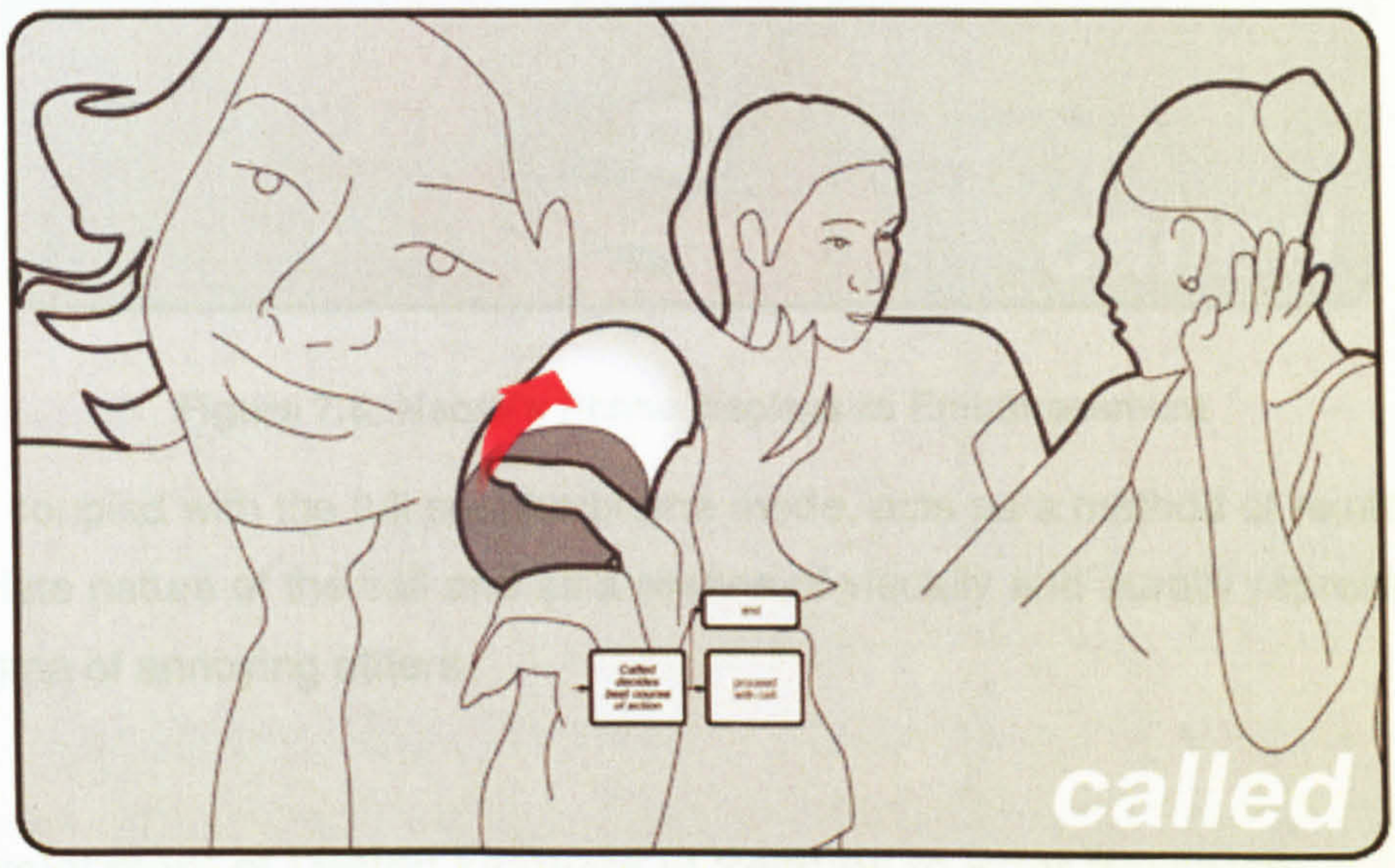


Figure 7.7: Naomi Answers Seymour's Call

Naomi's phone uses the available information to determine an appropriate point of intervention in response to her anti-social use behaviour and initiates a three stage intervention. Naomi's non-compliance prompts the movement through passive and assertive modes into the aggressive response. Deeply embarrassed, Naomi's phone emits a frenetic pulsing red light which is clearly visible to onlookers, whilst releasing parts of her conversation to the surrounding "audience", Figure 7.8.

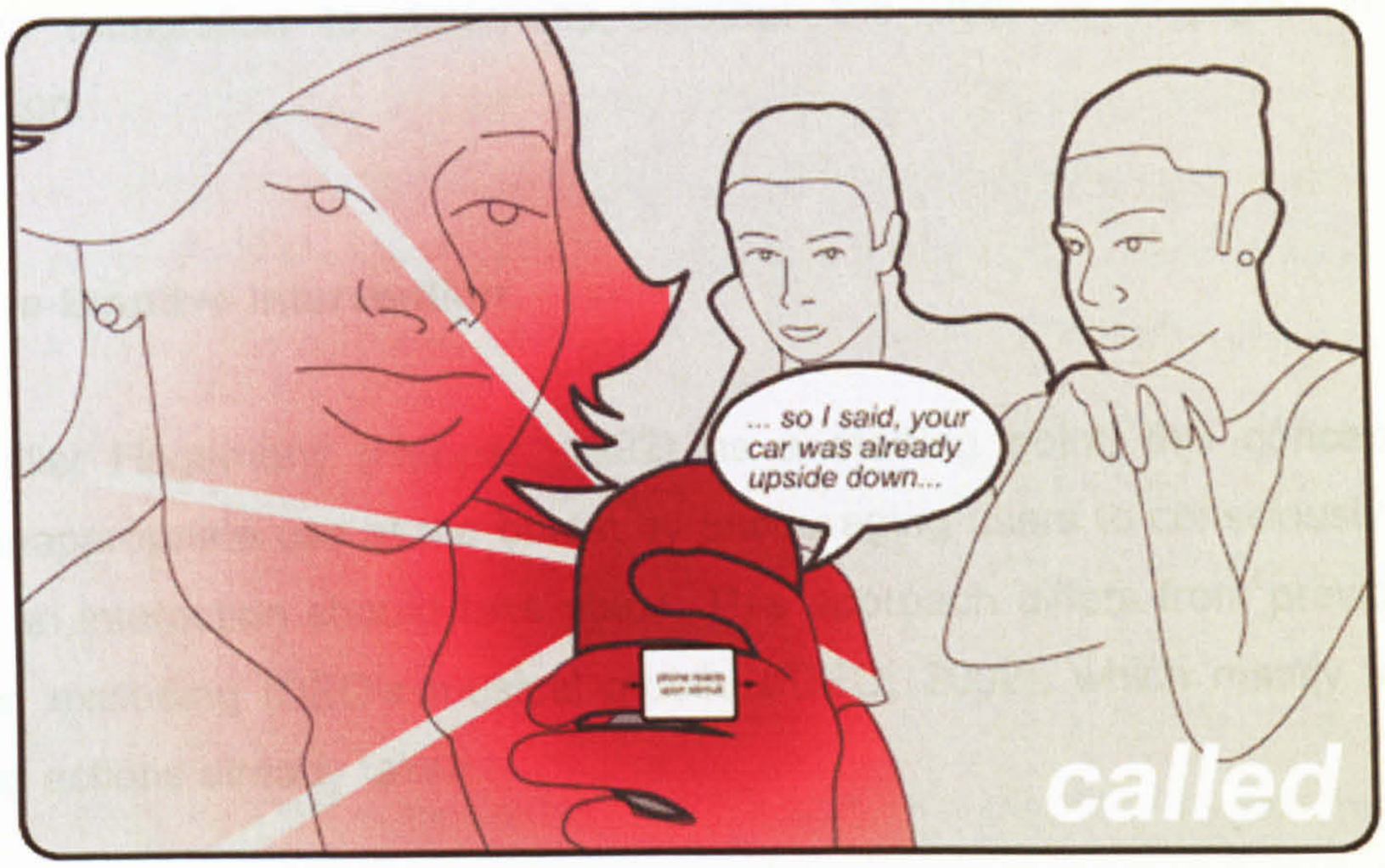


Figure 7.8: Naomi's Phone displays its Embarrassment

The light, coupled with the full speakerphone mode, acts as a method of reinforcing the inappropriate nature of the call and as a means of visually and aurally representing the social stigma of annoying others.

7.4 Development of Design Features in Relation to Prior Research

The development of specific design features and the process of engagement with the user were informed by earlier findings of this research, particularly those in Chapters 2 and 6. The following sections expand upon these features, and the links to prior research, in detail.

7.4.1 Context Awareness

As discussed in Chapters 2, 5 and 6 many products, including mobile phones, are designed with the ability to use sensorial inputs to guide product responses or inform user behaviour (DeVaul and Dunn, 2001, Siewiorek et al., 2003, Madan and Pentland, 2005). This concept utilises similar in-built technological capabilities to collect relevant data regarding the user behaviour and the context of use, Figure 7.3. It is equipped with "inherent memory" which it uses to determine its current state, "previous memory" which refers to learned experiences, Bluetooth connectivity, operational within a 10 metre radius, a global satellite positioning tracking system used to pinpoint the current location and to ascertain whether the phone is in transit or stationary, a 24 hour clock

and voice recognition to determine whether the user is engaged in physical conversation.

7.4.2 Pre-Emptive Intervention

Using Caller Hegemony (Hopper, 1992) as a starting point, this concept aims to prevent inappropriate use at the outset by encouraging users to consciously reflect on whether an interaction should take place. This approach differs from previous design concepts, excluding IDEO's musical mobile (IDEO, 2002), which mainly focused on mitigating actions already taken.

7.4.3 A Combined Approach

The design activities reported in Chapters 2, 4, 5 and 6 informed how "design-led" approaches may effectively be configured and how the degree of control should correlate to the seriousness of the behaviour enacted. This concept features levels of intervention which are enacted in a sequential manner in response to three variables; the user's level of compliance, the gravity of the consequences of actions taken and the context in which the interaction takes place.

The theory and justification behind introducing a stepped intervention, rather than proceeding directly to complete product control is based on several linked prior findings. In the first instance, the research showed that a balance needs to be achieved between persuading and coercing (Fogg, 2003). Indeed, respondents to Provocations, Chapter 4, expressed a preference for products to influence or persuade rather than control users. It was widely agreed that intelligent products, operating autonomously and ubiquitously, could potentially be incredibly effective. Yet the resulting lack of choice, awareness and ability to learn would impede the user's ability to recognise the consequences of their actions. The solution would be for the mobile phone to give users the choice to act in a considerate manner and intervene only if they failed to behave appropriately.

Based on this information, three successive levels of interventions were designed. These were set on a scale from "passive" to "assertive" to "aggressive". The idea being that the mobile phone would steadily increase the level of intervention towards aggression only when passive and assertive interventions failed to affect user

behaviour sufficiently. Initially the phone would have a limited range of protocols to deal with three forms of misuse in a social context; "Raised Voice", "Prolonged Conversation" and the presence of "Physical Others". As discussed in section 7.4.6, over time the "inherent memory" will be periodically updated with new protocols and the phone made aware of new forms of misuse via the central database, Figure 7.14.

In response to the user raising their voice to an excessive level, Figure 7.9, the phone, in the first instance, shows it annoyance by intermittently providing aural feedback of their voice. This is a passive intervention which aims simply to remind the user of the inappropriate nature of their call. If the user continues to speak loudly it becomes more assertive and gently begins to vibrate. Continuous loud talking prompts the phone to take an aggressive stance to hinder the progress of the call by vibrating frenetically whilst increasing the aural feedback.

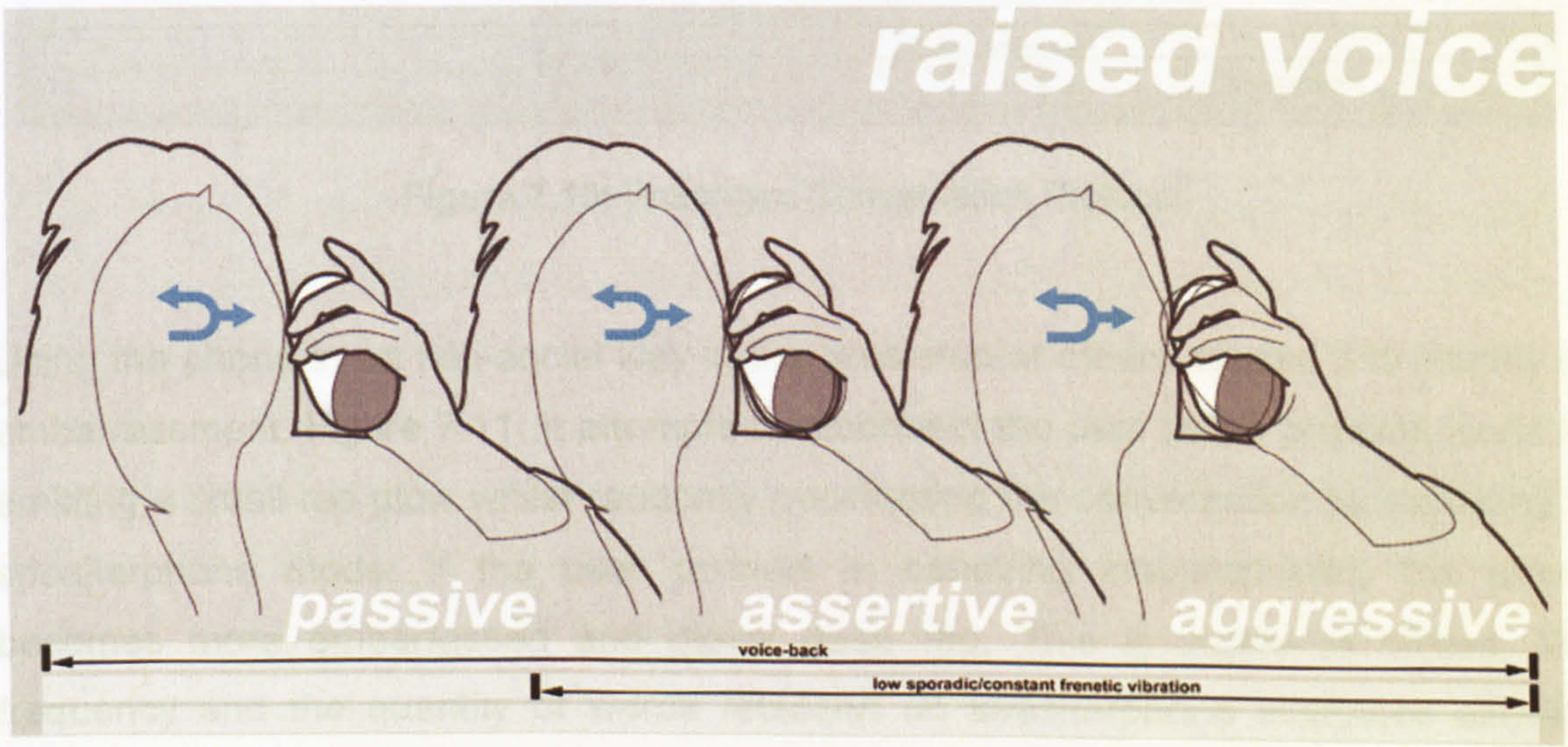


Figure 7.9: Raised Voice Protocol

Prolonged conversations in inappropriate environments cause the phone to become increasingly bored, Figure 7.10. Analysis of a series of contributing factors, as depicted in Figure 7.3, determines when the call has exceeded a sociable duration. The phone conveys its boredom by slowing down the conversation, creating a noticeable slurring of speech. If the user persists, the level of slurring increases in an attempt to further impede the conversation and encourage the "called" to hang up. Prolonged conversation causes the battery to drain, slowing and reducing the output of dual running functions such as reading text messages whilst talking. Finally, if the user refuses to acknowledge the emotional state of the phone, and therefore their own level of anti-social behaviour, the phone begins to drain the accumulated call time by

distributing the user's minutes to the phones nearby as compensation for wasting their time. Non-compliance at this stage causes the phone to eventually lapse into unconscious boredom. The phone can be reused afterwards once it regains consciousness.

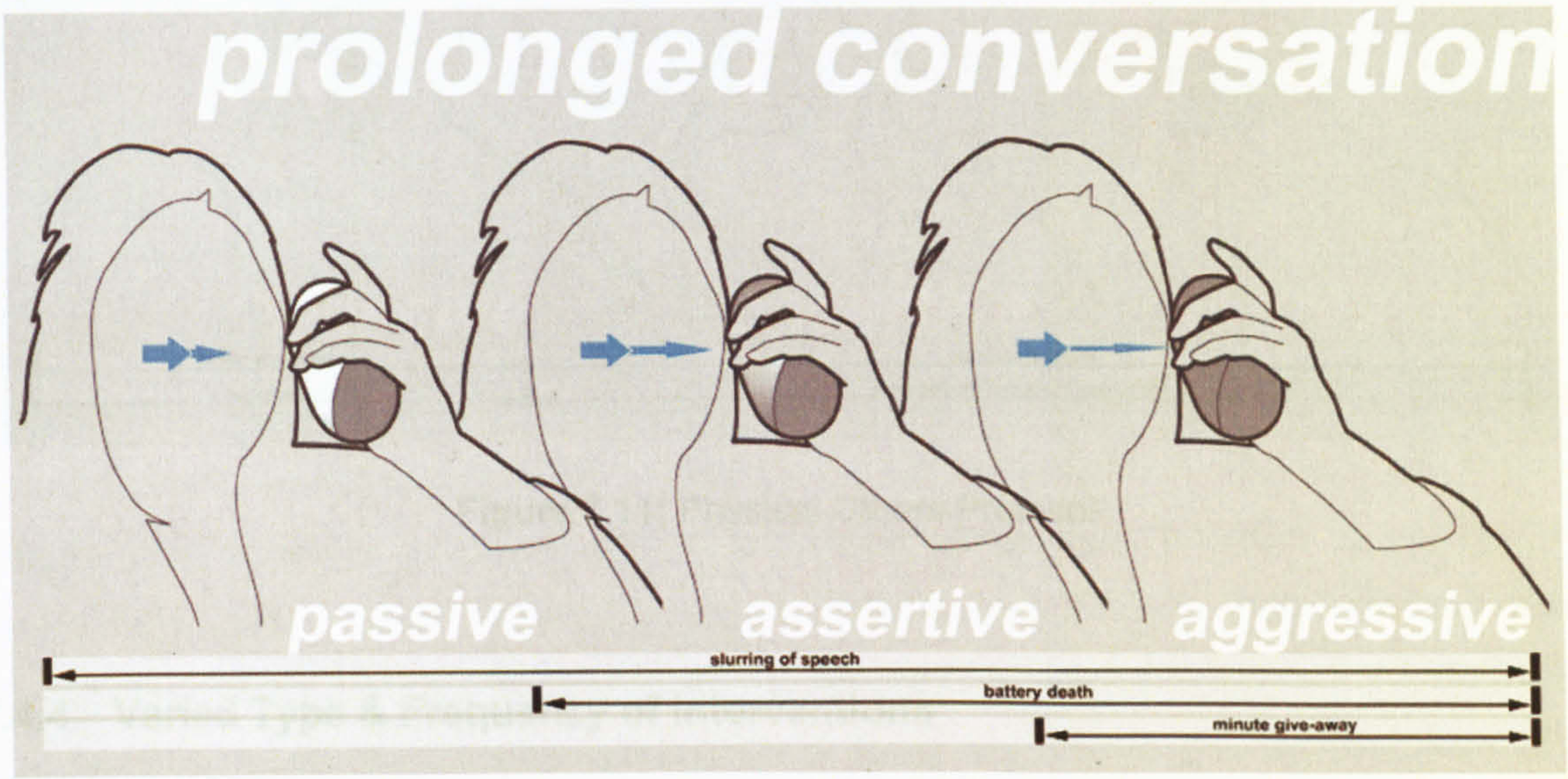


Figure 7.10: Prolonged Conversation Protocol

Using the phone in an anti-social way in the presence of others causes it to display its embarrassment, Figure 7.11. It attempts to reconnect the user to the physical world by emitting a small red glow whilst randomly punctuating the conversation by switching to speakerphone mode. If the user persists in behaving inappropriately the phone becomes more embarrassed and glows deep red. This is visible to others. The frequency and the quantity of words released on speakerphone increases allowing others to partially join in the conversation. Finally the phone takes an aggressive stance by emitting a deep red glow which showers light all around the user. The speakerphone is now at full capacity preventing the use of the phone near the ear and allowing all "spectators" in the vicinity to participate in, or comment on, the conversation.

The phone retains a cumulative memory of the user's actions in the "previous memory" which it uses to compute a suitable entry point in the "passive – assertive – aggressive" scale of intervention. For example, if the user persists in shouting whilst surrounded by company in a restaurant, switching to partial speaker phone may not be a sufficient deterrent; therefore the phone may immediately default to full speakerphone.

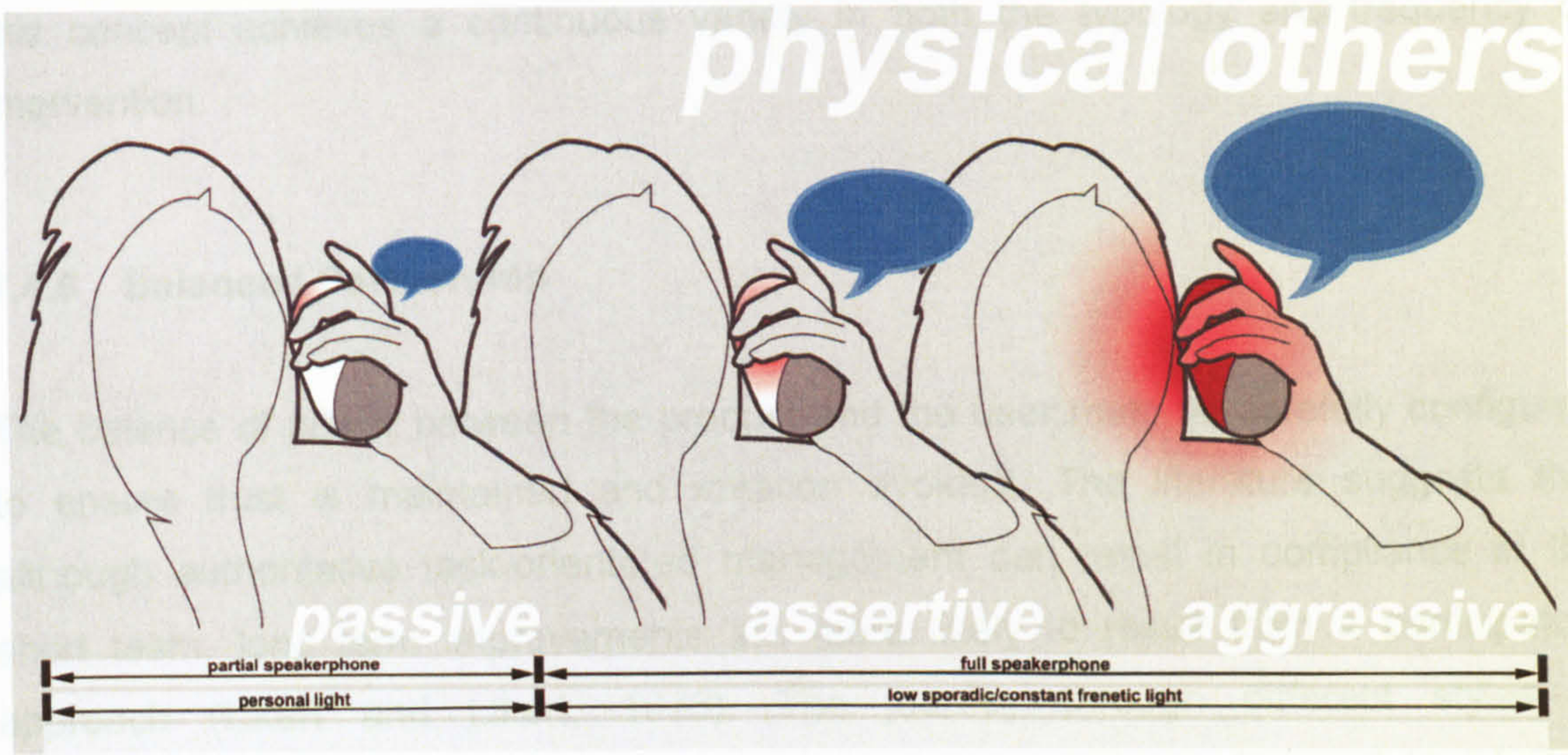


Figure 7.11: Physical Others Protocol

7.4.4 Varied Type & Frequency of Interventions

As discussed in the concluding section of Chapter 6, regular reinforcement can assist in ensuring changes in behaviour are maintained (Scott, 2004). However, repetitive reinforcement, particularly of behaviours already adopted by the user, may become annoying. The evidence suggests that varying the frequency and modality of interventions can; reduce irritation and increase spontaneity (Arroyo et al., 2005) whilst reducing the potential for users to anticipate and circumvent actions taken by the device to change their behaviour (Jelsma and Knot, 2002). As suggested by Chapman (2005) interesting and evolving interaction may also help to create and maintain the user-product relationship.

This concept uses a similar approach to that taken in the design of Waterbot, a device which *"chooses feedback modalities depending on how long water has been running and on the type of interaction with the sink"* (Arroyo et al., 2005). The frequency of interventions enacted by the phone is gradually reduced as the user's compliance increases. Should the user desist at any point the phone will decline in its emotional response, thereby providing real-time feedback at the point of compliance and strengthening the link between action and consequence. By introducing a stepped process of intervention, Figure 7.9, Figure 7.10, Figure 7.11 in response to variable parameters, Figure 7.3, updating "inherent memory" with evolving protocols for dealing with emergent behaviours, section 7.4.6, and enabling a reciprocal exchange of educational feedback between the phone, the user, the central database and others,

this concept achieves a continuous variety in both the typology and frequency of intervention.

7.4.5 Balanced Partnership

The balance of power between the product and the user must be carefully configured to ensure trust is maintained and irritation avoided. The literature suggests that although authoritative task-orientated management can result in compliance in the short team, long term improvements are more likely to result from a participatory approach (Likert and Likert, 1976). The journey through different styles of management, as illustrated in the model of situational leadership, Figure 7.12 (Mullins, 1985), illustrates the progression from a micro-management process of Telling to a more supportive, non-directional style in Selling and Participating towards finally Delegating responsibilities to the employee. As the employee's maturity level increases the management style is adapted to reflect their needs and the relative amount of supervision required. The four levels of maturity depicted in the diagram refer to a continuum from low (M1) relating to those who are unable or unwilling to accept responsibility to high (M4) where the subordinate is willing and able to take responsibility (Hersey and Blanchard, 1982).

The transfer of responsibility from the product to the user was modelled on this approach. By applying the four stages of situational leadership to the design of the relationship between the user and product, a process of interaction emerged. In the early stages of use the phone enforces learning by Telling. It continuously reinforces the inappropriate nature of the user's behaviour and micro-manages all interactions. As the user's level of learning, confidence and compliance increases the phone gradually reduces its intervention thereby increasing the user's level of autonomy.

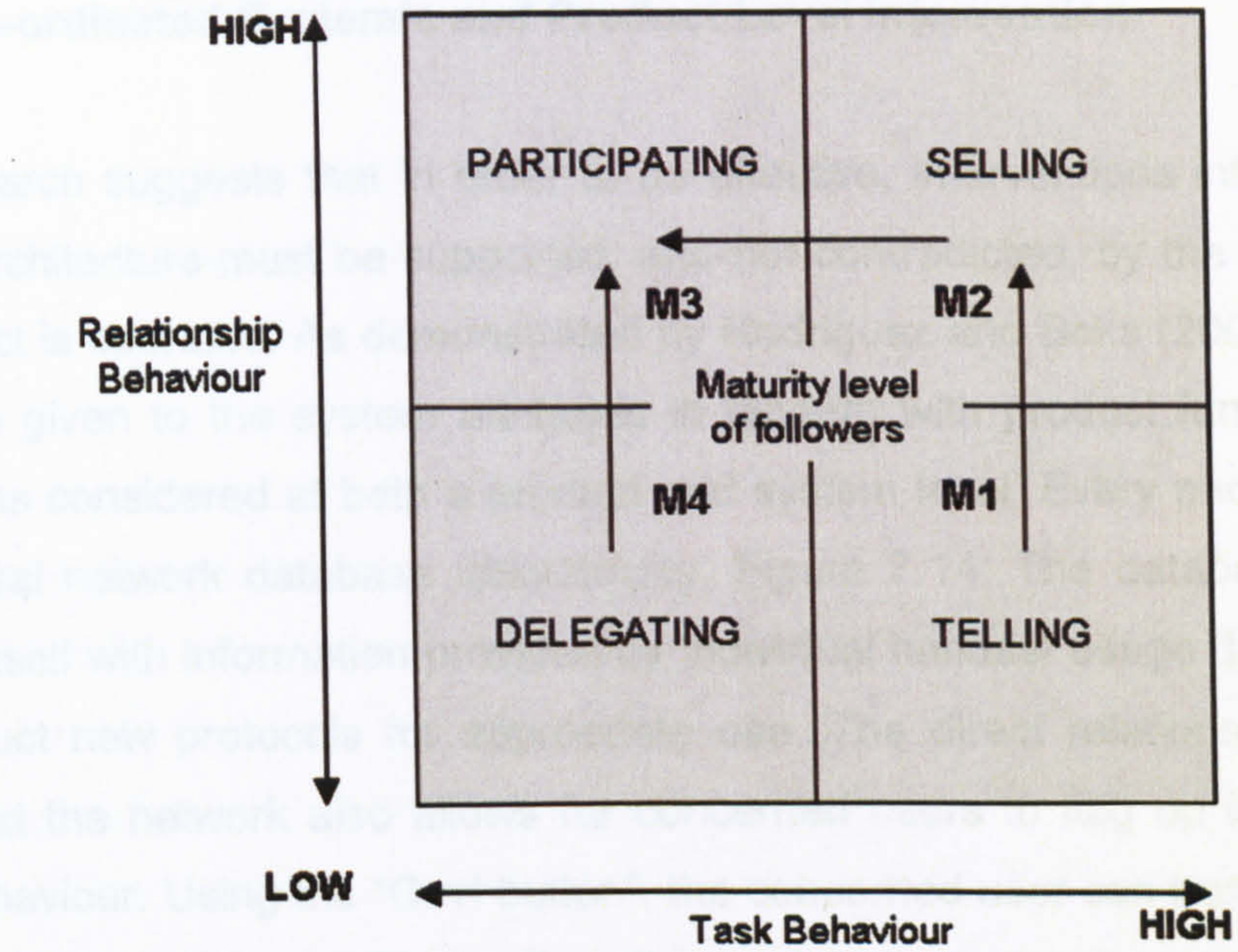


Figure 7.12: Situational Leadership Model (Mullins, 1985, p. 245)

The learning process is not restricted to the user. The phone also moves along a learning curve informed by user feedback. As it moves through Selling, into Participating, a mutual definition of appropriate behaviour is developed with the user. The user educates the phone by tapping or stroking the tactile membrane located on the handset, after use, to communicate displeasure or satisfaction in respect to the quality of interaction, Figure 7.13.

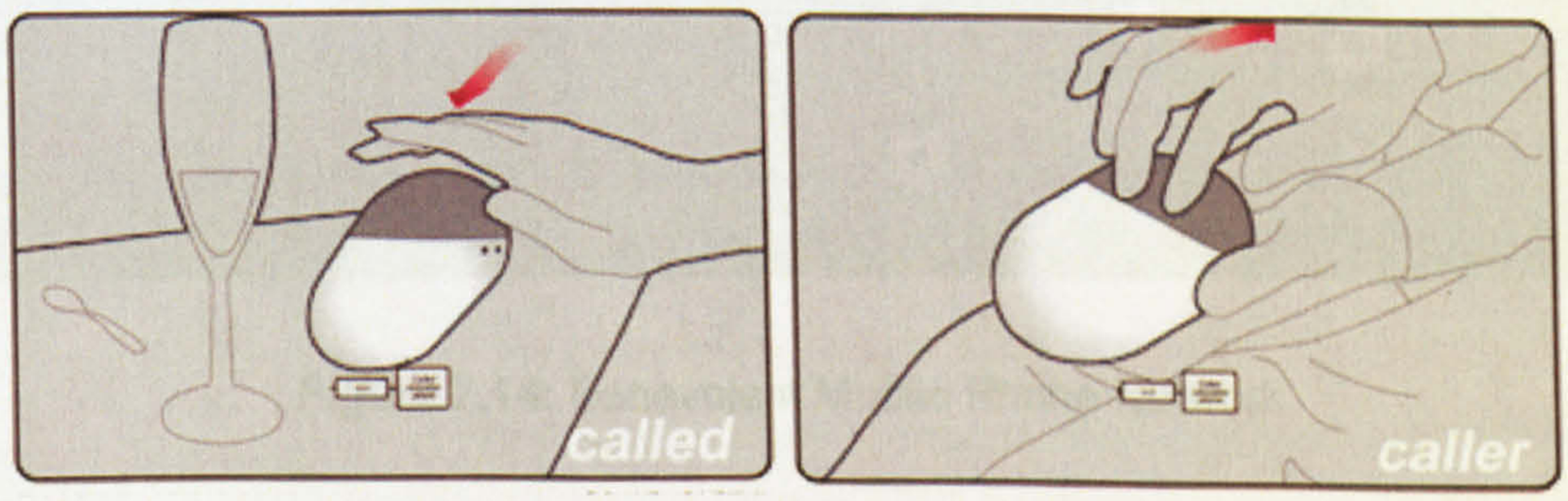


Figure 7.13: The User can Reprimand or Reward the Phone for its Actions

The phone integrates this feedback into the "previous memory" and uses this data in conjunction with that derived from other sensory inputs, to guide subsequent responses. Finally, in the Delegating stage, the phone restricts its intervention to the occasional reminder to reinforce "good practice".

7.4.6 Co-ordinated Systemic and Product Level Intervention

Prior research suggests that in order to be effective, interventions integrated into the product architecture must be supported, and not contradicted, by the system in which the product is operated. As demonstrated by Rodriguez and Boks (2005) consideration should be given to the system attributes in tandem with product functions. The final design was considered at both a product and system level. Every phone is connected to a central network database ubiquitously, Figure 7.14. The database continuously updates itself with information provided by individual handset usage data which it uses to construct new protocols for appropriate use. The direct relationship between the phone and the network also allows for concerned users to flag up instances of anti-social behaviour. Using the "Grrr! button", the concerned user can transmit a snap shot of all phones in a 10 metre Bluetooth radius back to the network anonymously, thereby avoiding confrontation. The scenario depicted in Figure 7.14 shows this process.

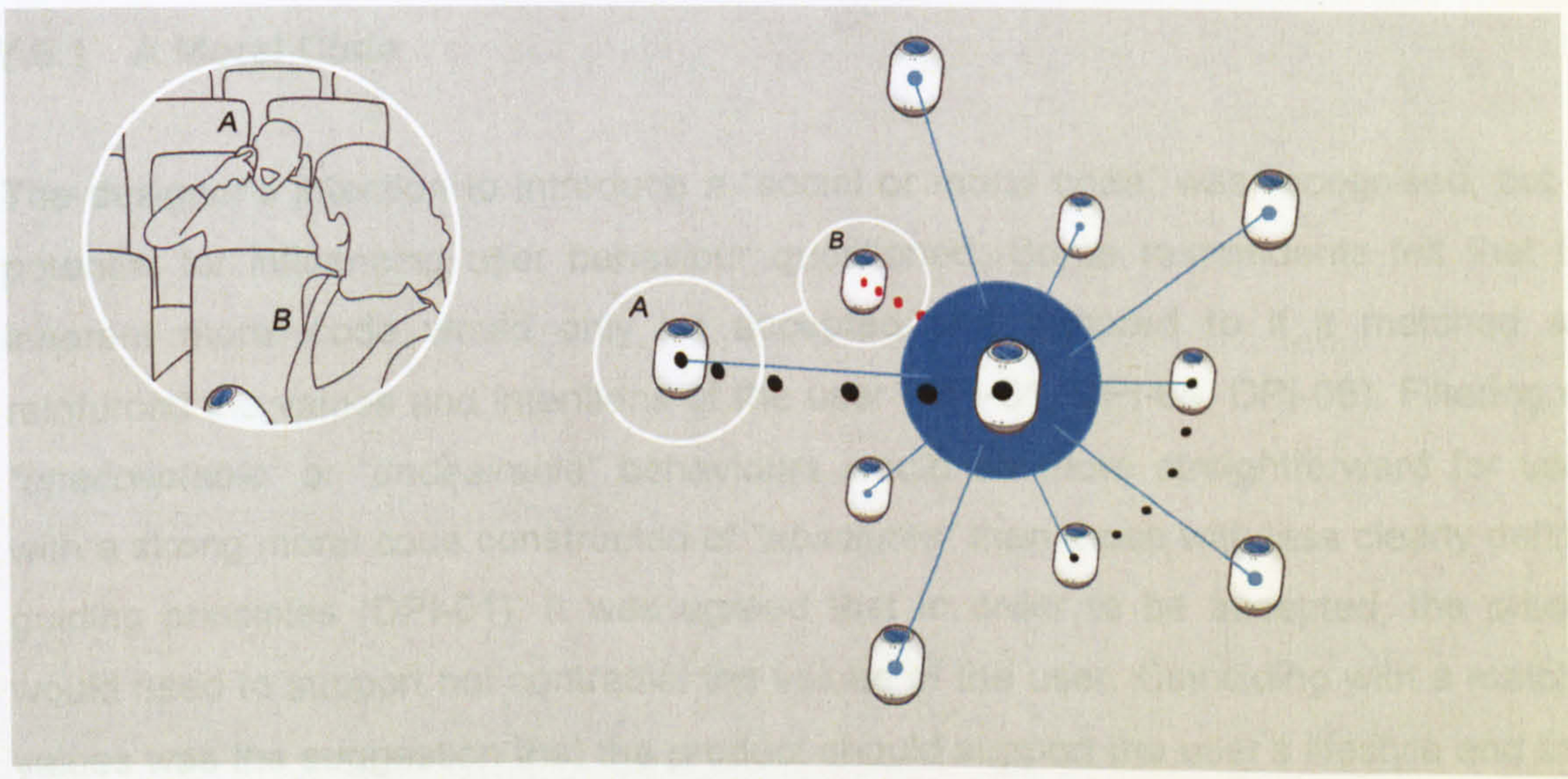


Figure 7.14: Benevolent Mobile Phone Network

Two users, A and B, are at the theatre when A starts a conversation. A's phone does not recognise the social boundaries of this location and as such remains indifferent. B considers this behaviour to be anti-social and sends a "Grrr!" message to the central network database. When a particular complaint has been logged by many users the network transmits a protocol upgrade to all handsets registered on the network. The next time A attempts to make a phone call in this type of location their handset will react accordingly to try to prevent the call from progressing.

7.5 Results of Evaluation by Design Professionals

The following sections present findings relating directly to the product or system features. The concept was generally well received and its presentation provoked some interesting responses which can be classified into the following broad areas;

- The implications of introducing a moral code through a product,
- Difficulties in establishing a baseline of common social norms,
- How to weigh the strength of an intervention applied against the severity of the consequences of a user action,
- The implications of product dominance in light of technological limitations,
- The benefits of context awareness weighed against a perceived loss of civil liberty,
- The potential for enacting "rebound effects",
- Usability issues and inclusivity concerns.

7.5.1 A Moral Code

The designer's intention to introduce a "social or moral code" was recognised, but its potential for influencing user behaviour questioned. Some respondents felt that the inherent moral code would only be accepted and adhered to if it matched and reinforced the values and intentions of the user (DPI-01, DPI-04, DPI-06). Filtering out *"unacceptable"* or *"undesirable"* behaviours would be more straightforward for users with a strong moral code constructed of *"absolutes"* than those with less clearly defined guiding principles (DPI-01). It was agreed that in order to be accepted, the product would need to support not contradict the values of the user. Coinciding with a match in values was the suggestion that the product should support the user's lifestyle and tailor its interventions to suit their temperament. Assessing the *"tolerance levels"* of the user would be a key step in setting appropriate, personalised boundaries for interventions made (DPI-04).

7.5.2 Baseline of Social Norms

Linked to the discussion around formulating a moral code was the need for a baseline of societal norms on which to model the levels of interventions enacted as part of a protocol. This baseline would also, respondents felt, help determine the types of protocols included in the "inherent memory". Potential considerations would be how to

determine the acceptable length of a conversation in a crowded restaurant or the level at which a voice becomes "too loud", for example. Keeping up with constantly changing social norms was perceived to be problematic, as norms are affected by the context of use and differing levels of acceptability. A protocol based on a projection of how people are *"likely"* to react may be defunct, for example, if those in the vicinity do not object to that behaviour (DPI-04).

7.5.3 Relationship between Use Impact & Strength of Intervention

Related to the discussion of how to construct a baseline of social norms was consideration of how to rate the significance of certain behaviours in light of the severity of their impact on others. There was some discussion as to whether the use of a design intervention to limit behaviour was perhaps more justifiable if the potential consequences of such actions were severely detrimental to society. There appeared to be some consensus that product intervention may be *"more acceptable when used to ensure safety"* (DPI-05). A particular example being the use of mobile phones whilst driving; *"you can make the case for safety in cars because it's life or death"* (DPI-02). In this instance it was felt that interventions to prevent non-hands free mobile phone use in cars would be considered justifiable particularly as there is *"hard data...[and] it's supported by law"* (DPI-02). This in turn would increase user acceptance.

7.5.4 Dominance of the Product

The dominance of the product in determining how an interaction played out caused great unease for most respondents. The relationship between product and user has long been characterised as Master and Slave, i.e. the product's role is to serve the user; *"We are used to mobile phones being in absolute subservience to us"* (DPI-06). This concept, however, was seen to reverse this relationship (DPI-01). The idea that decision making could fall into the domain of the product rather than the user, even intermittently, was considered problematic. Participants questioned the acceptability and viability of deferring decision making to the product in light of the current limitations of artificial intelligence (AI). AI, they felt, would be unable to replicate complex human thought patterns and decision making, particularly in the context of mobile phone use. The system would, they felt, be *"unable to represent the complexity of behaviours [and].....comprehend and analyse the meaning of data"* in human terms (DPI-01). User difficulties in interfacing with the technology may also cause problems. An extremely

important call may be inadvertently blocked, for example, if the caller is unable to master the "Urgency Squeeze" feature sufficiently and the phone fails to register their call as urgent. The product's inability to adequately reflect on, and respond with empathy to, the reasons behind a persistent interaction in an "inappropriate" context would cause problems. In some situations *"increasingly trying to deter"* the user may even be *"counter-intuitive"* (DPI-03). Respondents felt that inevitably these interactions would result in annoyance and frustration on the part of the "called" and that continuous frustration would result in the premature disposal of the unit.

These discussions were also interlinked with concerns over the dominant approach taken in the design of some of the protocols, namely Physical Others and Prolonged Conversation. There was an overwhelming perception, across the majority of those interviewed, that this concept used predominately negative forms of intervention to influence product use. Some of the features, particularly the Physical Others protocol, were singled out as examples of a perceived dominant approach, described as *"controlling"* (DPI-07), *"confrontational"* (DPI-06), *"prescriptive"* (DPI-05) and *"more stick than carrot"* (DPI-07). Some participants drew parallels with approaches already used to try to change behaviour, such as legislation or Anti-Social Behavioural Orders (ASBOs) which, they felt, also focus too heavily on penalties rather than incentives. *"It's always about blocking negative behaviours....what you can't do"* (DPI-01). Although they could see merit in the concept of designing for behavioural change, many interviewees struggled to find a reason why users would opt for a product which uses overtly controlling mechanisms; *"the concept behind it makes sense but the application is wrong"* (DPI-06). Those functions which inhibited the phones capacity to facilitate interactions, such as the Prolonged Conversation protocol, were seen as particularly counterproductive in ensuring the continued use of the product. In a general sense, interventions which raise awareness by drawing attention to a problematic behaviour were seen as more acceptable and empowering. These interventions, many felt, would encourage behaviour change without reducing the user's ability to choose how to interact with the product. The Raised Voice protocol was positioned in these terms *"being made aware of having detached yourself from the people around you in a heated situation is a positive thing....likely to have a positive effect"* (DPI-03); *"[its] giving me the information to allow me to make a better decision"* (DPI-06).

7.5.5 Levels of Intervention

The stepped nature of the interventions was generally well received. One respondent, however, suggested a need for a stage prior to "Passive" to be enacted in the user's private sphere only. This *"gentle nudge"* or *"tap"* audible or visible only to the user would *"let them decide to change their behaviour before anyone else knows about it"* (DPI-04), thereby avoiding embarrassment and lessening annoyance. This was reflected by another respondent who wondered if there should be a time delay to enable the phone to reprimand the user in private after the event (DPI-02). This, he felt, would be less confrontational.

7.5.6 Context Awareness & Civil Liberty

The information gathered by sensors to inform interactions was generally seen as useful in enabling the "Caller" and the "Called" to judge the appropriateness of planned interactions. Although respondents understood the importance of gathering data to build context awareness, there were some concerns regarding the protection of civil liberties and personal privacy. This extended to include the "Caller" as well as the "Called", principally with regard to the Physical Others protocol where parts of the conversation are aired publicly. In this case in particular, participants felt that the "Caller" is at a slight disadvantage as they could be unaware of this lack of privacy. It was felt that the device should *"make people at the other end aware…..that potentially their conversation is being heard"* (DPI-04). To be given information regarding the "Called's" context would, some felt, infringe on their right to privacy and potentially undermine trust; particularly if used *"as a tool to try to prove infidelity"* (DPI-01). The resulting loss of anonymity reflected in the unbiased *"honesty"* of the information provided by the technology may not sit well with users who enjoy a fluid relationship with the truth when conveying their circumstances i.e. location and company. *"I'm not sure people would want technology to provide that degree of honesty" "because one of things phones give you…is the ability to lie"* (DPI-08). Some argued that the technology could be simpler and less invasive if the "Caller" was only given an indication of the "Called's" status i.e. busy call back later, for example (DPI-05). The crux of this debate was considered to be comprised of two points; *"what information is needed to help people make better decisions"* (DPI-06) and how can this information best be delivered without compromising the privacy and liberty of those affected?

7.5.7 Rebound Effects

The possibility of users' actively trying to disable or circumvent functions was considered as a potential problem for product intervention. Being humiliated, dominated or reprimanded by a product may, many felt, deter users from purchasing or continuing to use a phone with this system. It may even damage relations between consumers and manufacturers *"you'd end up throwing it and vowing never to buy that brand again"* (DPI-02). If product interventions caused a level of annoyance which prompted a decline in sales, manufacturers' interest in applying these approaches would arguably also decline; *"you don't want people to get so annoyed with it that they're not going to use it or get the next upgrade"* (DPI-04). A majority view was that there is a need for a manual override function which enables consumers to disable certain functions, particularly in cases of emergency; *"As long as you can override it....you need to give somebody a point where they are still master of their device"* (DPI-03). The problems associated with including a manual override, however, were acknowledged *"if you could override it – you probably would"* (DPI-04). It was suggested that it would not be inappropriate to place the onus to disable functions on the user. Users may only choose to disable automatically installed protocols if they strongly oppose their use; *"I would probably argue that to work that out [how to disable functions] you'd probably have to have a desperate need to do that"* (DPI-03). Therefore, it is possible to assume that default functions would, for the most part, remain active, particularly if locating the means by which to disable them was difficult or time consuming.

It was felt by some that if users purposefully try to enact interventions on their own phones or sabotage others, these phones could potentially *"become tools for anti-social use"* (DPI-01). Particularly by those people *"who don't care less....[and] want to be the most offensive... they can be"* (DPI-01). As they would *"get their kicks"* not by *"lowering.... the impact of use but escalating it"* (ibid).

7.5.8 Should Technology Mitigate for the Limitations of Society?

The ability to contribute to the "inherent memory" via the "Grrr!" button was considered to be an empowering means of enabling users to express their attitudes en masse towards a troublesome user in a non-confrontational way. Confronting others behaviour in public has *"become more problematic and less and less people do that – because*

they are fearful of people being aggressive back" (DPI-08). Providing this service would accommodate people's need for *"ways of telling people they're annoyed in a discrete way"* (DPI-05). The central service would, they felt, in effect act as a mediator delivering anonymous feedback without the possibility for direct retaliation from the recipient. There was, however, some *"sadness"* expressed that technology would need to be developed to mitigate a lack of human restraint and respect for others (DPI-01, DPI-08).

7.5.9 User Typology and the Need to Segment

The typology of the user was seen as an important consideration to ensure that interventions were sufficiently targeted to address social problems. There was an overwhelming perception that the youth market be targeted. This group were seen as the least considerate mobile phone users, though equally, the most likely to respond strongly to product intervention, therefore providing a good test market. *"I can see the...younger market liking this and I can see it having commercial viability"* (DPI-08). There was also a reflection on the fact that this would largely suit a western market. It was widely agreed that users who would see the societal benefits associated with the use of this system were arguably not the people whose behaviour warranted intervention. Those people whose behaviour warranted intervention, however, would be the most difficult group to engage as *"they probably don't care and aren't interested in how people are reacting to them"* (DPI-05). The problem was not considered to be a lack of education but a lack of will to change; *"it's because they don't care not because they are not aware"* (ibid).

7.5.10 Haptics & Usability

Due to the presence of a number of those engaged in practical design work, several points arose directly relating to the aesthetic and functional qualities of the device. The use of Haptic feedback mechanisms, in the "Urgency Squeeze" and the "On and Off Motioning", were considered interesting features (DPI-03, DPI-04, DPI-06). However, many felt that extensive usability testing would be required, particularly for those with reduced mobility or strength in the hands. The tolerances for the "Urgency Squeeze" would need to be researched and tested to reach a standardised scale relating pressure to urgency (DPI-04). Equally, the visual semantic reference indicating where and how to hold the phone to connect with the pressure pads would need to be

carefully considered. In terms of motioning on and off to accept or reject a call, tests would need to be carried out in relation to the user's posture or positioning *"looking at the different orientations the phone will be in at any one point"* (DPI-04). The user may, for example, be lying down whilst taking a call and this may affect the motion sensors. The reliability of the product in fulfilling the users needs is an important consideration to ensure its longevity; this is particularly so when considering *"sustainable"* products (DPI-07). Quality, reliability and performance are, therefore, key; *"you don't want to be accidentally disconnecting people"* (DPI-04).

7.5.11 Semantics, Anthropomorphism & Longevity

One respondent correctly identified the designer's intention to use anthropomorphic semantic styling to *"humanise"* the product and create an emotional connection with the user. *"It wants to establish an intimacy level that's over and beyond a lump of electronics"* (DPI-06). This anthropomorphic approach coupled with the intention to establish a personalised relationship could, he felt, result in a longer lifespan. *"If this is inherently learning from you and developing with you – you're building up a history with it.....there's a possibility of extension of product life through the fact that it's becoming ...part of you"* (DPI-06). There was some discussion by other respondents about longevity issues and how the mobile phone currently has a very short lifespan. Due to its increasing status as a *"fashion"* item rather than a communication tool, many felt that the technology should be contained in the SIM card rather than on the handset. This, they felt, would enable users to transfer accumulated learning in the form of "previous memory" to a new phone and accommodate the reuse of old handsets (DPI-02). Through discussions with one respondent an idea emerged to encourage the transfer of the *"brain, heart and soul"* of the phone semantically by creating a hard wearing detachable element, possibility in the form of a heart or brain, which plugs in to a handset designed using appropriate materials for a short lifespan (DPI-07).

7.6 Discussion of Collaborative Design Project

The following are initial reflections on perceptions of the collaborative design project. Some of these themes will be taken up and explored in more detail in Chapter 8.

The need to formulate a baseline of social norms is an interesting proposition. Its necessity is clear, particularly if there is to be coherence between product interventions

and a perceived need for intervention, but it may be difficult to achieve. Keeping up with constantly changing social norms would be problematic, as norms are affected by the context of use and differing levels of acceptability. If, as suggested in Chapter 2, values drive behaviour, then it may be more beneficial to assess which values are needed to create the required changes in behaviour. However, respondents confirmed the assertion made in the framework proposed in Chapter 6, that in order to be accepted, product interventions would need to support and not contradict existing values. As described by Cialdini (2007) the correlation between what is being asked of an individual and what they have already said, done or committed to can inform their willingness to change. The unpredictable nature of user behaviour, coupled with the interactive and responsive nature of the device, could, many felt, result in rebound effects such as game playing to escalate rather than reduce use impacts. This validates the need for development and comprehensive testing of a prototype to identify and counteract potential rebound effects.

At some points the response of the design professionals interviewed seemed to be at odds with the intention of the designer. This was particularly so in terms of appreciating the collaborative nature of the relationship and how it informs the learning process of both the user and the product. The intention of the mobile phone was not to be prescriptive in its intervention, but to allow the user to learn to adjust their behaviour when using the phone in public spaces. This notion of a co-defined definition of acceptable, benevolent behaviour may have been lost in the translation of the concept. But it is more probable to conclude that the majority of the respondents held different views on what is an acceptable level of intervention and what types of intervention they deemed too intrusive. Given the aggressive nature of some of the concepts reported on in the literature, Chapters 2 and 6, particularly Social Mobiles (IDEO, 2002), the interventions made by this concept represented a lesser degree of intrusion. Particularly as the escalation from passive-to-assertive-to-aggressive, which is triggered by prolonged non-compliance, does provide a degree of flexibility and choice. This discussion did, however, highlight the importance of the questions raised in section 7.5.3, regarding the relationship between the seriousness of the consequences of use and the strength of intervention which should be applied. Reaching a consensus on how to rate the severity of consequences enacted by different behaviours, and deciding on an appropriate level of intervention, however, would prove problematic as decisions would almost certainly be subjective. Additionally, there is the question of who would lead such an ambitious undertaking. It is possible to speculate that most

manufacturers may not be entirely comfortable rating the potentially negative consequences of the use of their product.

The overwhelming feeling of product dominance, particularly related to Physical Others and Prolonged Conversation, was also interesting and unexpected. Particularly as many respondents felt even the "passive" interventions to be too intrusive. Perhaps, on reflection, given the current status quo of product as slave, owner as master, these types of intelligent intervention require a change in perception, and level of trust in products (and indeed manufacturers) which is too great to accept. The introduction of an additional level of intervention prior to "passive" was a good one, as this would enable a very private exchange between product and user. The advantage of this level of intervention would be the re-introduction of a feeling of product servitude and reverence, traits currently expected by users. It is also interesting to reflect that moving in this direction may, for manufacturers, seem a risky proposition, particularly as the emphasis of this concept was read as advocating less communication. Communicating differently may be a more palatable suggestion. In conclusion, finding an acceptable level of product influence through intervention will be a crucial element in ensuring consumer acceptance and manufacturer buy-in.

7.7 Short Film: "A Haphazard Journey"

The findings of the design study in Chapter 6 and the discussions in 'Provocations', Chapter 4, showed that designers value the inclusion of user centred research to assist their design development. However, they may not always have the funds, time or opportunity to carry out these studies.

To fulfil this need, a series of motivational and inspirational short films, playable via a dedicated website or downloadable for use with an MP3 player or I-Pod were proposed. One film entitled "A Haphazard Journey" was developed and produced in conjunction with an independent film-maker as an example of this type of resource, for testing purposes. This film depicted personal and public safety issues raised by texting or accessing voicemail whilst on the move in public places as seen in Figure 7.15 below. A copy of this film can be found in Appendix L.

Figure 7.15: Selected Screenshots from "A Haphazard Journey"

In line with designers need to be exposed to the right kinds of problems to solve, the aim of producing an issue-based film was twofold;

1. To raise designer's awareness of social issues resulting from mobile phone use,
2. To spark creative ideas for overcoming these issues through problem solving.

7.7.1 Methodology for Short Film

As discussed previously in Chapters 4 and 6, film footage or photographic images depicting the activities of individuals interacting with products can be extremely beneficial in providing stimulus for the design process. Capturing this footage in an ethical fashion however, can be problematic as to capture real life unedited behaviour often requires the subject to be unaware that they are being filmed. Although subject's permission can be sought after filming has taken place, permission is not always granted. Ethical considerations and data protection legislation also present problems in terms of publishing the data collected.

To provide an informed insight into the social issues resulting from mobile phone use, without infringing personal privacy, a fictional recreation was proposed. This entailed an actor acting out scenarios and behaviours, reported in previous studies, to depict how users manage the use of non-verbal functions whilst in public and the social consequences of these actions for others. Three main locations in were used; a public footbridge, an alleyway and a pelican crossing. In light of the public nature of these locations, a sign indicating that filming was in progress was put on display as a precautionary measure to pre-warn passers-by that by walking into shot they were giving consent to be filmed. This is a standard practice recommended by Evans et al (2002) amongst others. During filming however, the actor provoked real reactions from passers by in response to his behaviour whilst using the phone. The final film, therefore, blended fictional recreations of behaviours observed in prior research with

real-life footage of situations and behaviours resulting from the impact of the actions taken by the actor on others in the vicinity.

The film was screened at the 11th Sustainable Design Network seminar, Appendix I, to a mixed audience of academics, practicing designers and industrial representatives. Respondents were issued with a short evaluation questionnaire, Appendix J. The questionnaire sought to:

- determine if the audience could identify the types of behaviour depicted,
- how they thought it could be improved,
- what they considered to be the value of this type of resource in informing the design process,
- find out which delivery mechanism they thought would be the most suitable for the resource.

Twenty-two questionnaires were returned, the respondents remained anonymous. To distinguish their answers a code was given to each completed film evaluation questionnaire e.g. FEQ-01. The content of the questionnaires was clustered into broad themes and relevant quotations extracted to inform and support the findings discussed in Chapter 6. The follow sections discuss how the concept was developed and how designers responded to the final film.

7.7.2 Results of Short Film Evaluation

There was a strong correlation between the responses given to questions 1 and 2. The majority of respondents recognised the central theme of the film, and most identified two or more of the issues depicted. There was an overwhelming consensus that using a mobile phone whilst walking reduces personal safety. Several issues were identified in relation to this, particularly the difficulties of navigating and avoiding physical hazards whilst operating the phone caused, some felt, by *"reduced vision, concentration and awareness"* (FEQ_05). Writing a text message whilst walking was seen to *"distract attention away from the surroundings"* (FEQ-05) and *"slow the reaction of the user to the events surrounding him"* (FEQ-07). Many also observed the user's difficulties in using various functions while effectively multi-tasking; *"he finds it difficult to do several things while texting e.g. walking, looking at traffic etc"* (FEQ-14). The need to *"look at the screen and your environment"* (FEQ-16) was recognised and this was linked, by a

few respondents, to the design. In particular the *"amount of user interaction required"* to operate functions whilst walking (FEQ-20); the *"improper design of product functions"* (FEQ-17) and the *"limitations of traditional interfaces"* (FEQ-14).

The user's lack of privacy when making calls in public was raised in a minority of responses, but responses concerning problems associated with *"anti-social"* use were more prevalent. The actions of the mobile phone user talking loudly whilst sitting on his bike, Figure 7.16, in particular, was considered by one respondent as potentially causing problems for passers-by, *"people feel uncomfortable when walking by a person shouting into their phone"* (FEQ-07).

Figure 7.16: Mobile Phone User on his Bike "A Haphazard Journey"

The respondents also highlighted the lack of social interaction between the user and other people and in a general sense it was felt that *"mobile phones cut users off from society making interaction less likely"* (FEQ-03). Many pointed to the user's *"self-absorption"* in interacting with the phone and the resulting lack of awareness of the external environment (FEQ-08, FEQ-09); *"He is not aware of anyone around him"* (FEQ-12). This was linked, in some cases, to the safety of, and consideration for, other people *"[he] is not aware of [the] safety of other bridge users"* (FEQ-13).

The third question concerned potential improvements which could be made to improve the film's impact and effectiveness. In response to the options provided in the questionnaire, Appendix J, the majority opted to include interviews with users/non users, the second most popular option was to include a narrative describing user actions and resulting social impacts. Many felt that these options should be added after the film, not during. Two versions of the film may be advisable, one with the *"added*

feature commentary" and one without, possibly running one after the other. Alternatively, it was suggested that the user be able to run additional features on demand (a feature now installed as an "extra bonus" on many DVDs).The least popular option was the inclusion of a designer's narrative, this could be attributed to the possibility that it *"may stifle creativity"* (FEQ-03). Additional suggestions were that the film could be expanded to represent more issues or contexts of use (FEQ-15, 16) and that *"it would have been interesting to include more dialogue between the protagonist and other characters"* (FAQ-16).

In response to question four, the majority felt that this type of resource would be most beneficial if applied in the early stages of the design process to;

- Help designers to identify and get to grips with real issues and behavioural problems (FEQ-01, 05, 07) by raising their awareness of user actions and the resulting impacts (FEQ-16) *"[films] communicate the inherent problems very well and help designers to get to grips with the problem"* (FEQ-05)
- Set the design challenge (FEQ-10) and define the brief (FEQ-03, 08, 11)
- Consider usability issues (FEQ-07)
- Provide justification to inform the decision-making process (FEQ-14).

Finally, the majority indicated that, depending on who it is aimed at, this resource would best be delivered in the form of a downloadable or playable file rather than a DVD.

7.8 Discussion

The findings of both evaluation exercises revealed a series of interlinked issues relating to more macro concerns associated with the concept of designing for behavioural change. These findings can be classified into the following broad themes;

- Perceived responsibility for use impacts,
- The role of the designer in product development decision making,
- Links between product use, Corporate Social Responsibility (CSR) and branding,
- Ethical considerations related to influencing behaviour through design,
- The types of tools, methodologies or approaches which could assist in the consideration of the impacts of product use, and more specifically the application of design for behavioural change.

7.8.1 Limitations of Designers Influence

One of the objectives of the research was to investigate whether designers' consider themselves to be responsible for the impacts resulting from product use. There was an overwhelming assertion that the decision to implement approaches or strategies to reduce use impacts would need to be made at a strategic level. Designers, however, are often not in a position to influence product development at a strategic level; *"it is often not designers making these important strategic decisions"* (DPI-02). In many cases, particularly in large companies, strategic decisions relating to product development have already been made prior to the design stage; *"Often, other people have already decided what the product is going to be"* (DPI-08). There was an acknowledgement that although designers are often perceived as an *"independent driving force for change"* their ability to influence the strategic direction of the product development is somewhat limited (DPI-08). The scope and parameters of the product strategy is often predetermined before the resulting brief reaches the designer. The brief dictates what can and cannot be considered. Although they acknowledge the need to challenge the brief at a commercial or strategic level, few designers are in a position to do so. Most are restricted to working *"within the context of the brief and the scope they've been given"* (DPI-03). The exception being those *"iconic"* or *"influential"* designers who tend to have greater *"clout"* or influence with clients who regard their opinion highly (DPI-03).

One of the difficulties is that environmental issues in general are not often seen as part of the designers remit, *"they're seen as business decisions"* and are often dealt with at the manufacturing or *"business"* end of the line (DPI-08). There is, according to several respondents, a fundamental problem of perception in terms of responsibility for use. Designers have always focused on taking the product to the point-of-purchase (DPI-08). The impacts associated with product use therefore, although of concern to some designers, are not wholly considered to be within the remit of the majority. Designers, particularly those engaged in User Centred Research, are however, uniquely placed to consider the potential impacts of product use if they are involved in the early stages of development. However, given the current constraints outlined above *"it is difficult for designers to see how they could engage with this, particularly because of where they are in the chain"* (DPI-08).

7.8.2 Challenge to Engage Manufacturers & Service Providers

Many respondents seemed to indicate that manufacturers, and more specifically service providers, were better placed to influence product use. Engaging mobile phone manufacturers or service providers in implementing product design strategies for addressing use impacts however, was considered problematic. Particularly in relation to the concept presented as it was largely perceived to limit use (DPI-02, DPI-03, DPI-05). The overall view was that *"manufacturers won't want to limit use"* (DPI-03) or *"be... involved in a product design which limits talk time, surfing or texting"* (DPI-02) as this would reduce profit margins. In short, the questions to be addressed in any pitch to engage manufacturers or service providers would be; what are the benefits of implementing strategies to reduce use impacts? Or, perhaps more powerfully, what are the threats associated with not doing so? At most, respondents felt manufacturers would feasibly consider strategies which promote *"communicating differently...more appropriately...or responsibly"* (DPI-05) but certainly not less.

Several respondents linked the impacts of product use with the Corporate Social Responsibility (CSR) agenda. The case for addressing use impacts through design should, many felt, be positioned in terms of enhancing or protecting the brand. *"If you can present the argument on the social responsibility side and brand benefit side they'll put these things in"* (DPI-03). Respondents did not believe that manufacturers would voluntarily introduce strategies for influencing user behaviour to reduce social impacts of use unless there was a sizable consumer backlash. If the use of mobile phones in public *"reached a 'tipping point' in social acceptability"* towards being unacceptable (DPI-03), i.e. the frustration and annoyance of the public reached critical mass, or customers *"came under threat from others about the way they use it"* (DPI-05) then manufacturers may be forced to act. *"Keeping on the right side of social acceptability is definitely in their interests"* (DPI-03). Two respondents used the example of developments in the alcoholic drinks industry to illustrate how the consequences of product use can be addressed positively as part of the CSR agenda. The Portman Group, an initiative set up in collaboration with several drinks manufacturers, seeks to educate consumers about the pitfalls of binge drinking by encouraging *"responsible"* consumption. Using a simple labelling promotion, Portman project a responsible brand image without instigating a reduction in consumption, a win-win situation (DPI-03). In the mobile phone sector, the advertisements by Orange were cited as being a bold step in encouraging more appropriate use by advocating the practice of "on and off"

time. Unlike the Portman Group campaign, Orange advocates a reduction in use (DPI-05).

7.8.3 Appropriate Resources

One of the objectives of this research was to create appropriate resources to assist designers in implementing design for behavioural change approaches in their work. It was necessary, therefore, to investigate which types of tools designers find useful, and how these tools could best be presented.

The evaluation of the short film and collaborative design project, though not as part of a design project, was undertaken with design professionals who did provide useful insights into their potential value as future resources.

In addition to the comments made on the short film and collaborative design project, the respondents described other tools or methodologies which could be used to communicate the overall concept of designing for behavioural change and the benefits of understanding user behaviour in response to product attributes. These included;

7.8.3.1 Product Design Case Studies

Case studies were seen as particularly useful in providing an insight into how a particular design problem was approached by another designer. Case studies provide tangible examples *"in another project, of where questions have been asked and how they led to the outcome"* (DPI-05). As a general observation, case studies were considered more useful when targeted to a specific audience. In addition, case studies tended to be considered as more useful if they are supported with evidence that validates the outcome. The value of the Collaborative Design Project as a case study was recognised. Because it is *"representational of a larger idea"* (DPI-02), it serves *"as a means to think about intervention in general"* (DPI-02) operating as a *"metaphor for other products"* (DPI-01). In summary, *"this raises very interesting questions... [using] a project like this you can get into larger conversations...how technology is able to influence a social situation and whether that's the right method to use in those situations"* (DPI-08). The schematic nature of how the product was represented helped to distance the audience from aesthetic concerns, focusing attention instead on the

service attributes (DPI-04, DPI-06). The use of simple line drawings in the form of a scenario was recognised as a common technique used for this purpose (ibid).

7.8.3.2 Stories, Scenarios & Role Playing

The use of stories, scenarios and role play techniques were all viewed as creative, engaging and interesting methods of exploring product use in a specific context. In both evaluation exercises the importance of representing a range of users in different environments and situations was agreed. Scenarios were viewed as particularly effective when presented visually e.g. as audio/visual films, animation and physical role play *"not necessarily through traditional boards"* (DPI-02). Short scenario-based films depicting actual behaviours were considered extremely powerful as stimulus in highlighting behavioural problems; *"We do a lot of video capture of scenarios in different environments and use it as stimulus to say 'this is the problem – look!'"* (DPI-04). The response to "A Haphazard Journey" confirmed these assertions. The visual nature *"communicates the message"* without the need to *"explain it to people"* (FEQ-04), helping designers to *"analyse behaviour effectively"* and *"get to grips with problems"* (FEQ-05). *"This film...does a good job of getting the issues across....to aid designers in identifying some of the "real" issues and problems"* (FEQ-01). It was suggested by one questionnaire respondent however, that *"the design process should be based on <u>real</u> observation not dramatisations"* but she did concede that *"the design challenge could be set forth with this type of film"* (FEQ-10).

7.8.3.3 Checklists & Prompt Questions

Informal checklists, in the form of prompt questions, appeared to be more valuable than prescriptive sequential *"steps"* to follow; *"people find checklists...really valuable... they don't have to be 'tools' as such, they could be starting points or questions to consider"* (DPI-01). These questions or prompts could be presented in the form of a matrix or framework (DPI-04) or just a *"list of tips or questions you should ask"* (DPI-05). The list of attributes presented in Chapter 6 could, according to some respondents, form the basis of such a list. Several suggestions were made as to how these attributes could be communicated. It was felt that each attribute would benefit from a corresponding product example illustrating how it could be realised. This could be presented in a similar fashion to the 'Information-Inspiration' website (DPI-06). The principle behind

each attribute could also be represented in the form of a metaphor presented as a film clip or animation (DPI-04).

In general terms, it was noted that any tool, approach or methodology should be tailored to suit the working practices, constraints and knowledge level of the intended recipient. The type and size of the company, whether it designs in-house or out-sources work to external agencies and if it produces mass-market goods or one-off products are all factors which will affect the type of resource which is applicable (DPI-01, DPI-02, DPI-04, DPI-07, DPI-08). The needs of SMEs, for example, are likely to be very different to those of larger design consultancies (DPI-07). The potential for adaptation and customisation of tools was mentioned by several interviewees. The need for space to enable the designer to adapt, refine and customise any tool developed was an important consideration (DPI-01). The key aim for any tool, according to one respondent, is to *"mak[e] the issue 'front of mind'"* (DPI-03).

7.9 Conclusions

Two tiers of conclusions can be drawn from the findings presented in this chapter; those relating to the individual resources and larger issues relating to the implementation of design for behavioural change approaches.

7.9.1 Suitability of Resources Developed

The perceptions of designers questioned in Chapters 4 and 6 largely correlate with those of the participants reported on in this Chapter. Collectively, the findings indicate strongly that resources for designing behavioural change should be explorative not prescriptive, focus on problem solving and ideally be applied in the early "ideation" stages of the design process. These perceptions both strengthen and validate the direction taken in developing the resources described in this chapter. The case study worked well as a vehicle for discussion, enabling larger debates to rise out of the initial commentary on specific product features. The wealth and diversity of points raised in the relatively short interviews conducted validated the usefulness of this type of resource in enabling a different way of thinking leading to the emergence of wider, more strategic debates. The general response to the short film also confirmed its validity as a useful resource for problem identification by raising questions not necessarily providing answers. Indeed, some respondents even cited issues which

were not intentionally referenced in the film e.g. the lack of interaction with others. This demonstrates that a film of this nature can instigate a thought process which includes consideration of wider issues related to mobile phone use beyond those explicitly included in the scenario. The suggestions for improvement were particularly helpful, and if applied, could improve the effectiveness of this film in delivering its message.

The overall usefulness of these resources would, however, depend largely on the situation of the intended recipient; their working practices, constraints and knowledge level, the type and size of the company, whether design is kept in-house or out-sourced to external agencies and if the products produced are mass-market goods or one-off items are all factors which will affect the type of resource which is applicable. Resources should, therefore, be tailored to specific markets/recipient types.

7.9.2 Incorporating "Behaviour Change" into Product Development

For the most part, the notion of designing for behavioural change was well received by the design professionals interviewed when considered as a conceptual idea. When transposed into production, however, a different story emerged and several barriers were identified to its successful adoption. This was particularly so with regards to its successful integration into the product development process and its acceptance by consumers.

Designers were not seen as being able to influence product development at a strategic level. This, they felt, would be the remit of top level management i.e. those who deal with "business" decisions. The respondents concluded that the key to ensuring that the impacts of product use are considered early in the product development process would be; to engage those at a senior level; to internalise responsibility for use in the organisational ethos; and to instigate a *"top down"* remit for change which empowers designers to give due consideration to investigating use impacts in the product design stage. This indicates that development of resources to enable designers to integrate behavioural change into their design processes, a key objective of this research, is in fact a secondary consideration. The first step is to build a convincing case for support to business leaders, which in order to be taken seriously, should ideally linked to Corporate Social Responsibility (CSR) and brand image.

In response to the conclusions drawn in this chapter it is possible to visualise the following factors which may help to drive the behavioural change agenda within industry;

- As stated, a strong business case linked to CSR and brand image needs to be developed to engage manufacturers and service providers in the debate and ensure senior level support. This needs to set out the advantages of influencing product use and, if appropriate, the risks for the brand and corporate image associated with not doing so. This may include successful case studies of where other manufacturers have reduced some of the social impacts of use and improved their corporate image without reducing profitability e.g. Portman Group, Orange etc.
- The impacts associated with the use of the product in question need to be assessed and a method for rating the social and environmental consequences of user actions developed. This may help in the identification of points of influence. Linking these actions to existing means of influencing behaviour, particularly legislation, and to research indicating customer's perceptions of anti-social use, may help in building support or justification for addressing these impacts.
- The focus of design education needs to be adjusted to extend designers involvement (and responsibility) for lifecycle impacts beyond point-of-purchase to encompass use and disposal. In industry, one of the objectives will be to encourage multi-disciplinary, concurrent work practices to be employed so that the designer is engaged earlier in the process where strategic decisions are made.
- The technological capability of products, particularly artificial intelligence, needs to be developed to enable the product to cope with the level of complexity involved in user decision making.
- More research and development is required to create prototypes for consumer testing which enable potential rebound effects to be identified and dealt with in the design. These case studies would also provide valuable stimulus for the design community.

In addition, there would need to be some societal changes to pave the way for the acceptance of "behaviour changing products", particularly those utilising intelligence;

- All manufacturers in a particular product sector would need to buy-in to a similar code of conduct reinforced by standard interventions to ensure universal use.

- User's expectations and concerns, particularly with regards to the use of context awareness technologies and the resulting perceived loss of civil liberties would need to be addressed.
- There would need to be a change in mindset to transition from the master-slave model, where the onus of control is within the user domain, towards acceptance of a co-defined notion of what is acceptable and responsible use.
- Consumers level of trust in products, and in turn manufacturers, would need to be raised to enable intelligence to be used as a tool for behavioural change.
- Product interventions may need to be further segmented into those received "internally" i.e. private and "externally" i.e. in public to increase potential acceptance by users and avoid undermining trust.
- To ensure the majority of users keep the default protocol settings active the onus for disabling these functions would need to be placed on the individual.
- The device would perhaps best be marketed at younger users, particularly the "early adopters" as this may increase the likelihood of its adoption and migration through to the mainstream.
- All other criteria for the design need to be met i.e. quality, reliability, aesthetics, and performance etc and not compromised by the introduction of interventions.

8 DISCUSSION

8.1 Introduction

Encouraging people to change their behaviour towards more sustainable actions is a problematic task. This is particularly so as the actions required for preserving the environment or placing others' welfare above ones own desires are widely perceived to signify a reduction in lifestyle quality or choice. The messages communicated via educational campaigns, though influential in the short term, require ongoing support and reinforcement for changes in behaviour to be sustained. Values inform decision making. Voluntary behavioural change towards more sustainable actions, therefore, may only be achievable if individual and collective values prioritise environmental and societal concerns. This research sought to find ways of influencing behaviour through product design in order to reduce the social impacts of product use. Carrying out this research brought to light two clear areas for discussion;

1. The ethical acceptability and viability of design for behavioural change.
2. The enablers of, and barriers to, the application of design for behavioural change approaches in industrial design practice and their acceptance by consumers.

The discussion relating to considerations of theory and practice in designing for behavioural change is continued below.

8.1.1 Perceived Short Term Nature of Approach

Before discussing this research in detail it is necessary to address a fundamental criticism which could be levelled at this investigation. It could be argued that this research represents a short term view, that it does not challenge the current dominant social paradigm but firmly locates itself within it. This is true. It is acknowledged that although influencing patterns of use may result in reduced social and environmental impacts; it will not, however, halt or even challenge the relentless pace of consumption in the West, and rising consumption in the East. This research does not propose a solution to address the longer term goals of reducing consumption levels and working towards sufficiency, although it acknowledges the pressing urgency to do so. Instead it offers a series of recommendations for designing behaviour changing devices which

may, when prototyped, developed and tested more thoroughly, prove to be a viable way of changing user behaviour to reduce the social and environmental impacts of use.

8.2 Intelligence vs. Eco-Feedback or Effectiveness vs. Acceptability

This research sought to identify potential approaches for designing behavioural change. Three key approaches were identified in the literature (Chapter 2); two however, emerged as being those most easily understood and applied; Eco-feedback and Intelligence (Chapters 4, 5 and 6). Behaviour steering was the least understood, though this may be due to the lack of tangible examples of the application of behaviour steering approaches towards a reduction in environmental and social impacts, with the exception of Jelsma (2003) and Jelsma and Knot's work (2002). Design work produced in activities related to the PhD research seemed to favour a combination of these two approaches. Evaluation of this work by other design professionals however brought to light an interesting perception of the trade-off between effectiveness versus acceptability represented by the application of Intelligence versus Eco-feedback. The findings in Chapters 6 indicated an overwhelming bias towards interventions which steer user behaviour towards more socially-conscious actions without diminishing the user's ability to choose how to interact. It is telling that the most favoured protocol was Raised Voice, an eco-feedback based intervention in which the user is subtly provided with information regarding the loudness of their voice as an incentive to reduce their speaking volume.

There appeared, in the findings of this research, to be a level of acceptance for feedback not necessarily matched by its potential for effecting prolonged changes in behaviour. Intelligent products, operating autonomously and ubiquitously, were seen as having the potential to be incredibly effective as they automatically override any decision making by the user. The use of intelligence however, was considered to reduce the individual's right to choose how to act, and with this lack of choice so too, it was felt, would come a lack of awareness. The central question in this debate is; is it better to educate the consumer and risk failure or overrule users to reduce societal impacts of use, and in doing so spread naivety? In the face of the ineffectual nature of public information campaigns, zoning and etiquette guides, all based on a "feedback" methodology, the question becomes; do interventions need to "force" behaviour in order to achieve demonstrable results?

If we consider the application of these two approaches in product design only from the perspective of reducing use impacts, one clear winner emerges and that is intelligence. Not withstanding current limitations of technology, product intelligence offers a certain and replicable method for ensuring users behave in the ways prescribed by the designer. The application of intelligence in behaviour changing products to reduce use impacts however, is problematic when viewed against the wider concerns of sustainability, particularly societal concerns. The social sphere of sustainability encompasses, amongst other attributes, social equity and inclusion, community impact and interaction and human health (Blofeld et al., 2002). Taking these attributes into account, can a product which aims to ensure the wellbeing of many by prescribing, controlling and monitoring the actions of the individual be justified?

The perceptions of the design professionals reported in Chapters 4 and 7 revealed a number of reservations about intelligence approaches which may explain why intelligent products designed to influence behaviour were not considered acceptable. To enable the phone to operate intelligently some degree of context-awareness would be necessary. Currently, the user has the choice and indeed right to privacy with regards to their whereabouts and choice of company. Changing this dynamic would change the nature of "truth" in our interactions and imbue seemingly inanimate objects with the ability to report on and "judge" user actions. There is obviously an ethical issue involved in gathering contextual information to inform product decision making and this represents a legitimate concern regarding the ethical acceptability of intelligent devices.

Although a great deal of information about consumer behaviour is already available to government and businesses via census data, store loyalty cards and CCTV, consumers appear reluctant to provide personal data freely. Arguments presented in defence of, and opposition to, identity (ID) cards provide a parallel example of this type of debate. The government insist that carrying ID cards will ensure the safety of all UK citizens by assisting government authorities and bodies to identify those whose actions place others at risk. Opposition to the introduction of ID cards, recently popularised in the film Taking Liberties (2007), has been widespread. It has been argued that being forced to produce an ID card whenever an official demand is made infringes ones right to privacy. Further concerns have been raised regarding the accumulation and distribution of personal data. Reports indicate that up to 50 *categories* of facts which may be registered are set out in the Bill proposing an ID card scheme (NO2ID, 2007). The strength of opposition to ID cards demonstrates that a widespread group of people

are not, it seems, willing to release personal data unless the objective of such an exercise is clear and justifiable.

This dilemma, though arguably on a much smaller scale, is mirrored in the debate over using intelligent products to ensure certain behaviours. Can the infringement of civil liberties and personal privacy be justified in the face of user activities which erode social wellbeing and quality of life in public spaces on the basis of protecting the rights of others and the environment? Berdichevsky and Neuenschwander (1999) insist that *"the creators of a persuasive technology must ensure that it regards the privacy of users with at least as much respect as they regard their own privacy"*. Based on this edict, the scope of data collected by context awareness technologies applied in intelligent devices must be considered carefully to avoid infringing the liberties and privacy of the user and those affected by use. But what constitutes an acceptable level of information regarding consumer behaviour and how should this information be used?

A further issue raised by contributors to Chapters 4, 5 and 6 in response to the use of intelligence referred to the distribution of power between the user and the device. Given the current subservient nature of the product, elevating the product's level of influence and autonomous decision making capability would almost certainly be seen as unacceptable to consumers used to being the "master" of their devices. Take for example, the forcing functionality of a DVD which prohibits the user from skipping the DVD piracy commercial or, in some cases, the new release trailers. Blocking operations which are "prohibited by the disc" often results in annoyance and frustration on the part of the user (Dant, 2006b).

Perhaps a more refined debate would be in assessing the "intentionality" of the designer or manufacturer. According to Berdichevsky and Neuenschwander (1999) the intended outcome of a persuasive device is one of the factors which can determine its ethical acceptability. Fogg (2003) defines the distinction between products or services which persuade and those which coerce. A persuasive approach, he maintains, seeks to achieve a *voluntary* change in behaviour; a coercive technology, on the other hand, *forces* behavioural change.

The National Consumer Council, an advocate for consumer protection, recently published a report exemplifying the benefits of *"Choice Editing"* (Sustainable Consumption Roundtable, 2006b). Choice editing refers to decisions made by manufacturers, retailers and regulators to edit out less sustainable products on behalf

of consumers. Choice editing reduces the complexity of decision making required by the consumer, and ensures issues are dealt with upstream by government and industry. This method of influencing behaviour intentionally restricts the user's ability to act autonomously by limiting the field of choice and is therefore, in Fogg's (2003) terms, a coercive approach. The intention behind choice editing is however, a righteous one. It could be argued that editing choice by default leads to "better" choices. Consumer acceptance, if grudging, is inevitable as these products are the only ones available. The acceptance of choice editing, however, is called into question when considering the recent disputes over waste collection. Many local authorities have reduced the collection of household waste and introduced "weigh and pay" schemes to facilitate a change in behaviour towards waste minimisation. Though widely opposed, these initiatives have been introduced with the best intentions and arguably with good reason given the amount of waste produced by households and the rate of recyclable material still disposed of in household waste. It could be argued that these schemes are coercive as the majority of residents have few choices but to comply. But, in most cases, they are presented as persuasive. The method of influence here is not insidious or hidden, it is a clear and straightforward intervention. But is it justifiable? Is editing choice to force behavioural change justified if removing choice would greatly benefit society and the environment?

Perhaps the legitimacy and acceptability of the use of intelligence relates directly to the magnitude of the behaviour enacted. If this is the case, how do we determine which types of behaviour warrant more forceful interventions? The findings from Chapters 6 and 7 indicated that those behaviours which may diminish personal or public safety such as driving whilst talking on the phone are perhaps more damaging than talking loudly in a café for example. It may be easier for manufacturers to justify the use of more forceful interventions if the target behaviours are already legislated against, widely deemed as socially unacceptable or illegal. These interventions would, arguably, also be more readily accepted by users as legitimate concerns. Most of the design professionals interviewed agreed that key stakeholders would need to "grade" different types of behaviours as being more or less environmentally or socially damaging to provide a clear framework for the strength of intervention applied.

Finally, if intelligence is considered wholly unacceptable and eco-feedback is the path of least resistance how could it be made more effective as a method for changing user behaviour? This research argues that adherence to the ten point attributes list at the end of Chapter 6 may go some way in creating viable behaviour changing devices. But

to really test the acceptance and effectiveness of these devices, manufacturers must engage consumers in testing these devices over a prolonged period.

8.3 Points of Influence

The focus of the outcomes of this research has generally been on influencing design practice via the provision of processes or tools for designers. It is important, however, to consider manufacturers.

8.3.1 Manufacturers

Evidence of a mounting backlash against manufacturers whose products are used to suppress human rights or damage the environment has been observed in recent years. Caterpillar, for example, continues to face severe global criticism after it emerged that they supply D9 bulldozers to the Israeli military who armour these vehicles for use to level Palestinian homes, destroy agriculture and shred roads. According to Human Rights Watch, Caterpillar's continued sales to Israel in light of these revelations *"make the company complicit in human rights abuses"* and it should immediately suspend sales to the Israeli military (Human Rights Watch, 2004). In the same article, Caterpillar's CEO defends the company decision to continue selling to Israel by saying that the company does *"not have the practical ability or legal right to determine how our products are used after they are sold"* (ibid). This statement opens up an interesting moral and legal debate concerning manufacturers' responsibility for the impacts of the products they produce. If the manufacturers' responsibility, as asserted by Caterpillar, does indeed end at the point of sale, can the company be held accountable for the use of its products to inflict damage on society or the environment? Caterpillar has active sustainability and corporate social responsibility reports. Its own code of conduct cites its endeavours to *"educate and encourage our customers to use the products they purchase from us in environmentally responsible ways"* (Caterpillar, 2005, p. 27). However, by failing to withdraw their services Caterpillar is arguably condoning the use of its products in a mode which violates human rights. How can this difference be reconciled? In one interviewee's opinion, Chapter 4, manufacturers do not widely consider themselves liable for the impacts of the products they make, except in relation to the user's safety when operating the device. This presents a sad irony in that Caterpillar's liability would feasibly extend to cover injury to an Israeli operative if

caused by a machine malfunction, but not the life of an American activist killed by an armoured D9 whilst protecting a Palestinian refugee camp and town.

At what point, however, can the manufacturer be viewed as culpable in the negative effects of product use? It could be argued that manufacturers should not be held accountable for the consequences resulting from the use or misuse of their products if they, themselves, are not aware of these issues. But what if the manufacturer is fully aware of a potential or actual consequence of the use of their product and, like Caterpillar, does nothing to prevent it? Dant maintains that the morality of things is only realised in use, a gun is, he argues, an inert object which only becomes a weapon when it is used and at that point *"the user is morally responsible"* for the consequences *"not the object"* (Dant, 2006b). The possibilities arising from use however, particularly in the case of a gun, are to a degree predictable. Should the gun manufacturer therefore be culpable for supplying a device loaded with the capacity to harm others? The answer in this debate depends entirely on how the relationship between object and human is perceived. If Gowri's view that *"things do not have intentions"* (2004, p. 44) is to be believed, then the intentionality of the user in operating the product determines the resulting consequences of use. If this is indeed the case, then we must exclude habitual behaviours, which are not consciously performed, as these behaviours can not be considered as intentional. If we refer back to the working definition of a *negative social impact of use* proposed in Chapter 1 and apply this logic the updated working definition would read:

> Any ***conscious or intentional*** action enacted or facilitated by the product or resulting from the behaviour of the user in the use of the product which ***deliberately*** diminishes the health, wellbeing, social equity or quality of life of others affected by the use of the product.

But whether an action is intentional or unintentional the consequences may still be the same, so is intentionality a plausible argument to put forward in defence of manufacturers who do not attempt to prevent anti-social or environmentally damaging behaviours being enacted by users?

Users often *"convert things to serve their own ends"* (Koskijoki, 1997, p. 135). *Appropriation* works against the designer's intention. It can be difficult for manufacturers to identify how products are actually used without extensive user centred research after point-of-purchase. Point-of-purchase, as discussed, is often

perceived as the end point in many designers involvement. Looking beyond point-of-purchase to observe behaviour during use, therefore, may be considered outside of their scope.

It is interesting to note that many consumers prefer to rely on manufacturers, or government, to address use impacts on their behalf (Sustainable Consumption Roundtable, 2006a and 2006b). However, given the discussion above, perhaps there should be a limit of the scope of a manufacturer's or designer's level of accountability to those consequences deemed foreseeable or preventable. If the product has been modified to perform actions outside of the manufacturers intended remit for use for example, they may not in all fairness be considered liable. The question is, who could (or should) hold manufacturers accountable for foreseeable consequences resulting from the use of their products and, equally as important, what should their criteria be for assessing accountability?

The United Nations has sought, since 2003, to develop standards for corporations regarding human rights. As stated in the U.N. Norms on the Responsibilities of Transnational Corporations and Other Business Enterprises with Regard to Human Rights, *"Transnational corporations and other business enterprises shall..... seek to ensure that the goods and services they provide will not be used to abuse human rights"* (United Nations, 2003). This is an interesting development as it is beginning to hold manufacturers accountable not only for the production and disposal of the items they produce, but also for the consequences of their use. The violation of human rights, exemplified by reports of the use of Caterpillar bulldozers in Palestine, is clearly a far greater and more serious consequence of product use than those discussed in this thesis. Yet the UN document referred to sets a precedent which may, in years to come, be extended to encompass wider environmental and social consequences of product use.

At a corporate level, the impetus to voluntarily take responsibility for sustainability issues resulting from company operations is often the result of organisational values. Respondents in Chapter 6 suggested that those manufacturers without these internal values may require further justification for considering use impacts beyond purely environmental and social reasons. This is particularly so given the absence of prescribed legislation relating to use, beyond compliance with safety and consumer rights issues. To encourage "buy-in" a persuasive business case for support to industry leaders would need to be made. The strong linkages between user behaviour, brand

reputation and Corporate Social Responsibility (CSR), as demonstrated with the Caterpillar example may be a potential point of influence with manufacturers. If the public's negative perceptions of the social or environmental impacts of the use of a product reached critical mass, adverse publicity or consumer pressure may be cause for manufacturers to act.

Assuming it is possible to willingly engage manufacturers in this debate, how far would they feasibly be willing to intervene in influencing user behaviour? As discussed in the literature, government agencies seem to advocate a moderate approach to consumption (UNEP, 2003b). Their premise being that increased efficiency will enable current lifestyles to be sustained whilst the impacts of consumption are reduced. This is a similar notion to that expressed by respondents when considering how manufacturers could, or would indeed choose, to engage in reducing use impacts. In the case of mobile phones, the emphasis of the design intervention would not, they argue, be on communicating less but communicating differently. In a market where profit depends on the increased usage of communication services, advocating talking less would be commercial suicide. In order to be acceptable to manufacturers and service providers the operative message would need to emphasise behaving "differently". In short, responsible use must not mean reduced use.

8.3.2 Designers

To be fully integrated into the product design, the impacts of product use must be considered in the early stages of the design process. One of the intended objectives of this research was to develop and test processes or tools which can assist *designers* in implementing design for behavioural change approaches in their work. Reflecting on the perceptions of design professionals reported in Chapters 4 and 7, the emphasis on designers as enablers of design for behavioural change was premature. Designers, according to these perceptions, are often not in a position to influence product development at a strategic level. Approaches to design for behavioural change would almost certainly need to be inserted at a corporate level in order to succeed in influencing product design strategy and design. Once this edict was in place, designers could then use the resources developed as part of this research to inform existing design processes with the aim of reducing use impacts.

Designers "borrow" from other disciplinary areas to generate new theories and practices, learn new techniques and acquire knowledge to complete a stage of work. They solve multi-faceted problems by drawing on cross-disciplinary information from a range of sources. They use this information to create links between previously unconnected ideas to construct new perspectives on existing problems and inform product design. This research took a similar "magpie" approach to generate theories to inform design practice. There was no book on Designing for Behavioural Change to draw on, and little in the way of previous design-led research in the field. To build theory, therefore, the net had to be cast fairly wide to encompass other disciplines whose researchers were beginning to engage with this debate. For this researcher, this represented a challenge. To be able to draw on this information it was necessary to quickly assimilate and understand not only new types of knowledge but new terminology. Equally, to render this information useful for designers a process of translation was required to enable theory to be supplanted in practice.

8.3.2.1 Resources for Behavioural Change

To enable manufacturers to put measures in place in the product design to preclude potential or foreseeable consequences resulting from use, they must first observe how people use and misuse their products. User Centred Research techniques are typically used as a means of observing and identifying user practices (Lofthouse and Lilley, 2006). As discussed in Chapter 6, seeing real behaviours in real contexts is extremely powerful in aiding design decision making. Capturing and reproducing this data, however, can be problematic depending on the mode of collection and the context of data use. The film produced as part of this research sought to represent "real" behaviours based on prior research findings. The resulting film, however, succeeded in capturing real reactions to the central actor's behaviour. It is possible, therefore, to view it not as a recreation but as a social experiment where actor is the protagonist and the real data is collected via his interaction (or lack of interaction) with others. The value of this film as a resource was recognised by respondents and in some cases insights gained from watching the film were actively linked to product attributes.

8.3.2.2 Extending Responsibility for the Product Lifecycle

The results of this research suggest that Industrial Design education must encourage designers to take some responsibility for reducing use impacts as part of the product

design process. Many industrial design courses now include sustainable design thinking as part of their curriculum. Designer's knowledge and awareness of techniques to reduce lifecycle impacts, particularly dematerialisation and end-of-life strategies, has risen in recent years. Their focus, however, still largely only extends to point-of-purchase. In industry, there has been some consideration for the impacts of use, particularly in response to the Ecodesign Requirements for Energy Using Products (EuP) Directive, but the narrow remit of this legislation has precluded any wider considerations relating to societal impacts.

For the impacts of use to be actively considered by designers, their remit of consideration must be extended beyond point-of-purchase and end-of-life to include use. One potential way of achieving this is to adapt the current product lifecycle model to more adequately represent user practices such as rebound effects and appropriation. It may also be advisable to use this revised model to illustrate the importance of identifying rebounds (or anti-scripts) and devising approaches to address the effects of these.

9 CONCLUSIONS & FUTURE WORK

9.1 Introduction

This chapter brings together the overall findings of the PhD. It describes how the aim and objectives were achieved, presents overall conclusions, explores the limitations of the outcomes and demonstrates the wider applicability of the results of this investigation. The contribution of this research in forming new knowledge is outlined and suggestions for further work given.

9.2 Meeting the Aim & Objectives

This section describes how the research activities carried out, met the objectives set out in Chapter 1. Completion of these objectives enabled the overall aim to be realised.

The first objective was to link theory and practice identified in existing literature from diverse disciplinary fields to build knowledge in "design for behavioural change". The lack of existing design-led research in this area necessitated the use of a multi-disciplinary approach to identify relevant information. The initial literature review drew references from several disciplinary fields such as science and technology studies, computing technology and social sciences to build theory and identify practice-based examples to inform the research questions set for the literature review, Chapter 2.

The second objective was to identify and evaluate existing design-led interventions which attempt to moderate user behaviour towards a reduction in use impacts. This was achieved through carrying out a literature review spanning academic journals, conference papers, websites and blogs to uncover potential case studies and via discussions with fellow researchers in this field. Three design-led approaches for behavioural change were identified and taken forward for application and evaluation.

The third objective was to devise and run workshop activities which test designers approach towards designing for behavioural change. Design I Behaviour was run on the 12th April 2006 at the Design Council in London. This event brought together design activities and facilitated discussion within a workshop format to explore issues arising from the literature and fulfil the criteria set out in this objective.

The case study produced and reported on in Chapters 5 and 6 fulfilled objective 4. This case study explored the ways in which mobile phone use in public places is regulated and introduced design concepts attempting to change user behaviour. User's perceptions of social issues arising from mobile phone use in public were explored via two preliminary user studies and a more comprehensive main user study conducted in conjunction with the National Consumer Council. The results of these studies informed the main design study carried out by nine Industrial Design Masters students to apply and evaluate design-led approaches for behavioural change to address social impacts of mobile phone use. Evidence of their design processes was recorded and subsequently analysed. The results of these design activities informed the development of the collaborative design project in Chapter 7.

In fulfilment of objective 5, two resources were developed to assist designers in implementing design for behavioural change approaches in their work. These were tested with design professionals and the results discussed in Chapter's 7 and 8. Additionally, recommendations were made as to how other, arguably more influential, players such as manufacturers and service providers could be engaged in taking shared responsibility for implementing actions to reduce use impacts through design.

9.3 Conclusions

The aim of this research was to investigate the feasibility of applying design-led approaches to influence user behaviour and reduce the social impacts of product use. This involved exploring not only the viability of applying design-led approaches in the design process, but also the acceptability of their implementation in new product development strategies and an analysis of any opportunities or difficulties which may arise. Due to the limitations described below, the findings presented in this thesis largely addressed theoretical issues relating to the design process, ethics and stakeholder responsibilities for use impacts. This research did not conclusively prove the effectiveness of the approaches identified. It did however, reflect on the perceptions of the various stakeholders who may play a part in implementing, or be affected by the implementation of, these approaches in consumer products.

This research has clearly demonstrated that there is a need to consider alternative methods for influencing consumer behaviour beyond technological innovation and consumer education campaigns. The findings indicated that there is a great deal of

interest and support for design-led approaches for behavioural change if a balance can be achieved between influencing and coercing. Although the use of intelligence in product design could ensure users behave in the ways prescribed by the designer, the application of intelligence to reduce use impacts was considered problematic by most respondents. This was mainly due to the potential infringement of civil liberties, loss of control and reduced capacity for learning. The level of acceptance for eco-feedback approaches by respondents, however, was not necessarily matched by its potential for effecting prolonged changes in behaviour. The findings of this research suggest that two or more behavioural change approaches used in tandem may increase the effectiveness of the device and contribute to a greater level of acceptance amongst users.

The findings strongly indicated that the successful implementation of design-led approaches for behavioural change in new product development would require a radical shift in designer's and manufacturer's perceptions of their responsibility for product use. Additionally, careful consideration of the ethical acceptability of applying these approaches would be required prior to designing.

The discussions in Chapters 4, 5, 6 and 7 provided insights into the perceived responsibility of manufacturers and designers and the changes required to facilitate the adoption of a design for behavioural change approach;

- Reportedly, designers are often not in a position to influence product development at a strategic level. Prior work, therefore, is needed to engage senior staff.
- A strong business case linked to Corporate Social Responsibility policies and brand image needs to be developed to engage manufacturers and service providers in the debate and ensure senior level support.
- In industry, one of the objectives will be to encourage multi-disciplinary, concurrent work practices to be employed so that the designer is engaged earlier in the process where strategic decisions are made.
- In education, the focus of designers' engagement with design development needs to be adjusted to extend their perceived involvement (and responsibility) for lifecycle impacts beyond point-of-purchase to encompass use and disposal.

Analysis of the findings of Chapters 4, 5, 6 and 7 enabled conclusions to be drawn regarding the type of resources which could be used by designers wishing to consider design for behavioural change;

- Collectively, the findings indicate strongly that resources for designing behavioural change should; be explorative not prescriptive, focus on problem solving and ideally be applied in the early "ideation" stages of the design process.
- The importance of understanding the complex set of values underlying consumer behaviour should not be underestimated as only by understanding these factors can effective strategies be devised to change behaviour.
- The overall usefulness of resources would depend largely on the situation of the intended recipient i.e. their working practices, constraints, knowledge level; the type and size of the company and scale of output. Resources should, therefore, be tailored to specific markets and recipient types.

In terms of ethics, this research has shown that social scientists, and to a lesser extent design theorists, are beginning to question the morality of things. Yet despite calls for designers to consider the actions products facilitate, few designers, particularly those practicing in industry, are openly discussing the moral consequences of products and their use. There do not appear to be any hard and fast answers to the underlying moral concerns of influencing behaviour through design and few ethical guidelines for designers exist. This research, therefore, has concluded that;

- The "intentionality" of the designer or manufacturer is a key consideration when assessing the ethical acceptability of the device.
- To adequately match the strength of intervention with the severity of the action taken, the impacts of individual product's use need to be assessed and a method for rating the social and environmental consequences of user actions developed.
- This needs to be a collaborative, inclusive exercise involving all affected stakeholders. In support of this, research indicating customer's perceptions of anti-social use may help in building support or justification for addressing these impacts.
- Actions identified, where possible, should be linked to existing means of influencing behaviour, particularly legislation as this may help to increase their acceptability with users.

Finally, there was a strong consensus between the design professionals who took part in activities and literature surveyed that 'behaviour changing' product ideas need to be prototyped and tested with consumers to ensure their effectiveness and acceptability.

9.4 Limitations of this Research

A great deal has been achieved in three years but given additional resources the scope and outcomes produced could have been greater. The following sections discuss some of the limitations of this research.

9.4.1 Focus on Mainstream Designers

In hindsight, the findings of this study indicate that it would have been beneficial to discuss the concept and implications of designing for behavioural change with other professionals who play a part designing, producing and marketing consumer goods. However, given the time constraints of the PhD and problems in accessing multi-disciplinary design teams, this was not possible. One of the limitations of this research, therefore, lies in the singular focus on the opinions and work of designers, particularly students, for the investigative phase. This was, however, addressed in the selection of interviewees for the evaluation phase, which was more diverse.

9.4.2 Lack of Industrial Collaboration in Design Phase

A further limitation of this research, though not for want of trying, was the absence of an industrial collaborator. The involvement of such a partner would not only have contributed much needed funds, but also expertise, potentially prototyping capabilities and access to a wide ranging customer base for research purposes. Though the quality of the design work produced was commendable, with an industrial collaborator on-board this research could have been pushed further. As it is, the design work produced only took the idea as far as the concept stage. Development into prototyping would have given the product interventions developed far more credence in terms of their potential to effect changes in behaviour. The lack of prototyping for consumer testing has made it difficult to gauge the potential success of these interventions beyond the collated perceptions of design professionals and success factors identified in the few projects in which products or prototypes have been tested and reported on i.e. Waterbot (Arroyo et al., 2005), Static! (Interactive Institute, 2004) and the Kambrook Kettle (RMIT, 2003). Analysis of these sources, however, does support the ten point attributes framework presented at the end of Chapter 6. However, there is some way to go if these attributes are to be proven conclusively.

9.4.3 Product Selection

Due to the level of preparatory research required to establish a sound base for a design brief. It was necessary to choose one product as the case study upon which to test the emergent approaches. Although the study of the social impacts of mobile phones in public was an extremely fruitful area for study it was somewhat limiting to consider only one product category. Had there been sufficient time it would have been interesting to pursue a range of product types and explore both social and environmental dimensions. This would have enabled comparisons to be made between product types and an analysis of the generalisability of the approaches devised to be made.

9.4.4 Methodological Limitations

A two-pronged approach to capturing behaviour in both action and intent; i.e. through direct and covert investigation can help to overcome the action-awareness gap often considered as a limitation of behavioural studies (Lofthouse and Lilley, 2006). The user diary methodology used in the preliminary user study was specifically chosen to record *actions* versus *intentions* associated with consumer behaviour. However, this activity did not garner the quality of data anticipated. In terms of analysis, it was difficult to avoid assuming participants logic for taking a certain course of action, this left many unanswered questions regarding some of the behaviours described. Additionally, there was some post-rationalisation of accounts of behaviour in some cases due to the gap between the user taking the action and recording the action taken. The failings of the user diary methodology pointed to the renewed relevance of ethnographic based observational fieldwork in capturing actual user behaviour. Yet due to cost, time and ethical issues it was not possible to carry out observational studies in the field. Inclusion of this type of data, particularly video recordings, would not only have provided stimulus for the design activities which followed but would have provided "raw" footage for the resulting short film. The shortcomings of the user studies carried out, however, did succeed in providing the inspiration, impetus and justification for the development of the short film as a design resource.

9.4.5 Limitations of Design Work Produced

Ironically, in choosing to focus on diminishing the *social* impacts of mobile phone use, the design work presented in Chapters 6 and 7 did not, in some cases, give adequate consideration to the environmental impacts enacted by its use or design. A fair criticism of this work would be its lack of recognition of how some of the interventions to reduce societal impacts would in fact increase the use of materials, the complexity of component parts and the energy used by the device. This not only reinforces the complex nature of designing for behavioural change within the context of sustainable design, but also the need to evaluate any design work produced most carefully.

9.4.6 Limitations of 'Resources' Produced

With the benefit of knowledge acquired through undertaking this research it is also possible to identify how the quality and applicability of the resources developed could have been improved. If, as discussed, these resources should be tailored to suit the situation of the intended recipient it may have been advisable to target a particular type of designer or design consultancy. Admittedly this would have reduced the potential audience for the resources developed, but it would have increased its usefulness and applicability for the targeted segment. In the particular case of the short film, it was originally planned that a series of films be produced and formatted for use on a designated website. This website would have formed a central portal for designers to access all of the resources developed as case studies and to download or watch the inspirational short films. Time constraints, however, meant that this development of the resources was not possible. As it stands, the film and the collaborative design case study can be seen as elements which, when put together, would form a complete web-based resource.

9.5 Applicability of the Research Findings

This research focused on the application of the approaches identified to address the social impacts of mobile phone use in public places. The scope of this investigation was justifiably narrow to enable the research undertaken and solutions produced to be suitably focused. The research processes adopted, design-led approaches applied and success factors identified through the analysis of primary and secondary evidence collected, however, could be applied to other product types, contexts and user types.

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Additionally, the perceptions of design professionals in response to the outcomes produced, Chapter 7, serve to inform the wider theoretical and ethical debates involved in considering the application of behavioural change approaches in design practice.

9.6 Contribution to Knowledge

This PhD represents one of only a few doctoral research projects specifically investigating how design can facilitate a reduction in the impacts of product use through influencing behaviour. These investigations are, for the most part, being carried out at the same time as this research (Rodriguez, 2004, Rodriguez and Boks, 2005, Park, 2004, Park, 2006) or in response to it (forthcoming PhD work of note includes that of Tang and Lockton currently studying at Loughborough University and Brunel University respectively).

The absence of significant prior work in this field reinforces the contribution to knowledge made by this research, specifically in;

- Linking theories and approaches originating in diverse disciplinary fields to build knowledge in designing for behavioural change,
- Applying these insights to inform design practice and producing documentary evidence of the research and design processes adopted,
- Formulating an initial framework of attributes for "behaviour changing" devices based on the results of practice-led investigations,
- Facilitating discussion within the design community to inform theoretical debate concerning;
    - The extent of manufacturers and designers responsibility for use impacts,
    - The ethical acceptability of using design to influence user behaviour,
    - Potential links between product use, Corporate Social Responsibility (CSR) and branding,
    - The types of tools, methodologies or approaches which could assist in the consideration of the impacts of product use, and more specifically the application of design for behavioural change.

9.7 Recommendations for Further Work

This PhD has contributed to the growing body of research in the field Design for Behavioural Change. Yet three years have been insufficient time to pursue the many other directions in which it could have been taken. The following sections propose further works which would contribute to the development of design theories related to the core issues, and help to further shape design and manufacturing processes.

9.7.1 Prototyping Design for Behavioural Change Devices

This research has demonstrated that few designs have been prototyped and the range of product types studied is limited. This research, and that conducted previously, has concluded that "behaviour changing" devices must be prototyped and subjected to rigorous consumer testing (Rodriguez and Boks, 2005). A practice-led research project with an industrial collaborator could be developed to test the application of the attributes for 'behaviour changing' devices described in Chapter 6. This type of investigation would greatly inform this field of enquiry by producing tangible, proven results regarding the effectiveness and acceptability of these, or other, design-led approaches for behavioural change.

9.7.2 Designing for Behavioural Change Website

As described previously, the format for the individual resources developed as part of the research was a designated website containing informative case studies, visual representations of user behavioural studies (i.e. short films, photographs, user interviews) and links to related research pages. Preliminary work towards developing the website structure and contents was begun as part of the PhD work, but never completed. Completion of the 'design-behaviour' website is an important area of future work, particularly given the success of "Information Inspiration" (http://www.informationinspiration.org.uk/) as an educational tool for designers

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Appendix A

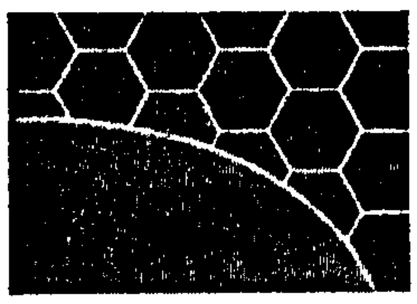
Appendix A: Agenda & Delegates List for Design I Behaviour: 10th SDN Seminar

AGENDA

'Design I Behaviour': 10th Sustainable Design Network Seminar

The Design Council, London, Wednesday 12th April 2006

9.30 – 10.10	Morning tea and coffee
10.10 – 10.30	Vicky Lofthouse, Sustainable Design Network, Introduction.
10.30 – 11.00	Tim Dant, University of East Anglia, "Materiality and Morality"
11.00 – 11.30	Lynne Elvins & Rupert Bassett, A420, "Sustainability Issue Mapping; Making Sustainability Personal"
11.30 – 12.00	Richard Miles, Loughborough University, "Case study 1: Designing Behavioural Change: Reprogramming the User"
12:00 - 12:30	Guy Robinson & Robert Brown, Sprout Design. "Case study 2: Understanding Behaviour for Successful Product Development"
12.30 – 1.30	Lunch
1.30 – 3.00	Design activities
	Parallel session 1: 'Designing behaviour' Parallel session 2: 'Using & consuming'
3.00 – 3.30	Afternoon tea and coffee
3.30 – 5.00	'Provocations': Group discussions and feedback
5.00	Close



DELEGATES

'Design I Behaviour': 10th Sustainable Design Network Seminar

Alastair Fuad-Luke	University College for the Creative Arts	kaw84@dial.pipex.com
Alina Congreve	University College London (UCL)	alina@congreve.prestel.co.uk
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Annabel Bradbury	Manchester Metropolitan University	annabel.bradbury@student.mmu.ac.uk
Ashley Phillips	Brilliantly Simple	eco_artbarn@yahoo.com
Carol Dair	Oxford Brookes University	cmdair@brookes.ac.uk
David J. Elliott	Chartered Institute of Marketing, Network for Responsible Marketers	david.elliott@mpgintl.com
David Willans	Futerra Sustainability Communications	david@futerra.co.uk
Guy Robinson	Sprout Design	guy@sproutdesign.co.uk
Jakki Dehn	Kingston University	j.dehn@kingston.ac.uk
Jane Penty	University of Brighton	j.penty@bton.ac.uk
Lizzie Dutton	DeMonfort University	edutton@dmu.ac.uk
Lucy Harbor	Commission for Architecture and the Built Environment (CABE)	lharbor@cabe.org.uk
Lynne Elvins	A420	elvins@a420.com
Matthew Simon	Sheffield Hallam University	m.simon@shu.ac.uk
Meredith Carter	University College for the Creative Arts	merrimentus@yahoo.com
Michael Herrmann	Leeds Metropolitan University	herbscape@blueyonder.co.uk
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Paul Micklethwaite	Kingston University ·	p.micklethwaite@kingston.ac.uk
Paul White	The Social Marketing Practice	paul.white@socialmarketingpractice.co.uk
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Robert Brown	Sprout Design	rob@sproutdesign.co.uk
Robin Roy	Open University	r.roy@open.ac.uk
Rupert Bassett	A420	bassett@a420.com
Sabine Hielscher	Sheffield Hallam University	sabineh10@hotmail.com
Sandy Black	London College of Fashion	s.black@fashion.arts.ac.uk
Sarah Johnson	[re]design	sarah@redesigndesign.org
Tim Cooper	Sheffield Hallam University	t.h.cooper@shu.ac.uk
Tim Dant	University of East Anglia	t.dant@uea.ac.uk
Tom Fisher	Sheffield Hallam University	t.h.fisher@shu.ac.uk

Appendix B

Appendix B: Preliminary User Study A: User Diary

The three pages below are excerpts from a user diary issued to participants of Preliminary User Study A. The first page explains the task, the second serves as an example of how to complete the daily diary entry in sufficient detail and the third provides an example of a completed page.

THANK YOU FOR PARTICIPATING IN THIS STUDY.

THIS IS YOUR ACTIVITY DIARY.

In this diary I would like you to record <u>how</u> you use your mobile phone and any problems or difficulties you have in using it over a four day period (Friday to Monday) using the tables provided. An example diary entry has been provided on the next page.

I am not interested in who you call or the duration of the call, but in <u>how you use the phone</u> for e.g. "I have to tape my handset to the car dashboard because the in-car hands free kit fixture provided with the phone keeps falling off when I'm driving"

Please use the notes page to write down any general thoughts on your own or other peoples mobile phone use. Use the disposable camera provided to take pictures to support your diary entries.

I will contact all participants to arrange the return of their diary and camera at the end of the study.

The results of this study will form part of a doctoral research project in the Department of Design and Technology at Loughborough University.

With thanks
Debra Lilley

07748 652879
d.lilley@lboro.ac.uk

DAY: Monday DATE: 4th April 2005

TIME	LOCATION	DESCRIPTION OF BEHAVIOUR
8.30am	In car	Charged phone in car on way to work. wedged handset between cigarette packets in open glove box compartment as phone slides off dashboard if I try to balance it there.
9.30am	In car park outside office	Phone rings whilst on way into office, fumble in bag and by the time I find it it's rung off

EXAMPLE

DAY: FRIDAY DATE: 2015

TIME	LOCATION	DESCRIPTION OF BEHAVIOUR
5·10am	Bedroom	Used phone to see what time it was - couldn't locate it easily
6·45am	Bedroom	Alarm - put alarm on 'snooze'
6·50ish	Bedroom	Alarm - turned alarm off, accidentally put it on silent
10·34 am	Office	Used phone to ring home to get someone to call me back.
10·35 am	Office	Phone rings - no problems as I was expecting the call.
10·40 am	Office	Phone rings Normal usage.
10·45	Outside	Phoned someone couldn't hear due to traffic noise - turned up volume
1·06pm	Office	Text received
1·08pm	Office	Text received - left on silent so as not to disturb anyone.
1·20pm	Office	Used phone to check time.
1·47pm	Office	Phone rang Normal usage.

Appendix C

Appendix C: Case Study: Pilot B Questionnaire 1st Iteration

MOBILE PHONE USERS PILOT STUDY
USER PROFILE QUESTIONNAIRE

sticker

1. Name: ..... 2. Age: .....

3. Make and model of your mobile phone:
.....

4. What would you consider to be your level of expertise in using your mobile phone? (Tick appropriate box)

a. Beginner (Can make & receive calls) ☐
b. Competent (As above + can text & operate camera) ☐
c. Advanced (As above + can use all other features) ☐

5. How often do you use your mobile phone? (Tick appropriate box)

a. All the time ☐
b. Every day ☐
c. Once or twice a week ☐
d. In emergencies only ☐
e. Only when it's free ☐
f. Other (please specify) ☐
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.....
.....

6. What do you use your phone for? (Tick all appropriate boxes)

a. Making phone calls ☐
b. Taking photographs ☐
c. Sending and receiving text messages ☐
d. Watching or recording videos ☐
e. Listening to music ☐
f. Sending e-mails ☐
g. Chatting to people on msn ☐
h. Playing games ☐
i. Surfing the internet ☐
j. Organiser features i.e. calendar, clock, alarm ☐
k. Other (please specify) ☐
.....
.....

7. How long have you had this phone?

.....

8. Have you deliberately made it last longer by doing any of the following? (Tick all appropriate boxes)

a. Bought protective cover / case ☐
b. Changed front / back fascia panels ☐
c. New battery ☐
d. Changed network ☐
e. New accessories (plug-in camera for e.g.) ☐
f. Other (please specify) ☐

.....
.....

9. Why did you extend the life of your phone?

.....
.....

10. How long do you think a mobile phone should last?

.....
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Please use examples where possible when answering the following 4 questions.

11. What do you consider to be socially responsible behaviour when using a mobile phone?

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12. What do you consider to be the NEGATIVE social impacts of using mobile phones?

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13. What do you consider to be environmentally responsible behaviour when using a mobile phone?

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14. What do you consider to be the NEGATIVE environmental impacts of using mobile phones?

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THANK YOU.

PLEASE BRING THIS QUESTIONNAIRE WITH YOU TO YOUR INTERVIEW.

Appendix D

Appendix D: Preliminary User Study B: Questionnaire 2nd Iteration

In this 2nd Iteration, Questions four to six in the first draft of the survey, Appendix C, were amalgamated into the table featured in question eight in this second iteration.

MOBILE PHONE USERS PILOT STUDY
USER PROFILE QUESTIONNAIRE

sticker

1. Name: ....

2. Age (tick the appropriate range)

0-9	☐	10-20	☐	21-30	☐	31-40	☐
41-50	☐	51-60	☐	61-70	☐	71+	☐

3a. Make and model of your mobile phone
.....

3b. How do you pay for your phone?

Contract ☐
Pay-as-you-Go ☐

4. How long have you had this mobile handset?

.....

5. Have you deliberately made it last longer by doing any of the following?
(Tick all appropriate boxes)

a. Bought protective cover / case ☐
b. Changed front / back fascia panels ☐
c. New battery ☐
d. Changed network ☐
e. New accessories (plug-in camera for e.g.) ☐
f. Other (please specify) ☐
.....
.....

6. Why did you extend the life of your phone?

.....
.....

7. How long do you think a mobile phone should last?

.....

8. Please fill in the table below to describe your activities when using your phone.
If your phone does not have the features to allow you to carry out the activity listed please tick N/A.

	N/A	Use all the time	Use every day	Use once or twice a week	Use in emergencies only	Use only when it's free	Never use (indicate why)	a) Don't know how to use	b) Don't want to use	c) Too expensive to use	d) Other	If 'd) other' please give your reason(s)
Making/receiving calls												
Sending/receiving text messages												
Taking photographs												
Watching/recording videos												
Listening to music												
Sending e-mails												
Chatting to people on msn												
Playing games												
Surfing the internet												
Using organiser features												

Please use examples where possible when answering the following 4 questions.

9. What do you consider to be socially responsible behaviour when using a mobile phone?

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10. What do you consider to be the NEGATIVE social impacts of using mobile phones?

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11. What do you consider to be environmentally responsible behaviour when using a mobile phone?

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12. What do you consider to be the NEGATIVE environmental impacts of using mobile phones?

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THANK YOU.

PLEASE BRING THIS QUESTIONNAIRE WITH YOU TO YOUR INTERVIEW.

Appendix E

Appendix E: Preliminary User Study B: Coded Sample Interview Transcript

MOBILE PHONE USERS PILOT STUDY
INTERVIEW TRANSCRIPT & QUESTIONNAIRE RESPONSE

Participant User_I-01 - 29th March 2005

What are the benefits of having a mobile phone?

I think the main benefit is convenience. When you are not at home and you are out and about you can still keep in touch with friends, your relatives and anyone else you need to call. There's a big social benefit to it. In terms of being able to call someone in an emergency **[SOC-EMER-POS]** it's a very useful thing to have. You don't need to go to a payphone and make your call. Your mobile is right there. So for me, those are the two biggest factors. Another thing is that it can make you feel a bit more secure **[SOC-SS]**. You know you've got your phone, even if you are not using it, you have it, your trusty mobile phone and it makes you feel better about going out and about, rather it makes me feel better about it because I've always got that capability to call someone even at short notice whenever I want to or whenever I have to.

What are the disadvantages?

Disadvantages? I guess a disadvantage is when you can become obsessed with the functionality of having a mobile phone **[SOC-CC-BEH]**, where you forget the idea of having a bit of discretion, especially in a public place. For example, if you've got the text 'beep' and it's sort of ten times loud it's like 'urgh!' turn it down **[SOC-CFO-LN-RING]** or change it to a buzz [vibrate] **[SOC-CFO-LN-VIB]** One of the downsides is not knowing the capabilities of your phone and it being a nuisance to people around you, if you know your phone can vibrate and you are in a public space then switch it on to vibrate if you are constantly using it and constantly texting someone so you don't disturb people around you **[SOC-CFO-LN-VIB].** People tend to forget that they are in a public place and they need to have discretion when they use their phone.

In what way do stories about the effects of using mobile phones affect how you use your phone?

I guess having flown and been asked by the pilots to switch off your phone because it may interfere with the on-board systems **[SOC-SS-INTERF-NO]** Because they are the ones saying it, and I haven't done any research into it, you tend to have a bit more faith in what they are saying in that regard. If it was just newspaper articles I probably would have it in my mind but it probably wouldn't affect me. I probably wouldn't think as much about it unless I guess I was living near a mast because they you think gosh, you know, the things you see in the paper blardy blah....but I think information like that should be in a more scientific or official format disseminated not just in newspapers, so it gives it more credibility **[SOC-HEA-TRUST] [SOC-HEA-RES]** Yes you are mindful of them [health related stories] but if I am on the phone to somebody for two hours it doesn't tend to worry me **[SOC-HEA]**

What do you consider appropriate mobile phone etiquette?

I think if you are in a public place like a bus or a train or restaurant, discretion is an important part of mobile phone etiquette **[SOC-CFO-HEAR-NO]** and being mindful that your voice does carry **[SOC-CFO-HEAR-NO]** People tend to raise their voices when they are talking on a mobile phone. So be mindful of people around you and keep your voice down **[SOC-CFO-LN-VV]**. Plus having the 'beeping' noises quite low **[SOC-CFO-LN-RING]** turned down low or on vibrate **[SOC-CFO-LN-VIB]** so that they are not a nuisance to people around you. I think it is the noise, someone who is constantly tapping away on their phone is no problem for me, it's the noises that the phone produces are too loud, or too often. Yes, too loud or too frequent and when the voice carries people don't realise that people can hear.

When or where do you feel the need to switch off your phone or put on silent?

When I am out and I have my phone in my pocket, when I am in a public place I find it's less likely that I'll hear my mobile phone beeping but I feel it vibrating. It's more for me, but also I don't want to feel that I am being a nuisance to people around me. So it's for my benefit as well as everyone else's. I'll switch it off obviously at work, when I'm in a place where they are saying [please switch off your phone] **[SOC-CFO-SIGN]** because mobile phones do carry or transmit, say if you've got your mobile phone near a computer it does have the ability to transmit information [from the computer]. Having it switched off is a courtesy. It's about my feeling that I can be discrete and that other people aren't annoyed.

What do you consider to be the positive social issues of mobile phone use?

I think it's probably allowed people to stay in contact; it's generated a different kind of communication, a different kind of social contact. The benefits of that are that people are able to communicate on a mobile basis, a fast moving basis in a fast moving culture **[SOC-CC-FLUID]** It's made communicating a lot easier generally. Also it's made people feel more secure in a lot of ways; it's easier for them to keep in touch with their families.

What do you consider to be the positive environmental issues of mobile phone use?

Probably not directly.....indirectly perhaps? **[indirectly in what way?]** This might sound a bit silly .....but I think the use of a mobile phone in order to improve awareness or action to address particular environmental issues...but directly I can't think of any.

What do you consider to be the negative social issues of mobile phone use?

I guess it has made it easier for people NOT to talk to each other in some ways **[SOC-CC-RSS]** I think that technological aspects have a negative impact on the use of mobile phones. For example a man goes into a mobile phone shop and complains quite forcefully that his mobile phone is not working, and all that the problem was that the phone, which can operate on different international networks, was trying to operate on a network that is not available in this country. Those technological advances make people either afraid to find out more about them [the features] because it might mean that they are not as knowledgeable as they think they are or it makes people complacent, thinking that the phone will look after or take care of everything and they won't have to worry about it. Technology effaces the 'how' it [the mobile phone] was created and the 'why' all people realise, or know, or want to know is that they can use it, [i.e.] they have the phone and they can use it. It's got to the point where we don't need to know 'how' it works just that it does and that's negative.

What do you consider to be the negative environmental issues of mobile phone use?

Probably noise pollution I guess and obviously the disposal. What do you do when you move on to the next mobile phone? A lot of the materials that are used I don't know if they are recycled or if they get recycled. When the phones are disposed of its how they are disposed of what happens to all the materials? Do they get reused? That is an issue **[ENV-EOL-WASTE]** Are you talking solely about use?

Can you give any examples of changes you could make to your behaviour to mitigate or reduce any negative social or environmental impacts?

[re: disposal] To not see that there is a need to upgrade **[ENV-CU-NO]**. Although in a lot of ways there is a requirement, as your relationship with your phone develops and changes you will want to upgrade. But I think for the user it's about being aware of the need to send back the phone to the suppliers I guess. But I guess being more thoughtful in which phone you choose, choose a phone that incorporates technological changes that may be introduced in the future rather than a phone where conceivably they have only produced it to last a couple of years. **[ENV-KEEP]** If there were ones which had a life that was a lot longer and it could incorporate changes or functions that would make the phone last even longer. So that phase when you're choosing your mobile phone, that's something I could maybe look at.

[re: noise] For me personally, I think I am discrete when I am using my phone, I put it on vibrate phone when I am out, I cause as little noise as possible. I think I already do that.

For example what I mentioned before about people not wanting to keep up with technological advances or afraid to keep up with technological advances whether they simply trust their phone you know they don't need to worry about how their phone works. I think one of the things I can do is to find out more about what the phone can do.

In what way could the phone be changed to mitigate or reduce any negative social or environmental impacts?

I think the phone could be changed by probably ... giving the user the ability to upgrade some of the functions of the phone not just the model because then all you would be upgrading is software **[SOC-CC-CU]** That's one example. Then obviously the information that's provided with your phone - I guess producing it in a way that would actually make people want to read it so that it makes people aware. From the side of the manufacturer; to give people as much information in a way that they feel comfortable digesting. **[so what you are saying is that manufacturers should take note of what people are saying are the negative impacts of use and then provide information that allows people to make those changes?]** Yes. To become aware that there are these aspects of the phone that they are able to change, that the individual feels empowered to change. Like settings, even information such as, not to be patronising but even information about noise pollution – to say "how considerate are you? Or how aware are you of the loudness of your settings?" especially in public places. **[giving people clues on acceptable behaviour?]** Yes, not dictating and at the same time not just putting the information there because it is required by law or regulation. But helping people to think about what they are doing and maybe encourage them to act in a more responsible way.

Can I just ask one more question? In terms of the user's behaviour when using the mobile phone, do you the think the impacts arising from mobile phone use are the responsibility of the user or do you think it is the manufacturers responsibility to design the phones so that they can only be used in a positive social and environmental way?

I think both parties share that responsibility. If users are aware of the social and environmental impacts of their phone then they have the information to use to press for change in companies marketing their campaigns and how they gather data. If people are more aware of these impacts of their phone use then they will be able to say "we want this type of phone, we want you to consider this when manufacturing your phone, we want this kind of information provided" and at the same time the manufacturers should have a obligation to provide that information. Obviously they should be aware that it might affect their sales. They should be required to provide information on the phone that they provide. There should be a requirement for them to manufacture their phones in a way that steers the user to behave in an environmentally responsible way and a socially responsible way. So I think there's a bit of both.

Appendix F

Appendix F: Main User Study: NCC Cover Letter & Questionnaire

Loughborough University

Dept. Design and Technology,
Loughborough University,
Loughborough,
Leicestershire,
LE11 3TU

Email: d.lilley@lboro.ac.uk
Work mobile: 07748 652879

Dear Consumer Network Member,

I am a PhD student in the Department of Design and Technology at Loughborough University. I am currently carrying out consumer research investigating people's perceptions of environmental and social issues related to mobile phone use. The National Consumer Council has kindly allowed me to invite Consumer Network members to be part of this research.

Enclosed is a short questionnaire; if you use a mobile phone it would be most helpful if you could complete the questionnaire and **return it to Loughborough University by the 30th September** in the postage paid envelope provided.

Many thanks,

D Lilley

Miss Debra Lilley

NATIONAL CONSUMER COUNCIL
MOBILE PHONE USERS STUDY
QUESTIONNAIRE

1. Name:

.....

2. Age (tick the appropriate range)

0-9	☐	10-20	☐	21-30	☐	31-40	☐
41-50	☐	51-60	☐	61-70	☐	71+	☐

3a. Make and model of your mobile phone:

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3b. How do you pay for your phone?

Contract ☐
Pay-as-you-Go ☐

4. How long have you had this mobile phone handset?

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5. Have you done any of the following?

a. Bought protective covers for your phone ☐
If so why?

b. Changed front / back fascia panels ☐
If so why?

c. Bought a new battery for your phone ☐
If so why?

d. Changed network but kept the phone ☐
If so why?

e. Added new accessories to your phone ☐
If so why?

f. Other (please specify) ☐
Why?

6. How long do you think a mobile phone should last?

.....

7. Please fill in the table below to illustrate how you use your phone.

	a) All the time	b) Every day	c) Once or twice a week	d) Occasionally	e) In emergencies only	f) Only when it's free	g) Never (indicate why)	i) Haven't got this feature	ii) Don't know how	iii) Don't want to	iiii) Too expensive
Making calls											
Receiving calls											
Sending text messages											
Receiving text messages											
Taking photographs											
Watching/recording videos											
Listening to music											
Sending e-mails											
Chatting to people on msn											
Playing games											
Surfing the internet											
Using organiser features											
Other? (please specify)											

Please use examples where possible when answering the following 4 questions.

9. What do you consider to be socially responsible behaviour when using a mobile phone?

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10. What do you consider to be the NEGATIVE social impacts of using mobile phones?

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11. What do you consider to be environmentally responsible behaviour when using a mobile phone?

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12. What do you consider to be the NEGATIVE environmental impacts of using mobile phones?

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THANK YOU.

PLEASE RETURN THIS QUESTIONNAIRE IN THE ENVELOPE PROVIDED.

I may wish to contact you by phone to talk to you in more detail about some of your answers:

☐ I WOULD BE HAPPY to take part. I can be contacted on the following telephone number:

.....

....

I would prefer to be contacted:

MON	TUES	WEDS	THURS	FRI	SAT	SUN	AM	PM

☐ I DO NOT wish to take part in any further research.

Please be advised that the results of the questionnaire and interviews will be reported on as part of my research and may be published; all respondents will of course remain anonymous.

Appendix G

Appendix G: Main User Study: Full Coding of Responses to NCC Questionnaire

The following table displays the collated and coded responses of all 129 participants' responses to the discussion-based questions (Questions 9-12) in the Main User Study: NCC Questionnaire, as seen in Appendix F.

Social Issues Identified		Environmental Issues Identified	
EMERGENCIES	SOC-EMER	ENERGY USE	ENV-EN
Use in emergencies	SOC-EMER-POS	Save battery energy	ENV-EN-BAT
Relying on a mobile phone in an emergency if: low credit, flat battery, no signal	SOC-EMER-NEG	Charge only when necessary	ENV-EN-CHAR
Contacting family	SOC-EMER-FAM	Turn off if not in use	ENV-EN-OFF
Reporting accidents	SOC-EMER-REP	Links to increased CO2 and climate change	ENV-EN-CLIM
Getting help if you need it in an emergency	SOC-EMER-HELP	END OF LIFE	ENV-EOL
CRIME	SOC-CRI	Recycle old handset	ENV-EOL-REC
Reporting crime (theft)	SOC-CRI-REP	Recycle old handset by donating it to charity	ENV-EOL-REC-CHAR
Becoming victim of crime including mobile phone theft	SOC-CRI-VIC	Recycle old handset by donating it to charity operating in developing country	ENV-EOL-REC-DEV
Network trace & tracking lost people	SOC-CRI-TRACE	Lack of recycling schemes available/More required	ENV-EOL-REC-LACK
Tool for bullying	SOC-CRI-BUL	Updating the phone rather than disposing	ENV-EOL-UPDATE
Facilitation of organised crime (especially with Pay-as-you-go phones)	SOC-CRI-ORG	Reuse handset by passing it to others	ENV-EOL-REUSE
Facilitation of terrorist activity	SOC-CRI-TERR	Safe, sensible, responsible, appropriate disposal of battery and phone	ENV-EOL-SAFE
ESSENTIAL USE	SOC-ESS	Waste of materials	ENV-EOL-WASTE
Not to overuse	SOC-ESS-OVER-NO	Hazardous/ non-recyclable/ renewable materials used and disposed of	ENV-EOL-MAT
Use for limited duration (including minimum)	SOC-ESS-LIMIT	MASTS	ENV-MAST
Use only when "mobile"	SOC-ESS-MOB	Cause a "blot on the landscape"	ENV-MAST-BLOT
Use only when landline not available	SOC-ESS-LAND-NO	New phone production - resource use	ENV-CU-NEW
Keep the phone a reasonable time if it continues to meet your needs	SOC-ESS-KEEP	ESSENTIAL USE	ENV-ESS
CONSIDERATION FOR OTHERS	SOC-CFO	Not constantly upgrading	ENV-CU-NO
Speaking quietly	SOC-CFO-QUI	Keep phone reasonable time (extending life)	ENV-KEEP
Not talking while in confined spaces	SOC-CFO-CONF-NO	New phone production - resource use	ENV-CU-NEW
Not being overheard (including being discreet)	SOC-CFO-HEAR-NO		

Appropriate content of conversation (& downloads)	SOC-CFO-APP-CONT		
Peacocks who enjoy having an "audience" (-)	SOC-CFO-AUD		
Priority – real conversation versus virtual interaction	SOC-CFO-PRI		
Phoning to change arrangements/inform of delays	SOC-CFO-PLA		
Movement or positioning of body – cupping hand over mouthpiece, stepping away from others	SOC-CFO-MOV		
Accidents due to lack of attention (personal safety)	SOC-CFO-ATT		
Taking photographs with consent only	SOC-CFO-CONS		
Switching off in public places (quiet, crowded, sacred)	SOC-CFO-OFF		
Obeying signs	SOC-CFO-SIGN		
LIMIT NOISE	SOC-CFO-LN		
Vibration not ring tone	SOC-CFO-LN-VIB		
Considerate ring tone level & type	SOC-CFO-LN-RING		
Appropriate voice volume level	SOC-CFO-LN-VV		
SAFETY & SECURITY	SOC-SS		
When alone at night	SOC-SS-ALO		
When going on long journeys	SOC-SS-LJ		
Call screening functions	SOC-SS-CS		
Security of information (particularly hackers)	SOC-SS-HACK		
When the car has broken down	SOC-SS-CAR		
Not interfering with equipment e.g. on planes, in hospitals	SOC-SS-INTERF-NO		
Not when driving at all	SOC-SS-DRIV-NO		
Not when driving unless using a hands-free kit	SOC-SS-DRIV-HF		
USE BY CHILDREN	SOC-CU		
Safety - positive	SOC-CU-POS		
Safety - negative	SOC-CU-NEG		
Limiting or preventing children's use of mobile phones	SOC-CU-LIMIT		
Links to poor concentration in children	SOC-CU-CONC		
Parents being able to keep track of their kids (+)	SOC-CU-TRACK-POS		
Parent paranoia (-)	SOC-CU-TRACK-NEG		
Should there be an age limit on child use?	SOC-CU-AGE		

CHANGES IN CULTURE	SOC-CC		
Instantaneous interaction (+)	SOC-CC-INST-POS		
Instantaneous interaction (-)	SOC-CC-INST-NEG		
Fluid and flexible nature of interactions	SOC-CC-FLUID		
Virtual reality versus present time	SOC-CC-REAL		
Reduced social skills (-), Face-to-face communication (-), Reduced skills in forward planning (-), Demise of letter writing (-), Reduced quality of interactions (-)	SOC-CC-RSS		
Fewer phone boxes due to decreased use	SOC-CC-BOX		
24/7 contact expected resulting in loss of quiet time	SOC-CC-24/7		
Changes in behaviour: self isolation, obsessive psychological need to be near the phone	SOC-CC-BEH		
CONSTANT UPGRADING	SOC-CC-CU		
Upgrading driven by advertising	SOC-CC-CU-ADV		
Phones becoming a fashion item	SOC-CC-CU-FASH		
Obsolescence (-)	SOC-CC-CU-OBS		
TEXT MESSAGING	SOC-CC-TEXT		
Abbreviations	SOC-CC-TEXT-ABB		
Detrimental effect on spelling & grammar	SOC-CC-TEXT-MIS		
HEALTH	SOC-HEA		
Taking precautionary measures	SOC-HEA-PREC		
Research unclear or more research needed	SOC-HEA-RES		
Lack of trust in information provided	SOC-HEA-TRUST		
Limiting duration of use due to health concerns	SOC-HEA-LIMIT		
MASTS	SOC-MAST		
Link to health concerns	SOC-MAST-HEA		
Should not be sited next to schools	SOC-MAST-SITE-SCH		
Should not be sited in residential areas	SOC-MAST-SITE-RES		
Need for mast linked to increased customer demand for /expectation of coverage	SOC-MAST-DEM		

Appendix H

Appendix H: Main Design Study: MSc Design Brief

05DTP880 SUSTAINABILITY & DESIGN
DESIGNING BEHAVIOURAL CHANGE

Background Context

Sustainable design takes account of the social, environmental and economic impacts of product design. The use phase of the product life cycle can often be neglected by designers. The role of the designer is evolving; designers need to take account of the social and environmental consequences of how the products they design are used.

'Mobile' phones have by their very design removed the private / public boundaries imposed by their predecessor, e.g. the fixed land line, and enabled unrestricted 'personal communication' in 'public space' The physical environment has been reshaped to address problems caused by mobile phone use by restricting use activities e.g. quiet carriage on a train, 'mobile phone free zones' and signage – yet these are consistently ignored by some. The obligation is placed on the user to moderate their behaviour and use their phone appropriately. Users who are conscious of the private nature of their interactions use gestures, movement and architecture to create temporary intimate zones. The impact of unrestricted use in public space has yet to be addressed in the design of the mobile phone. Can products address social issues by reprogramming the user? Current approaches include;

- Eco-feedback - providing information to users to encourage pro-environmental behaviour,
- Behaviour steering - products that guide the behaviour of the user through the inscription of; constraints which place limitations on what actions can be performed and affordances which inform the user how the product could be used.
- Intelligent products - products which mitigate, control or block inappropriate user behaviour automatically.

The Brief

Your challenge is to redesign a mobile phone to address one or more of the social issues identified in your research using one of the approaches described in the lecture.

Task 1: Research & Development (20%) – *Working in groups of two or three*

- Observe *and record in your logbook* - using images, photos and words – how people use mobile phones in public places.
- Discuss in groups what you think the social consequences of this behaviour are - record your thoughts in your logbooks.

Task 2 - (50%) Re-Design – *As an individual*

- Select one of the approaches from the lecture (i.e. eco-feedback, behaviour steering or intelligent products) – explain why you choose this approach.
- Using this approach sketch product-led design ideas that would change users behaviour through the design of the product and address the social impact of mobile phone use in public space.
- Choose and detail one final concept.

Task 3 – (30%) presentation – *As an individual*

- Choose one final concept and prepare a 15 minute PowerPoint presentation detailing your idea - *clearly describe how your design would change the user's behaviour.*

Assessment Criteria

05DTP880
Sustainability & Design

Name:

Task 1 – R&D (20%)

- Produced quality user centred research on mobile phone use
- Related observed user behaviour to wider social impacts

/20

Task 2 - (50%) Re-Design

- Applied results of research to product designs generated
- Demonstrated good understanding of design-led intervention approach chosen
- Applied this understanding in product design ideas
- Demonstrated iterative designing process
- Produced quality design output

/50

Task 3 – (30%) Presentation

- Demonstrated development of concept
- Clearly articulated in presentation how this concept addresses social issue(s) identified
- Explained design solution clearly both visually and verbally in presentation
- Delivered high quality presentation
- Able to discuss design ideas with others and respond to questions asked

/30

TOTAL MARK /100

Appendix I

Appendix I: Agenda & Delegates List for Sustainability: A Need to Think Differently: 11th SDN Seminar

AGENDA

'Sustainability: A need to think differently'

11th Sustainable Design Network Seminar,

Keith Green Building, EngCETL, Loughborough University, Tuesday 5th June 2007

10.00 – 10.20	Welcome, Coffee, Networking
10.20 – 10.30	Introduction to the day, Vicky Lofthouse, Co-ordinator of the Sustainable Design Network, Loughborough University
10.30 – 12.45	Design Dialogues presentation and workshop, Margarida Monteiro de Barros & Emma Dewberry, Department of Design and Technology, Loughborough University
12.45 – 1.45	Lunch & networking
1.45 – 2.00	**Thinking differently: a short film**
2.00 – 2.30	'Time for a Change. Closing the loop - a design strategy for long term sustainability', Steve Kelsey, Pi3
2.30 – 3.00	'Whole Systems Thinking: The Design of more Sustainable Solutions', Fiona Coley, Cranfield University
3.00 – 3.30	'Intersections between design and sustainability' Andrea Koerselman, IDEO
3.30 – 4.00	'An Investigation into user response to Sustainable issues in Fashion/Textiles and Affective Computing', Joan Farrer, School of Fashion and Textiles, Royal College of Art
4.00 – 4.15	Networking & Close

DELEGATES

'Sustainability: A need to think differently'

11th Sustainable Design Network Seminar,

Keith Green Building, EngCETL, Loughborough University, Tuesday 5th June 2007

Andrea Koerselman	IDEO	andreak@ideo.com
Andrew Jenkins	The Boots Company	Andrew.Jenkins@bcm-ltd.co.uk
Annabel Bradbury	Manchester Metropolitan University	annabel.bradbury@student.mmu.ac.uk
Brian Griffiths	Brunel University	brian.griffiths@brunel.ac.uk
Cay Green	University College of the Creative Arts, Farnham	caygreen@googlemail.com
Edward Elias	University of Bath	ewaelias@googlemail.com
Emma Dewberry	Loughborough University	e.l.dewberry@lboro.ac.uk
Fiona Coley	Cranfield University	f.j.s.coley@cranfield.ac.uk
Joan Farrer	Royal College of Art	joan.farrer@rca.ac.uk
Kate Goldsworthy	Chelsea College or Art & Design	ted@chelsea.arts.ac.uk
Margarida Monteiro de Barros	Loughborough University	m.monteiro-de-barros@lboro.ac.uk
Marianne Guldbrandsen	Loughborough University	m.n.guldbrandsen@lboro.ac.uk
Mark Smith	University of Central England Birmingham	Mark.Smith@uce.ac.uk
Matthew Simon	Sheffield Hallam University	m.simon@shu.ac.uk
Matthew Willox	Sheffield Hallam University	mattwillox@gmail.com
Neil Hart	Staffordshire University	n.a.hart@staffs.ac.uk
Nicholas Hobbs	Nicholas Hobbs Furniture	nicholashobbs@beeb.net
Philip Davies	Aston University	p.a.davies@aston.ac.uk
Rhoda Trimingham	Loughborough University	r.l.trimingham@lboro.ac.uk
Ricardo Victoria Uribe	Loughborough University	r.victoria-uribe@lboro.ac.uk
Sabine Hielscher	Sheffield Hallam University	sabineh10@hotmail.com
Shilpa Dani	Loughborough University	shilpasdani@yahoo.com
Steve Kelsey	Pi3	s.kelsey@pi3innovation.com
Tang Tang	Loughborough University	t.tang@lboro.ac.uk
Yoram Krozer	Cartesius Institute	krozer@xs4all.nl

Appendix J

Appendix J: Short Film Evaluation: Questionnaire

THANK YOU FOR YOUR TIME.

The results of this study will form part of a doctoral research project in the Department of Design &Technology, Loughborough University.

EVALUATION QUESTIONNAIRE

- What do you think this film is about?

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- What issues can be identified from the way in which the user is behaving?

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- Which of the following additions could improve the impact of this film? (please tick **all** that apply)
  - Interviews with users/non-users about how they/others use mobile phones in public, ❑
  - Narrative (voice-over) describing user actions and resulting social impacts, ❑
  - Designer's narrative (voice-over) of product design issues relating to user actions, ❑
  - Other (please describe) ❑

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- Could "issue based" films like this one aid the design process?
  If yes, how? and at what stage in the design process could they be used?

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- Which delivery mechanism would be most useful?
  - DVD, ❑
  - Downloadable from a website, ❑
  - Playable on a website, ❑
  - Other (please describe) ❑

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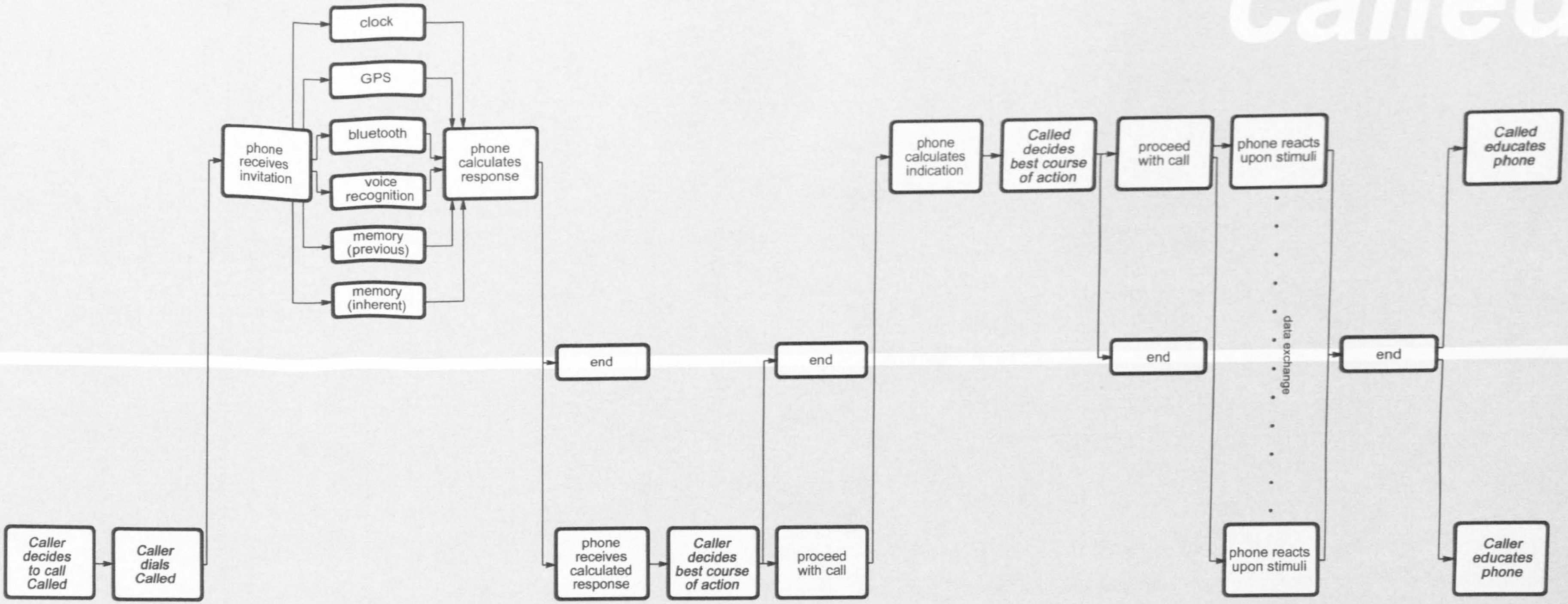
Appendix K

Appendix K: Collaborative Design Project: Presentation Boards



The *Caller* initiates the call with no knowledge as to the *Calleds* circumstance.

The *Calleds* phone receives the invitation and based upon the following criteria replies with an automated response as to the *Calleds* circumstance.

Clock: time of day/night.

GPS: current location, transit or stationary.

Bluetooth: number of members within 10m radius.

Voice Recognition: other physical conversation states.

Memory(Previous): past experiences and 'education'.

Memory(Inherent): current state.

With unbiased knowledge of the *Calleds* circumstance received, the *Caller* decides upon the appropriateness of the conversation.

To cancel the invitation, the phone is motioned to suggest putting the phone down.

To continue the invitation, the phone remains raised with pressure applied to the phones body to define the importance of the call. The pressure translates to the speed of indication the phone selects to inform the *Called* as to this invitation. The *Caller* receives audible feedback that relates to the pressure/speed.

A method of indicating to the *Called* that the *Caller* wishes to invite them to a conversation is selected. This is defined by the *Calleds* circumstance and the *Callers* defined call importance.

The method of indication comprises of colour, light, movement and sound. Function based.

The *Called* may proceed with the invitation by motioning the phone to the ear, or cancel by motioning to put the phone down.

The phone reacts emotionally during conversation based upon volume of voice, duration of conversation and number of physical others.

The scale of intervention is Passive, Assertive and Aggressive, with the starting point determined by *Calleds* circumstance and *Callers* call importance. This also contributes towards 'memory (previous)' for following phone use.

The method of indication comprises of colour, light, movement and sound. Emotion based.

Once the conversation is complete the *Called* and the *Caller* may elect to educate their phones.

The education of the phone contributes towards 'memory (previous)' for following phone use, creating a symbiotic profile with the user.

The phone is educated by positively stroking or negatively tapping the top of the phone.

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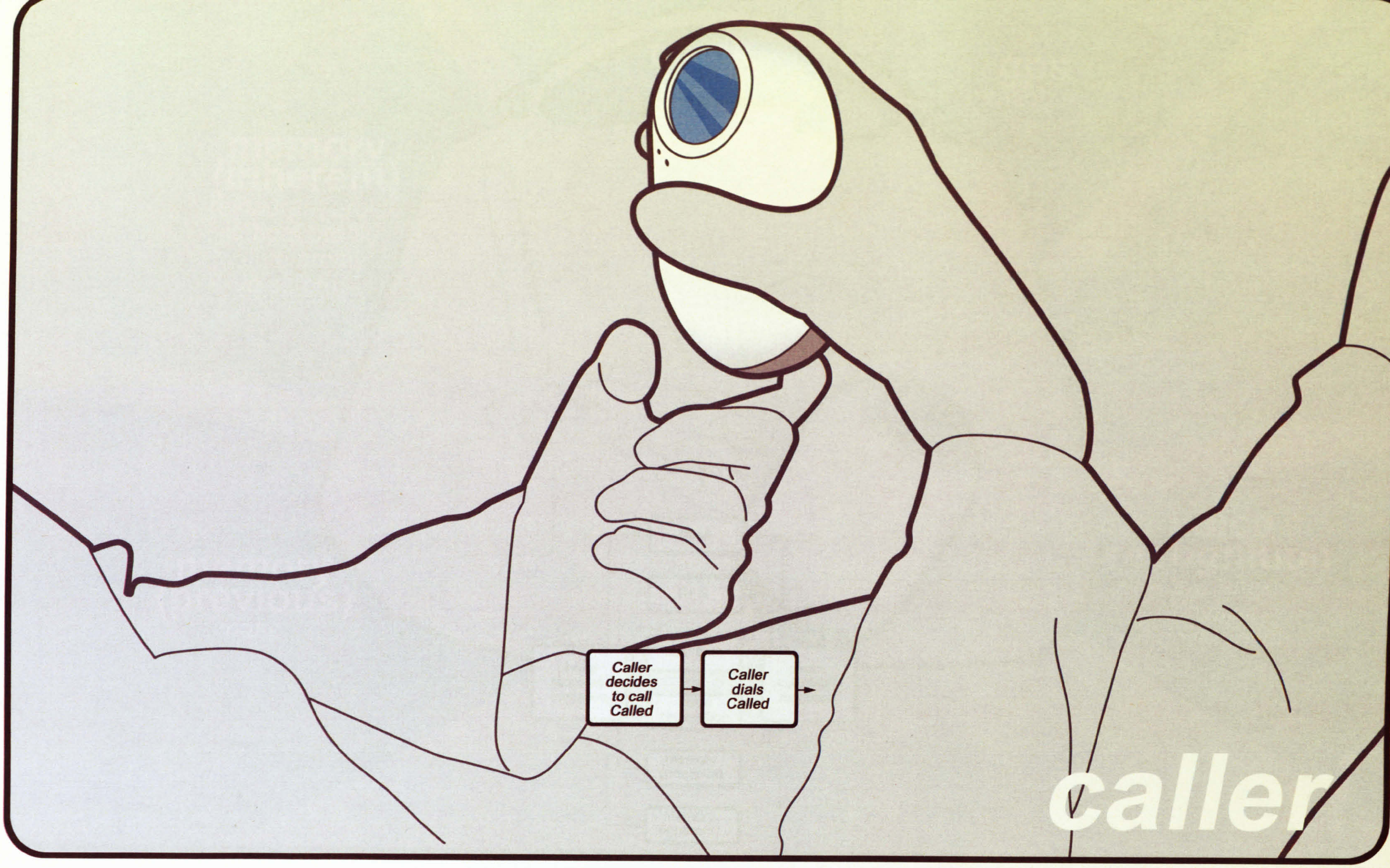

Using the tactile pressure sensitive control membrane of the phone the *Caller* dials the *Called*.

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clock
1pm

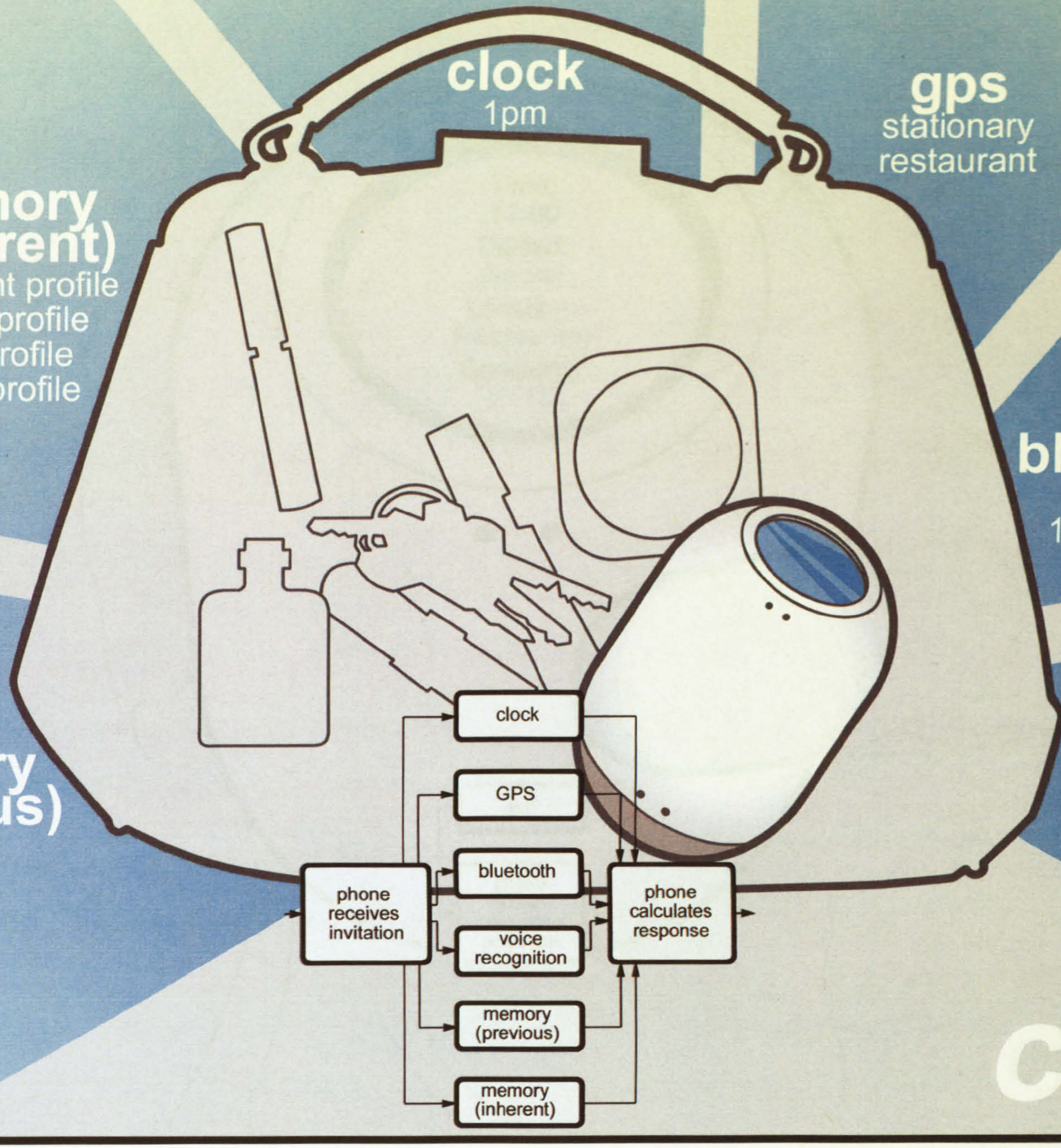
gps
stationary
restaurant

memory (inherent)
restaurant profile
others profile
time profile
voice profile

bluetooth
2 known +
18 unknown

voice recognition
owner in
physical
conversation

memory (previous)
none



called

Unknown to the *Called*, the phone automatically processes their environment and circumstance. The *Calleds* phone has never been communicated with by the *Callers* phone previously, or experienced use and consequentially 'education' in a similar environment. The phone therefore, must base its decisions on the inherent memory profiles, assigned to the phone from a central network.

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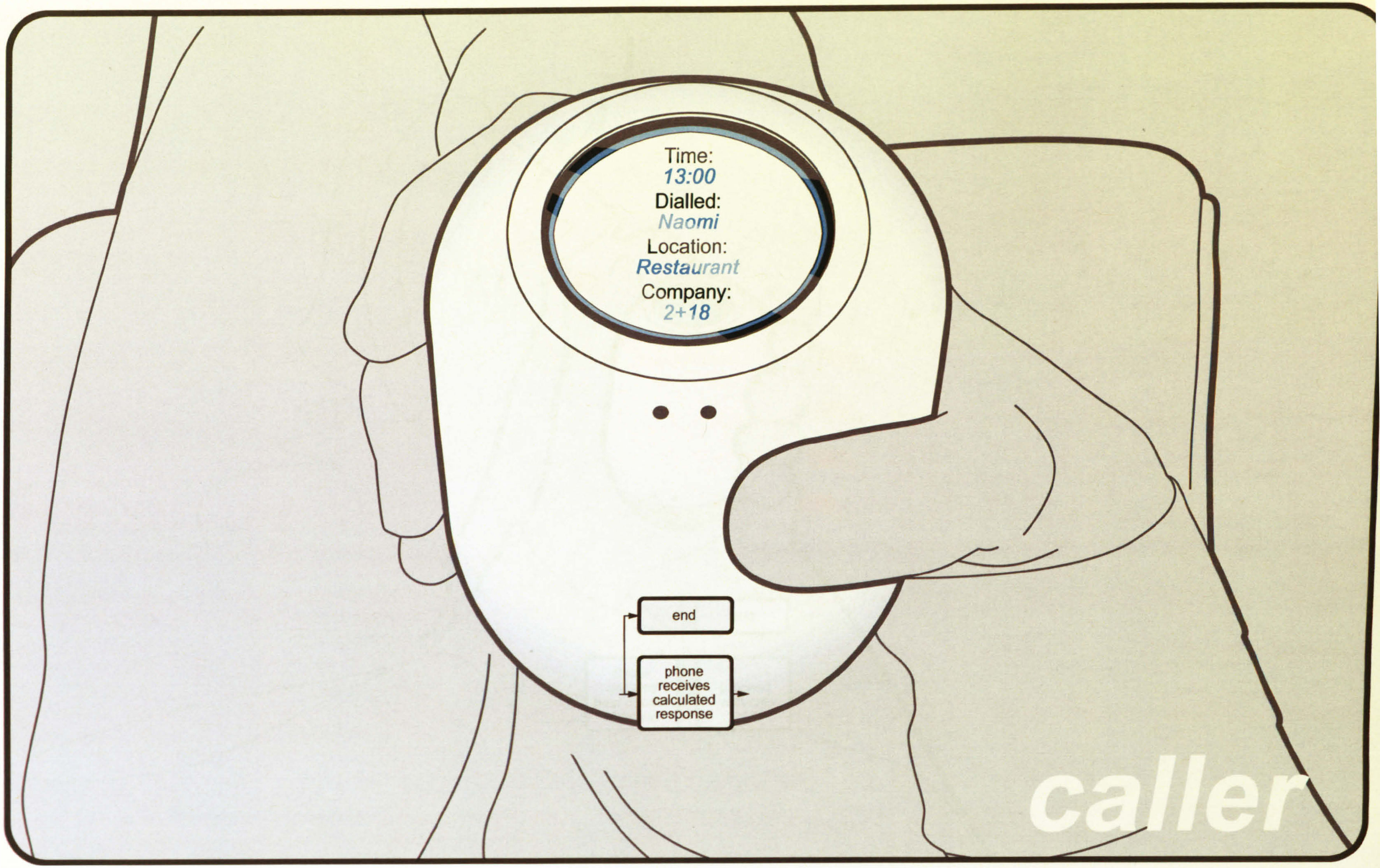

The automated response delivered to the *Callers* phone from the *Calleds* phone, contains the necessary information to allow the *Caller* to make an informed decision as to the social appropriateness of their potential actions. The information is clear and unbiased.

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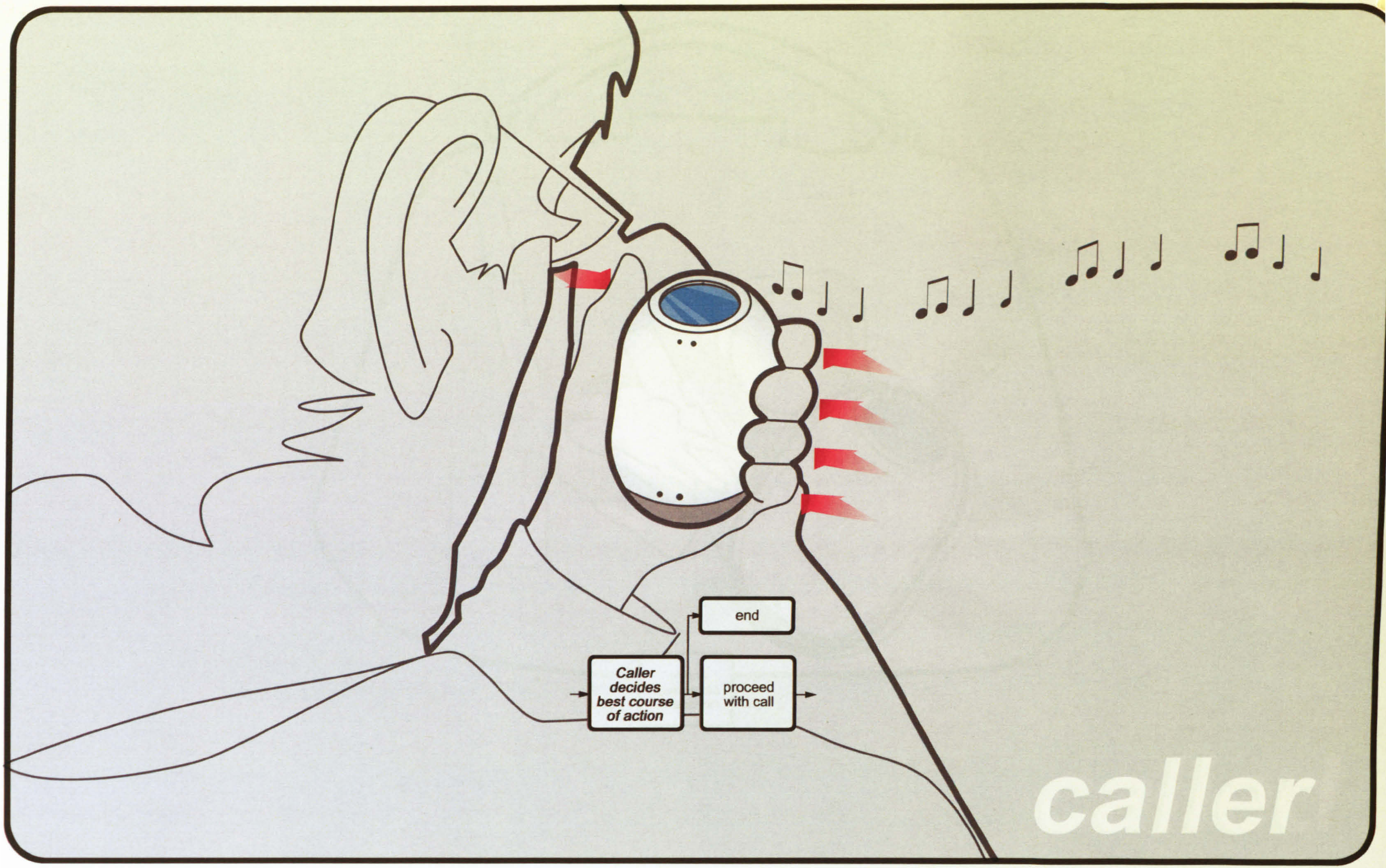

Call urgency is determined by selecting the speed at which the *Calleds* phone will perform its method of indication. The *Caller* achieves this by squeezing the body of the phone, with the pressure audibly relating to the speed. The information gathered at the start of the invitation combined with call urgency, creates an appropriate phone response profile should the *Caller* wish to continue in inviting the *Called* into conversation.

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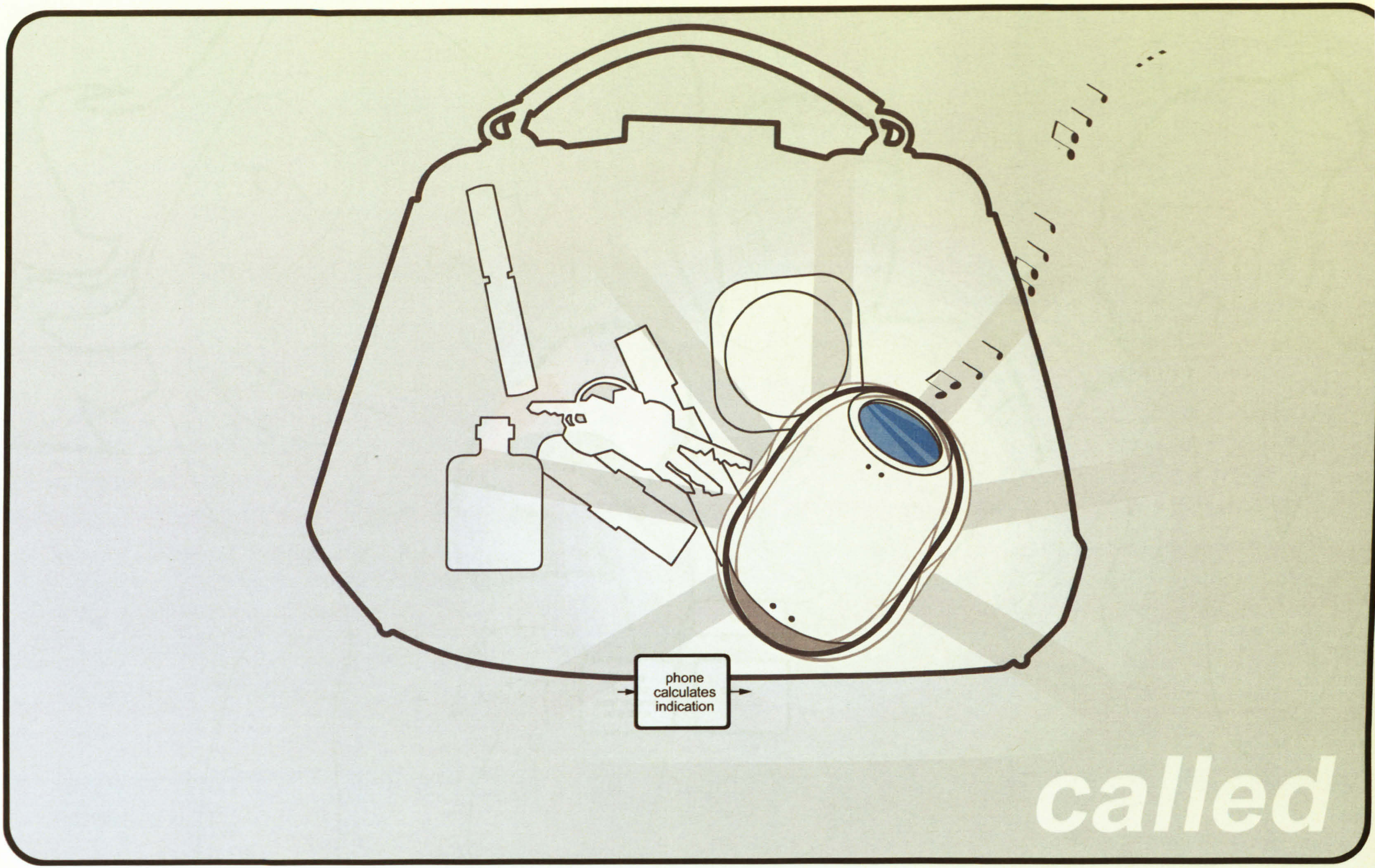

The best method of call indication is based upon the *Callers* determined level of urgency and the *Calleds* environment. The phone exhibits: slow high power vibration, slow flashing dull light, and a slow quiet ringtone. The slowness of the delivery was determined by the *Caller*, who deemed the call as being of low importance. The high power vibration, dull light and quiet ringtone are to create minimum disturbance to the environment whilst trying to catch the *Calleds* attention. Initially, the ringtone is silent as the *Called* is talking. Once the physical conversation has paused the phone will attempt its interruption.

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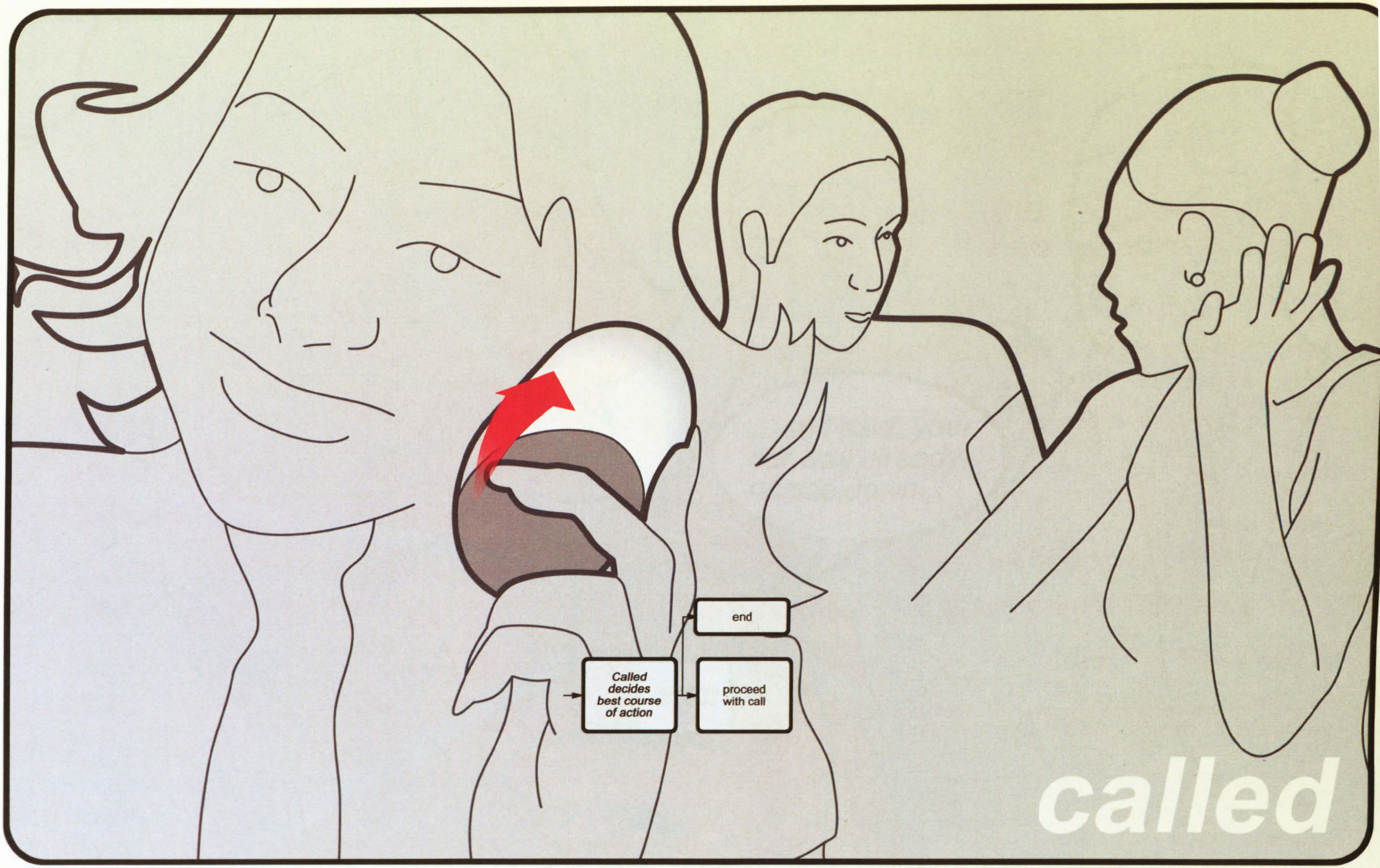

The *Called* is now in the position of deciding whether to answer the phone or not. The decision is guided by the *Called* being informed of the *Callers* urgency decision, with knowledge of the *Calleds* circumstance. By informing the *Called* as to the *Callers* urgency and reducing the uncertainty of the calls content, the immediate need to answer a ringing phone is diminished. To answer the phone, the phone is motioned to the ear. To cancel the call, the phone is motioned downwards.

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... so I said, your car was already upside down...

phone reacts upon stimuli

called

Based upon the *Calleds* extreme anti-social use of the phone when with Physical Others, the phone exhibits Aggressive behaviour. The phone reacts as if embarrassed to the situation, and emits a frenetic bright red light, the intention being to reprimand the *Called* and *Caller* for socially unacceptable behaviour. The light acts as a method of reinforcing to the *Called* their circumstance, and also as a method to artificially apply a stigmatic level of embarrassment on to the users.

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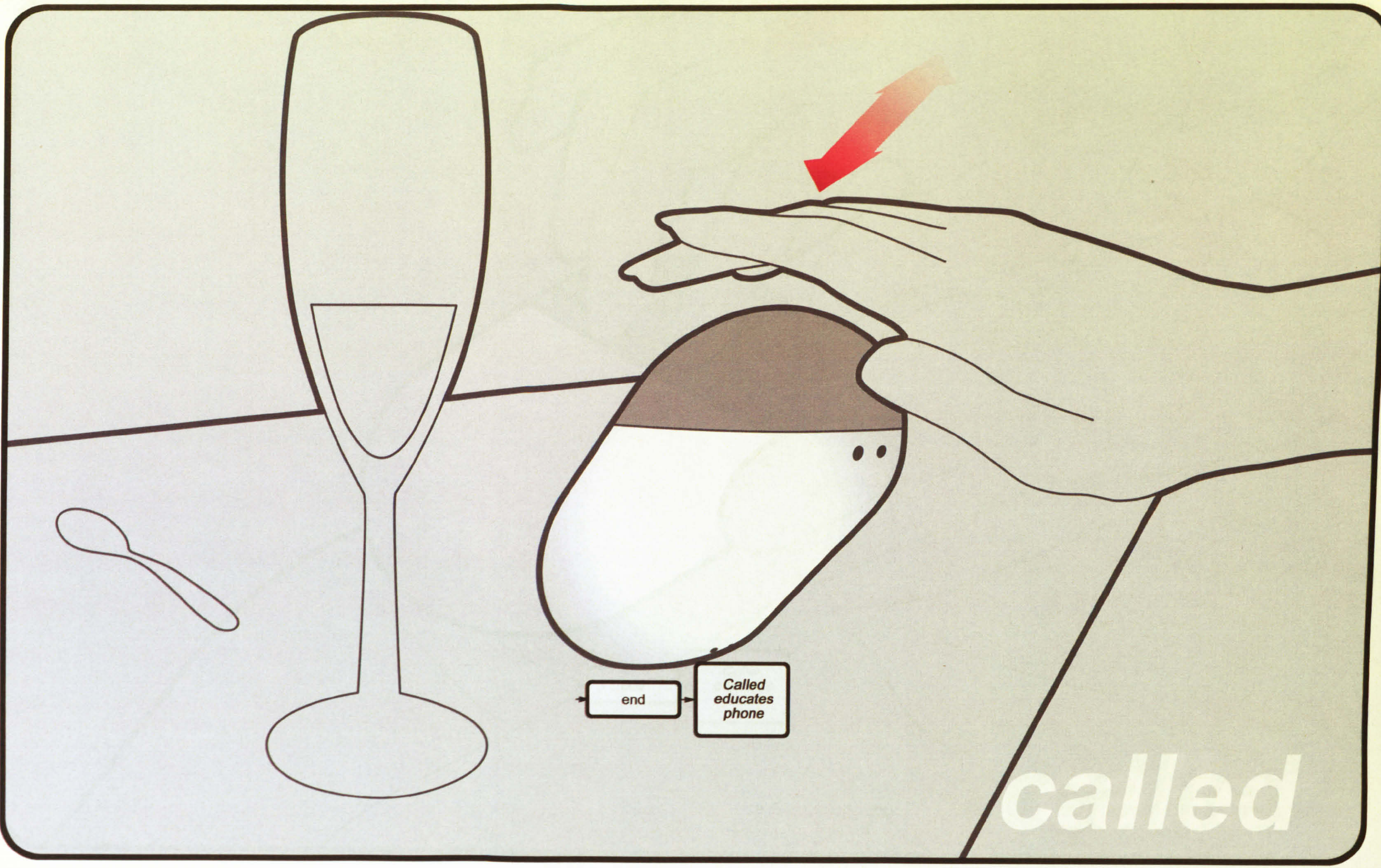

With the call over, the *Called* can 'educate' the phone. As the *Called* in this scenario was quite embarrassed at the phones reactions during conversation and the relative ease in which it allowed the conversation to take place, the *Called* decides to punish the phone. By tapping the tactile control membrane after use, the phone recognises the *Calleds* anguish. The phone may use this new knowledge in the form of Memory(Previous) during the next invitation, to react in a manner which may help prevent a similar embarrassment.

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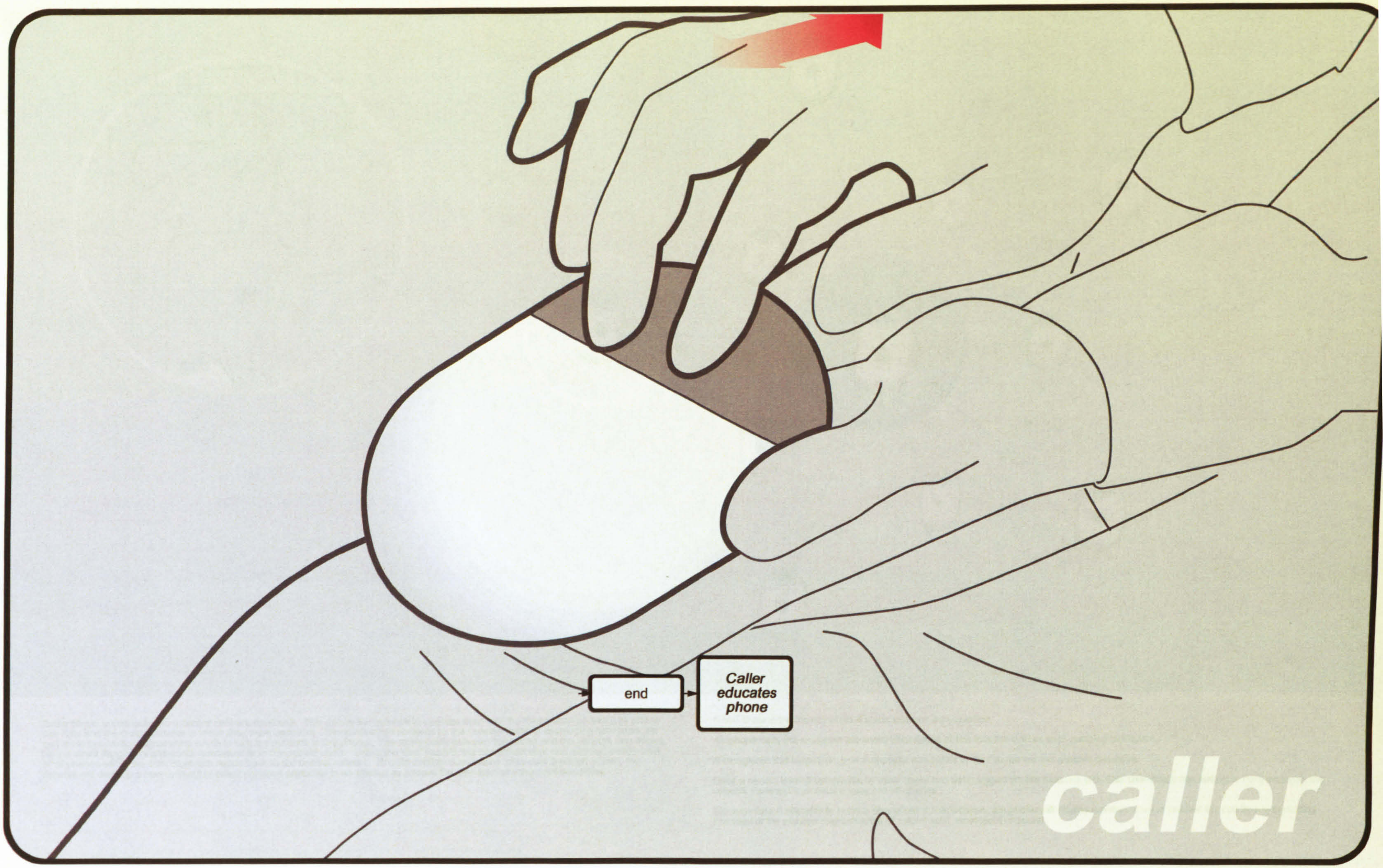

The *Caller* may also wish to 'educate' their phone. As the call was accepted and answered at a reasonable rate, the *Caller* wishes to thank their phone with a smooth stroke over the pressure sensitive control surface. The phone will remember this interaction as the form of Memory(Previous) during the next invitation, and will attempt to replicate its pleasing behaviour.

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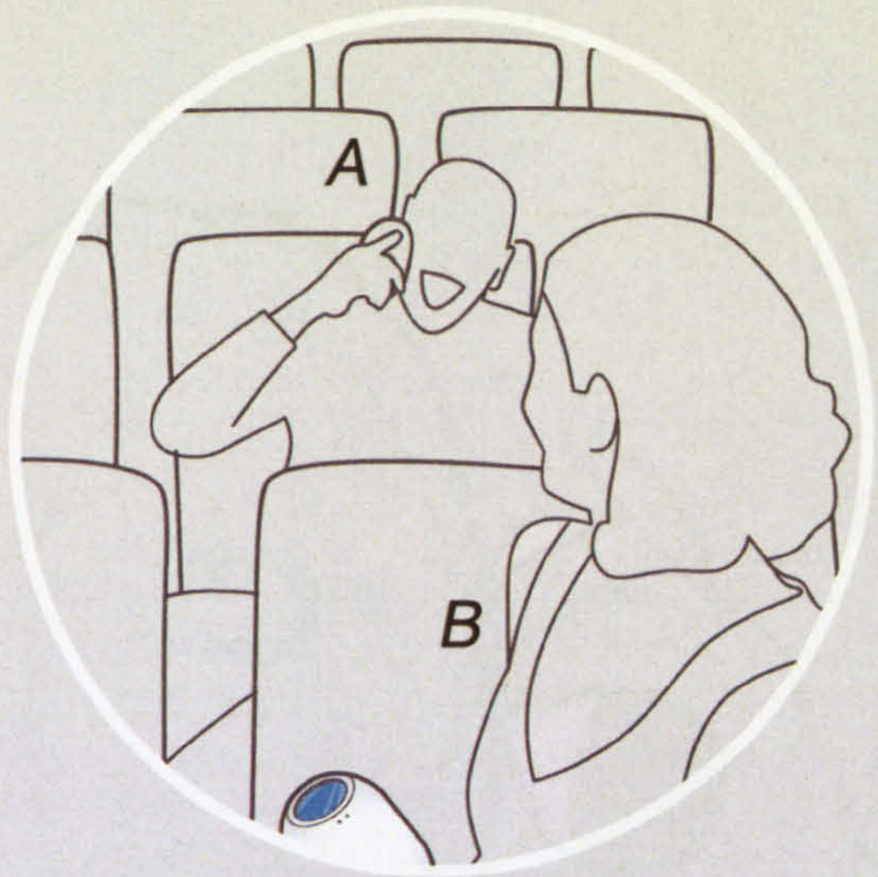

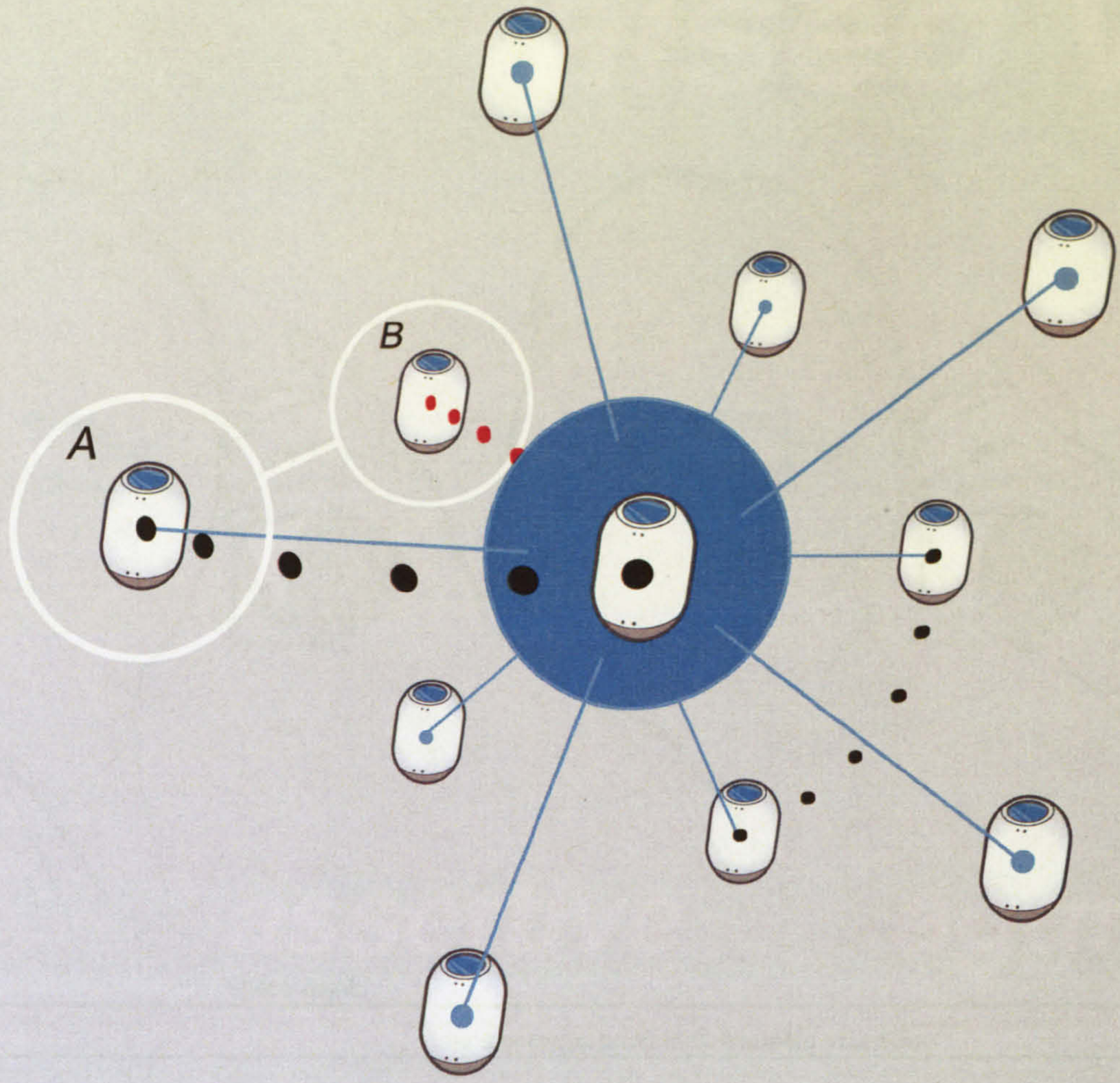

Every phone is connected to a central network database. This allows the network to upgrade itself with the information provided by phone use data and the circumstances in which they were operated. The information received by the network helps in developing new protocols and more symbiotic programming which in turn is sent back to the phone. The relationship between the phone and the network also allows for the direct flagging of anti-social behaviour from concerned users. Using the 'Grrr' feature, the concerned user can transmit a snap shot of all phones within the 10m Bluetooth radius back to the central network. Should multiple correlations arise over a period of time, the network will develop a new protocol or adapt previous protocols in an attempt to remove the new form of anti-social behaviour.

A and *B* are in the theatre when *A* starts a phone conversation.

A's phone does not recognise the social boundaries of this location and as such remains indifferent.

B recognises this behaviour to be anti-social and sends a 'Grrr' to the central network database.

Once a certain level of complaints by other users has been logged (in this instance with data specifically correlating to GPS location), the network transmits a protocol upgrade to all phones.

The next time *A* attempts to make a phone call in this location, the phone will display emotion to try to prevent the call from progressing. The form of the emotion may comprise of colour, light, movement or sound

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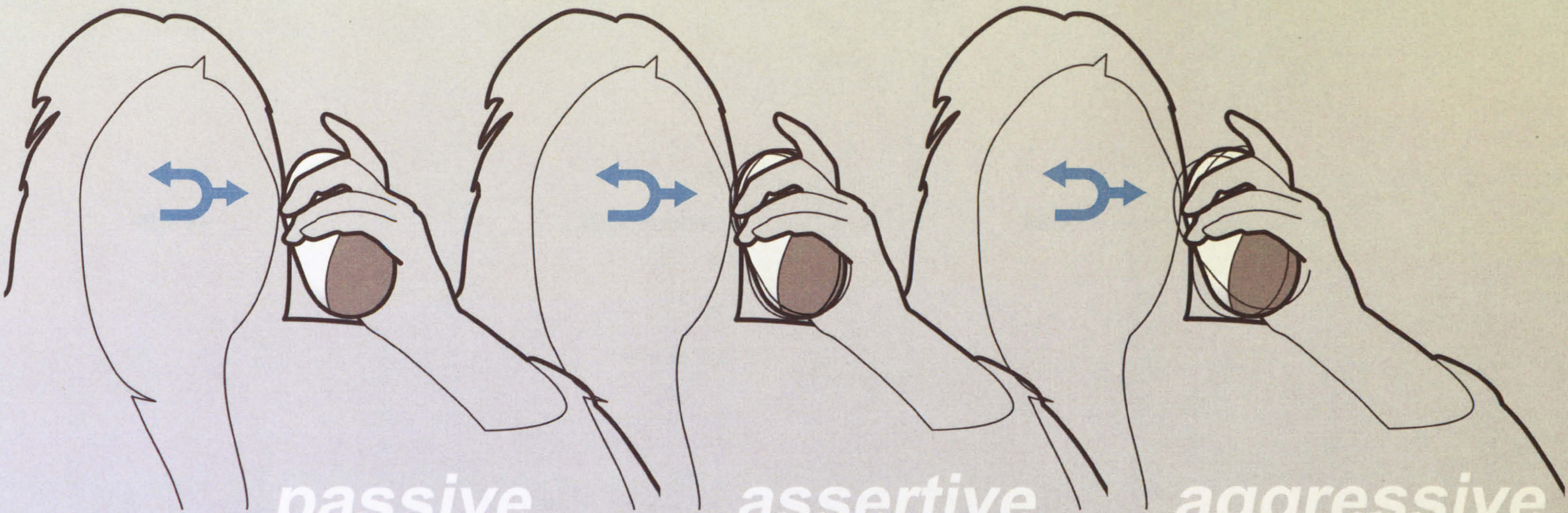
raised voice



Initially, the phone will have protocols to deal with three forms of phone misuse in a social context. These are: Raised Voice (excessive volume), Prolonged Conversation (excessive duration), and Physical Others (antisocial phone behaviour when with others).

For each mode of misuse the phone has been assigned an emotion to determine the most appropriate method of feedback.

The parameters governing the protocols is determined by the phones Memory(Previous) and Memory(Inherent).

Memory(Inherent) will be periodically updated with new protocols and made aware of new forms of misuse from a central database.

Memory(Previous) may be swopped between phones during conversation to help 'educate' both phones.

Through the changing and creating of protocol parameters and the limitless combinations of circumstance, the phone will react individually to every event.

Passive: Non-hindering. Gently illustrates to the user that their behaviour is becoming antisocial. Phone attempts to remind the user of their circumstance.

As the users voice becomes louder, which depending upon circumstance may be anti-social behaviour, the phone becomes ANGRY.

The initial response is to remind the user that they are having a virtual conversation, and attempts to do so through the voice-back feature.

Voice-back is when the user can hear their own voice whilst talking

Assertive: Intrusive warning to the user that their behaviour is firmly antisocial.

If the user persists in talking loud or the volume increases, the phone ramps up in its attempts to remind the user of their circumstance by gently vibrating the phone along with the voice-back feature.

Should the user lower their voice, the phone will decline in its emotional response.

Aggressive: Attempts to force the conversation to stop through extreme emotional response. The user has forfeited their rights to the conversation through excessive antisocial behaviour.

The phone now begins to rapidly vibrate in a bid to hinder the users operation of their phone or to end the call.

The phone has emotionally reached its limit.

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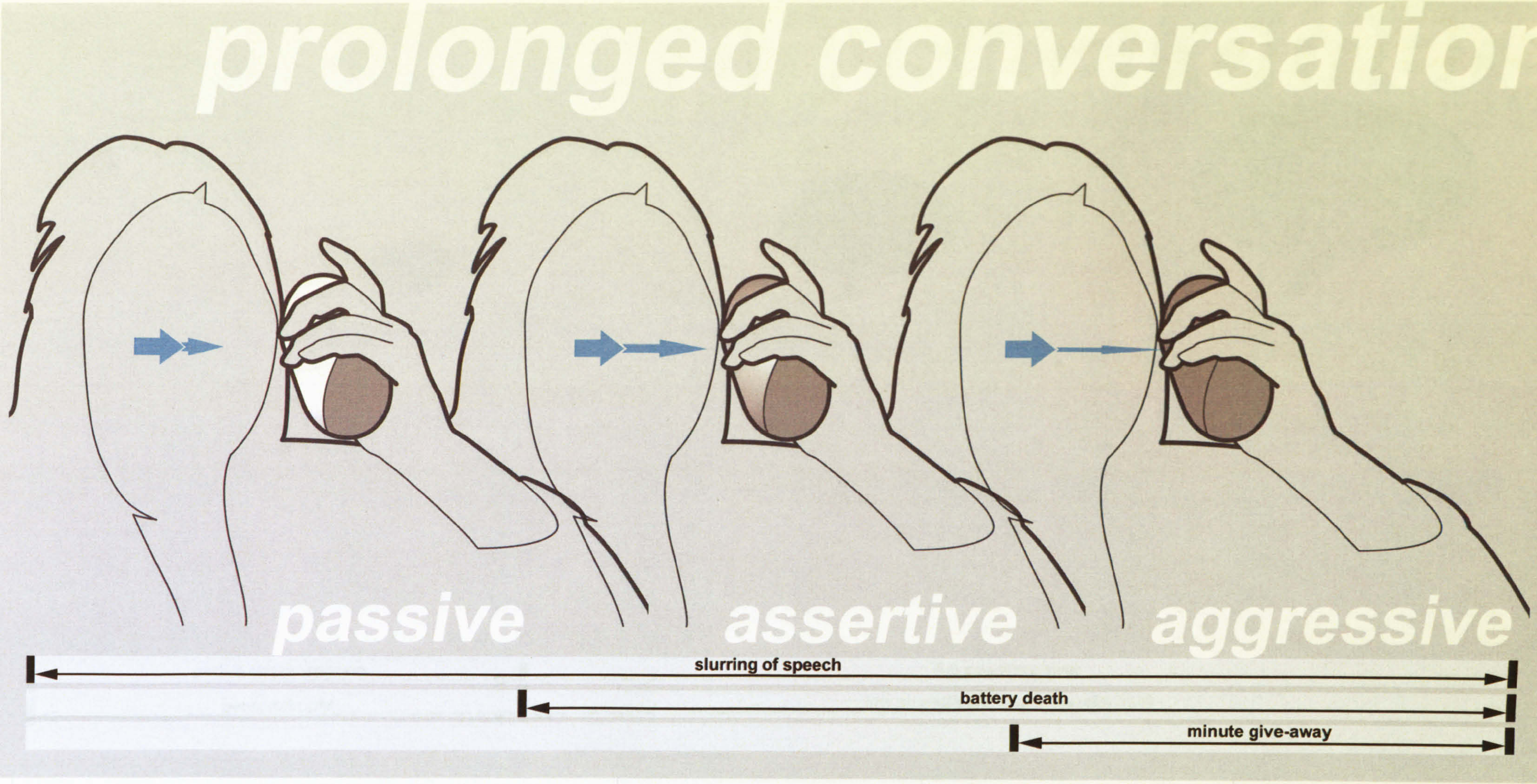

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When the phone decides the call to exceed what it considers to be a sociable length of time determined by the users circumstance, the phone becomes BORED.

The phone exhibits its emotion of boredom by slowing down the conversation, creating a noticable slur.

Assertive: Intrusive warning to the user that their behaviour is firmly antisocial.

Should the user persist in this anti-social manner, the phone increases the level of slur, to further impede the conversation and prompt the user to hang up.

The battery also begins to drain, slowing and reducing the output of dual running functions such as reading text messages whilst talking.

Aggressive: Attempts to force the conversation to stop through extreme emotional response. The user has forfeited their rights to the conversation through excessive antisocial behaviour.

If the user refuses to acknowledge the emotional state of the phone, and therefore their own level of anti-social behaviour, the phone increases the level of slur and battery death until the phone eventually stops. The phone can be reused afterwards once the phone has regained 'consciousness'.

The phone also at the latter stages begins to drain the number of minutes you have on your phone, distributing them to phones nearby as a form of compensation for wasting their time.

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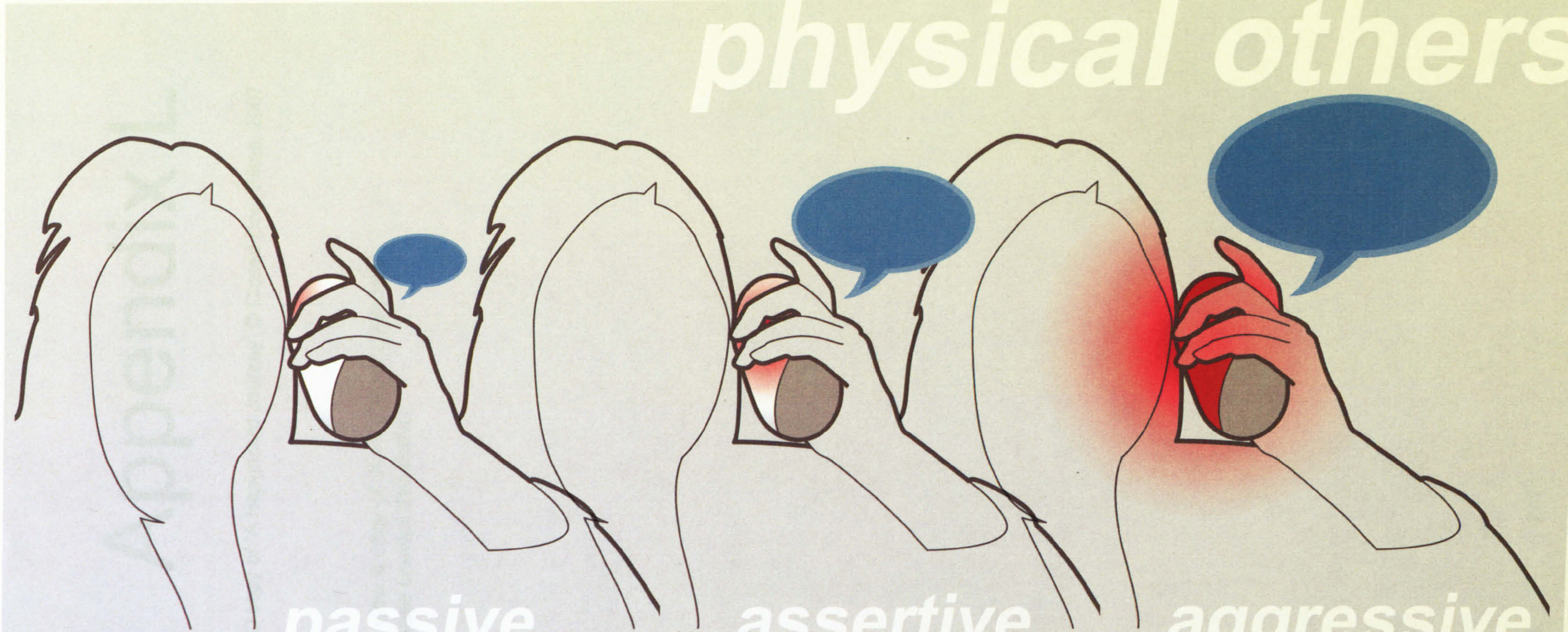

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Through the changing and creating of protocol parameters and the limitless combinations of circumstance, the phone will react individually to every event.

Passive: Non-hindering. Gently illustrates to the user that their behaviour is becoming antisocial. Phone attempts to remind the user of their circumstance.

Using the phone in an anti-social manner when with other people will result in the phone becoming EMBARRASSED.

Should the user behave anti-social with others present, the phone attempts to warn the user on a personal level of their behaviour. This includes a small personal light, only visable by the user, and the use of the speakerphone function to randomly punctuate the conversation and remind the user of the physical world.

Assertive: Intrusive warning to the user that their behaviour is firmly antisocial.

If the user insists along the route of anti-social behaviour the phone becomes more embarrassed, glowing a deeper and pulsing red, visible from a small radius about the person.

The speakerphone function increases the number of words it releases, allowing others to partially join in the conversation. If the user did not want other people to hear the conversation, then they should not be having the conversation in that circumstance to begin with.

Aggressive: Attempts to force the conversation to stop through extreme emotional response. The user has forfeited their rights to the conversation through excessive antisocial behaviour.

The phone at this stage is thoroughly embarrassed at its misuse and rapidly glows and pulses a deep red. The emitting light now showers the user, to draw attention and scorn from others nearby.

The speaker phone is now working at full capacity, both preventing the use of the phone near the ear and allowing anyone in the vicinity to join in the conversation.

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Appendix L

Appendix L: DVD copy of "A Haphazard Journey" © Closed Door Films, 2007

To view a copy of 'A Haphazard Journey'
please contact the author.

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ORIGINAL