

Understanding user-centred opportunities for supporting consumer behaviour through handheld and ubiquitous computing

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Abstract: As we move around our environment and interact with the physical world, we are surrounded by information exhorting and stimulating us to buy things. For most of us, not all of these impulses are followed: products may be too expensive, too hard to understand, similar to a product we already own, or other reasons. New technological infrastructures are being researched and developed that allow users to access contextually relevant information to support more informed purchasing decisions and access to mobile e-commerce services for in-the-moment acting upon those impulses. However, this work has emphasised the functional and transactional aspects of shopping and consumer behaviour, but largely ignores the experiential nature of much everyday shopping behaviour. We present a study of shopping and consumer behaviour that examines the reasons why purchasing impulses are deferred in mobile situations as a means of understanding this better. Results are used to inform thinking and motivate several possible design solutions for new mobile consumer services and technologies.

Keywords: shopping, m-commerce, handheld and mobile computing, context-based services

1. Introduction

Shopping is a feature of everyone's lives. While traditional bricks and mortar retail environment have played the dominant role in most peoples shopping the huge growth of the Internet is beginning to ask important questions about the nature of the future consumer experiences. On-line shopping, or e-commerce transactions are making up an increasing proportion of total sales, and this is particularly the case for relatively standardised products such as books and CDs and for relatively intention-driven shopping [1]). While this growth is set to continue over the next decade, it is expected to be limited; forecasts make an analogy with catalogue shopping, which plateaued at 10% of the retail market. It is predicted that on-line shopping will similarly plateau at approximately 20% of total retail sales [1]. As such, the majority of consumer behaviour will arguably remain in the domain of the physical retail environment. There are a number of reasons for this, such as the problems of immediate gratification and the need to sense physical consumer objects that is hard to replicate over the Internet for a large proportion of goods and services.

In addition to the above reasons, despite our increasingly 'wired' lives, people do not spend all their lives sat in front of a computer screen; indeed moving away from this fixed model of computer use is one of the goals of the mobile and ubiquitous computing revolution. Rather, people are essentially

nomadic beings moving through a physical world interacting with objects and people in that world [2, 3]. As they move around and interact with the physical environment, seeing, hearing, touching and smelling, impulses and intentions to act and consume are generated all the time.

On those occasions where these impulses are not or cannot be acted upon for some reason, there occurs what Gershman et al. [4] refer to as an *intention-action gap*. They describe 3 types of discontinuities which can create these gaps: the first of these occurs through a *physical* discontinuity whereby the person is not in the 'right' place to be able to act on the impulse. Second, there is an *informational* discontinuity where people do not have sufficient information to be able to act on the impulse. Third, there is an *awareness* discontinuity, where the opportunity to fulfil the impulse lies outside the immediate focus of the person's attention. By not acting on these impulses in the moment, these discontinuities can result in impulses being lost. Technology that would mitigate these three factors could have an enormous impact on subsequent purchasing behaviour.

A number of technological developments are being touted as interesting solutions to this intention-action gap. We have already seen a variety of Internet enabled mobile technologies that aim to offer anytime, anywhere access to consumer-related information and services. Although limited, these provide consumers with the ability to act on impulses in the moment that they arise. However, their impact on consumer behaviour has been low, probable

reasons for this being that they are relatively cumbersome to use, inappropriate for use in many situations, expensive, and fragmented in product coverage. Despite their limitations, these can provide consumers with a bridge over the action-intention gap. Some of these solutions are discussed in detail below:

Mobile and ubiquitous technologies give users the ability to augment the physical environment, with digital information and resources [e.g. 5, 6, 7, 8, 9, 10, 11]. For example, ubiquitous computing infrastructures such as Hewlett-Packard's Cooltown allow "People, Places and Things" to be associated with a web presence. A range of different sensing mechanisms (e.g. Barcodes, RFID tags, Beacons, Digital Watermarks) can be used to associate a unique identifier with these entities that can be picked up by complimentary mobile devices such as phones, wireless PDAs or scanners. These physical, entity-based web presences can then be used to access context-specific informational and transactional resources at the user's physical location in support of their users' informational needs.

The increasing convergence of technological developments has led to opportunities for combining the benefits of shopping in the real world with those of on-line shopping. Indeed, there are already numerous developing applications that build on these very ideas within the shopping and consumer domain. For example, Pocket BargainFinder [12] is a version of web-based comparison shopper developed for wireless mobile devices to find the cheapest on-line price for an object encountered in the physical world. By scanning a barcode on the object, the user's handheld device sends the unique identification information to a central server from which it is possible to compare prices for that article on various on-line stores. This comparison information is then sent back to the mobile device allowing the user to make a decision about whether to make a purchase. Having decided to make a purchase, the user can buy there-and-then through the device. In this respect, the user/consumer is able to overcome both informational and physical discontinuities that create the intention-action gap in this scenario.

Other more active systems include Randall and Muller's Shopping Jacket [13] and Fano's Shopper's eye [14]. In these systems, a wireless, wearable computer stores the user's profile or shopping list of desired items. As the user moves around the physical world, the device cross-links physical proximity - the user's location using either GPS information (Shopper's Eye) or Radio Pingers (Shopping Jacket) - to information from the user's profile and shopping list, back to the physical retail stores network. The physical retail stores use this information to search their stock databases to see whether they have any matching items in store. This is then sent back to the device to

inform the user whether it is worth entering the store or not. Such systems could also provide location-based reminders to the user based on their profile [cf. 15]. Alternatively, other local shops could send out bids for the same or comparable items.

Action and intention

While these and other examples of such applications are of interest, much of that interest is derived from the technical possibilities they demonstrate, rather than from a genuine compellingness of the application driven by the users' requirements. Many of the existing m-commerce services available through WAP have also been subject to this concern about genuine user value [e.g. 16]. One of the problems is that the focus of these systems is primarily on the functional and transactional aspects of shopping and consumer behaviour as embodied by the whole notion of reducing the gap between intention and action as the issue to be solved. Yet the nature of this gap has only been characterised at a very high level by the likes of Gershman *et al* (ibid.), and there is little detailed research about the shopping experience itself with respect to *action*. It is all too easy to use these high level characterisations to make exaggerated claims about the value of particular situated computing applications in the shopping domain. From the perspective of the user, this gap is a much more complex entity. The nature of intentions is hugely variable, as is their relationship with action. The strategies that people use to link their intentions with actions are also highly intricate and diverse. As such, we would argue that a deeper clarification of these issues from a human, rather than simply a technical perspective is a necessary component in developing the genuinely compelling context dependent m-commerce applications hinted at by the technological innovations.

We argue that the focus on the intention/action gap, and the functional and transactional assumptions about shopping that it embodies, is too narrow a characterisation of consumerism, and that this ultimately limits the kinds of applications developed. Furthermore, whilst a focus on the transactional aspects of shopping is particularly suited to desktop-based e-commerce [1], this is not necessarily the case for consumers moving around in the physical world. In these settings, the experiential aspects of shopping are much more significant than the financial transaction itself. As such, mobile and wearable consumer applications should not simply duplicate existing transaction-centric e-commerce applications, but should take a broader view of what the nature of shopping (and impulse deferral) is. If we are to build a deeper understanding of m-commerce applications from the perspective of

the user, these experiential aspects of shopping need to be investigated.

Human centred research

A great deal of human-centred research into consumer behaviour has been carried out, covering the diverse fields of marketing, psychology, sociology, cultural studies, anthropology, geography, economics and history. Much of this has been in the area of marketing, which has examined factors such as attitude change, motivation, personality characteristics, group influences, class and culture. People are treated as economic agents and rational problem solvers [e.g. 17] and the aim of this work has ultimately been to understand the factors that make people buy and consume [18].

Sociological studies of consumer behaviour have also emphasised the *buying* aspect of shopping although there have been a few exceptions that recognised the experiential and recreational aspects of shopping [19, 20, 21]. Tauber, for example identified motives beyond the transactional act to do with diversion from the daily routine, learning about new trends, role-playing, peer-group interaction and communication. But it is only more recently that sociological research on shopping has begun to explore in any depth what these interactional and experiential facets really are, and what they mean to people and their social relationships. The focus has begun to move towards examining the details of what people are actually doing when they shop [18].

Several ethnographic studies of shopping behaviour are now emerging in the literature, for example, Miller’s ethnographies of shopping in North London and Trinidad [22], and Lehtonen and Mäenpää’s [23] ethnography of shopping in the East Centre Mall. Miller [22], for example, talks about how relationships are demonstrated, shaped and maintained through acts of consumer behaviour. Gender differences such as the greater importance of the recreational aspect of shopping for women, and the greater importance of functional aspects for men, age differences and class differences have also been examined [24, 25, 1]. These studies also reveal a range of differences in shopping styles and experiences associated with different genres of shopping such as the mall vs. corner shop vs. the supermarket [see also 25, 26].

While these studies paint a rich picture that can provide some useful inspiration for design, their primary motivation is not design and they are limited in their application to the design process. It is also difficult to extract implications for more specific design questions related to particular types of mobile and ubiquitous computing technologies and services. The work of Underhill [1] offers some of the most design centred findings, but these

are primarily about the design of retail spaces and environments, rather than about the technological domain of interest discussed in this paper. With this in mind, we felt it was important to develop our user understanding more specifically within our particular domain of design enquiry. In order to do this we developed a study around the notion of the deferred impulse. That is the notion of consumption impulses generated by people, places and things in the physical environment, being deferred temporarily or permanently for various reasons.

Focussing in on deferred consumption impulses as a means of knowledge elicitation about shopping, allows us to explore user-related issues in the two areas identified earlier – namely, the intention-action gap, and the broader experiential and non-functional facets of shopping that are revealed through *non-buying* behaviour. This understanding will form the basis for new ways of thinking about opportunities for mobile shopping technologies and services based around the interaction between device and physical world.

2. Study

2.1. Participants

Sixteen participants were chosen across a range of different criteria (see table 1), and were paid for their participation. The study was carried out in summer 2000. The sample was not intended to provide detailed segmentation data for all these groups; rather, representing participants from across these criteria provide the opportunity for issues related to these different factors to be raised at some point during the study.

Occupation	Age	Sex	Family status
Teacher	27	F	Cohabiting with partner
Design Engineer	29	M	Engaged – partner lives away
Sixth former	17	M	With Parents
Retired	61	M	Married with adult children
Sixth former	17	F	With Parents
Teacher	28	F	Married plus young child
Secretary	31	F	Parent, living with partner
Technician	32	M	Living with partner
Young professional	29	F	Living in shared house
Unemployment adviser	49	F	One child-adult living with partner
Graphic designer	31	M	Living with partner – no children

Voluntary worker	17	F	Single/ living alone in shared house
Community worker	35	F	Single parent living with child
Mature postgraduate student	28	M	Single
Housewife	60	F	Married
Electronic Engineer	29	M	Single

Table 1. Table of occupation, age, gender, marital status and social status of the participants

2.2. Procedure

Participants were told that we were interested in the way in which things in their physical environment acted as a source of stimulation to buy something (e.g. physical consumables, services, entertainment and leisure activities that they were interested in purchasing). In particular, they were told that we were interested in instances where these impulses were not fulfilled immediately but were for some reason were deferred temporarily or permanently.

Participants were asked to keep a record of all impulse deferral events over the course of a week throughout the days and in the evenings. In order to do this, they were given disposable cameras to create a "picture diary" for which they would be required to take a photo of the stimulus whenever an impulse deferral event occurred. The cameras were collected at the end of their diary week and processed. Once the film was developed, a follow-up interview lasting 1 to 1.5 hours was conducted as soon as conveniently possible so that events were fresh in the subjects' memory. Participants were shown each photograph in turn and asked to elaborate on the events they depicted; the following kinds of questions were then asked:

- What was the context of the impulse?
- What motivated the impulse?
- When and where did the impulses occur?
- Were they recurring impulses? For how long?
- Why were the impulses deferred?
- What further information might they have wanted?
- How would they have liked to capture these impulses?
- Whether they thought about the impulses again, subsequently fulfilled them, or simply lost them?

The specifics of the events were also used to elicit information about more general practices

with regards to participants' shopping and transactional behaviour. Audio recordings were made for all interviews (later transcribed) and where possible, video recordings.

3. Findings and discussion

The findings were drawn from the conversations surrounding the diary episodes depicted in the photographs and from the photographs themselves. This section begins with a general discussion about the nature of the stimuli and impulses, the activity context in which impulses were generated and the relationship between them. Following this, there is a discussion of some of the critical characteristics of shopping and consumer behaviour emerging from the reasons *why* impulses were deferred. Implications for technologies are discussed where appropriate.

3.1. Relationship between stimuli and impulses

Participants took on average 36 photographs over the course of the week (ranging between 17 to 74), providing an indication of how many deferred impulses were typically taking place. Impulses were generated from a wide range of different stimuli. These included physical objects, paper-based representations of, or references to, consumer objects (e.g. books, magazines, newspapers, advertising posters, leaflets, shopping lists), electronic representations of, or references to, consumer objects (such as radio television and the Internet) and word-of-mouth recommendations by third parties. These are discussed in detail below:

Physical objects accounted for approximately 70% of the deferred impulses recorded. While this illustrates the potential opportunity for using physical objects as mobile access points to web-based information and services, further examination of the nature of the relationship between stimuli and action impulses over simplifies this somewhat. Nearly a third of these deferred impulse examples related to physical objects involved a somewhat "distant" and idiosyncratic relationship between the stimulus object and the consumption object in mind. These relationships were established through a complex chain of semantic associations that was highly personal to the participant. Such relationships are not really possible to design for in terms of some generic access point to information and services. However, their use as idiosyncratic reminders may suggest some need for personally tailored object augmentation that enable access to personally relevant web based information and services.

For the other two-thirds of physical object stimuli that led to deferred impulses, there was a much closer relationship between the

stimulus object and the considered object of consumption. Nevertheless, these relationships were still not always easy to specify. Understanding the relationships between these stimuli and the nature of the impulses is an important but potentially complicated issue. In the relatively simple cases there was a direct mapping between the stimulus object and the object of the transaction impulse. For example, on seeing a bottle of wine in a retail store, an impulse was generated in one participant to think about buying that exact bottle of wine. However, it could be seen from some of the other deferral episodes that the relationships were often more complex than this case, and there was rarely a simple one-to-one mapping between stimulus object and the object of the transaction impulse. For example, when talking about clothes purchases, subjects' comments referred to many different relationships between stimulus objects and impulse objects, such as "exactly like that one", "that one but in a different size", "that style of garment", "that brand of clothing", "a new top of some sort". Similarly, certain objects also had a network of close associations. For example, films were often cues to CD soundtracks of that film, or a book on which the film was based, or vice versa. Developing technologies to support user actions on this complex set of information and service relationships will be a major challenge to designers.

The range of these relationships lends some support to the idea of indirect sensing mechanisms (Kindberg, 2000) in which the identifier associated with the physical object picked up by the mobile device needs to be resolved by a particular service which then returns a URL. Different resolvers can act on the same identifier to return different context-dependent results according to the particular context and situation. The potential problem with this approach is that the very flexibility that we might want to support in this situation may in fact be detrimental to the simplicity and directness of the interaction that, *prima facie*, is what is so appealing about the use of physical objects as access points to digital resources in the first place. This may be particularly the case when the same device is used as the access point to multiple information and services possibilities associated with a single object since it introduces new layers into the interaction. This would reduce the appliance-like simplicity that is often associated with such devices.

An example from technology used in some music stores illustrates this case: barcodes are used for various purposes in these stores, but dedicated devices are used for each of these purposes. In one instance the barcode can be used to access the music of a particular CD to be listened to on a dedicated listening post. In another instance, the barcode is used to access pricing information at the purchase till when a

transaction is made. It is the use of these dedicated devices for these purposes that keeps the barcode interaction lightweight and immediate. This provides an argument for more direct mechanisms to be used in terms of augmenting the physical world with electronic information and services. So rather than trying to design for the vast and idiosyncratic relationships between context and information needs, it may be more usable and useful to constrain this flexibility and maintain interaction directness.

Paper based representations of consumption objects and references to consumption objects in paper-based media were also important sources of impulse generation accounting for approximately one quarter of the deferred impulse situations in the data. This included things such as direct advertising materials (posters, magazines, leaflets), home-shopping catalogues, magazine articles about particular items and third party reviews. Home-made lists and reminders on paper were also used, but only made up a very small proportion of the deferred impulses scenarios. On the few occasions these lists were generated, they were rarely taken shopping with the participants. "Casual capture" devices may be the most appropriate devices in these instances, with minimal 'intelligent' processing being done on a mobile device.

Examples of electronic and digital representations of consumption objects in the deferred impulse scenarios were low, accounting for approximately 3% of the photographs. This included Internet, television and radio as source of deferred impulses. The few examples from radio and television were primarily for music. This points to the potential for Bookmaking technologies such as the Sony eMarker [27] which links broadcast material to web based purchases of music. The Internet was also under-represented in the deferred impulse data. This is partly because the Internet was still not widely available to all the participants. Even when available, its use accounted for only a small proportion of the time spent in the participants' everyday activities. In explanation, the use of the Internet is often very goal directed and so was possibly less likely to lead to deferred impulses than impulses encountered in the physical world.

3.2. Location of deferred impulses

The location of deferred impulses is interesting to explore since it has important implications for the approaches that can be used to offer access to context dependent information and services and the level of design control that is possible over a complete solution.

Fig 1. Graph of locations for deferred impulses.

If we look at figure 1 we can see that only approximately a quarter of the deferred impulses were taking place in the shops (16%) and within the immediate vicinity of the shops (11%). This is perhaps not unsurprising since the shops provide the opportunity for impulse fulfilment. However, it is important when considering that an augmented shopping experience linking physical to digital world is something that would be easier to implement within the controlled boundaries of a particular retail environment. What this location data suggests is that only a small proportion of deferred impulses will be possible to “capture” by such a controlled and bounded approach. For example, certain shops now are providing specialised barcode scanners for their customers to allow product prices to be entered and totalled as the user moves around the supermarket and picks up items. If such a within-store approach were used to augment the shopping experience in other ways it would miss out on the larger proportion of deferred impulses that were taking place away from the vicinity of the shops and in the home. As such we would argue that technological implantations of an augmented shopping experience using ubiquitous and mobile computing should look to extend beyond the boundaries of specific retail locations into places such as the home environment.

4. Findings: Deferral of Impulses

This section discusses why participants in the study put off fulfilling immediate transactions. These reasons are summarised in table 2. By understanding what prevents immediate transaction fulfilment and what additional things the participants do in relation to that impulse, we can identify design opportunities for what can be done in the moment and which may reduce the likelihood of a “lost impulse”. These reasons are discussed in detail below, with their associated implications for the design of augmentative technologies.

4.1. Shopping is social and collaborative

In contrast to the individualistic assumptions of many m-commerce technologies and services, shopping and consumer behaviour were often highly social and collaborative activities [cf 1, 22]. Many of the participants spoke of going shopping with friends and family both for basic provisioning type shopping. Shopping provided the justification for engaging in this social behaviour. People would go with their spouses or peers, for example, or would spend time browsing through catalogues and magazines together.

Discussions around potential transactions, and conversations around aspirational items were an important part of maintaining group relationships and learning about each other’s interests and tastes. These conversations and shared experiences are both pragmatic and entertaining and represent some of the more experiential non-functional aspects of shopping and consumerism.

4.1.1. Making conversation and advice seeking

Much of the shopping activity involved sharing and discussion of ideas about what was “good” or “bad” to buy. Friends would seek advice and reassurance from each other about purchases they were considering which could lead to a transaction being fulfilled or could lead to a deferral.

Participants frequently talked about friends who had recommended certain items or that they had bought items because their friends had them or because they were the most popular products. With clothes shopping, for example, some participants described instances where they had not bought a particular item that had generated an impulse because of disapproval from a friend or because the opportunity to receive some assurance was not available to them. Some network services already provide this; consider how Amazon.com generates further sales by suggesting other items that people have bought as well as the product under question. This is similar to how the music charts are used to inform people about the popularity of particular products and how this influences sales. These and other such services can easily be delivered on mobile devices.

The Appliance Studio have developed prototype service solutions along these lines using WAP enabled mobile phones. The prototypes work on the basis of barcodes for books and CDs. Users enter a barcode into the device and the service returns various different types of information based on collaborative filtering principles (social navigation – [see 28] to show what other people also buying that product also bought.

The need for reassurance and discussion around a potential transaction did not just apply to those situations when friends and family were out shopping together but also involved deferred discussion, as well as discussion between geographically disparate groups. A number of participants described examples of deferral impulses where they had wanted to phone a friend (or indeed had) to discuss a particular purchase. People would also use the mobile phone in shops to give “word-of-mouth” recommendations about particular items their friends might like or about special offers. This would sometimes lead to purchase of items by proxy.

Participants also talked about showing pictures from magazines or collecting leaflets of objects they had seen while shopping to aid

later conversations around consumer items. The importance of these conversational resources is highlighted by some of the difficulties experienced when trying to describe particular items on the phone. One of the sixth form students described the importance of conversational resources: her group of friends would be out shopping in small subgroups and would arrange to meet up with the larger group in order to discuss the days shopping. In the absence of any visual representations of the items they had seen they would draw

pictures of items they had seen on napkins or pieces of scrap paper they had to hand to facilitate shared understanding.

A particularly interesting scenario involving a technological workaround to geographical separation again illustrates the importance of talk and the social bonding experiences around consumer activities as well as hinting at possible technological applications that might support these experiences more effectively:

The participant was engaged to be married but was currently living in a different city from his fiancé. He had been into a shop to have a look at wedding suits and spoken to the shop assistant, and taken away a catalogue to look at later that day while he had more time. He browsed it that evening and marked up the styles he was interested in. He then went to their Web site to check that out to see if there were any more things of interest there. The Web site had all the pictures from the catalogue, and so for the suits he was interested in, he thought it would be a good idea to save the pictures to a file on his local hard disk and send this file as an email attachment to his fiancé. The next day she phoned him up while viewing the attached file and they discussed the different suit options while he was looking at the catalogue.

Interestingly, this sharing of the information played more than just the role of eliciting advice and opinions from a second party. His fiancé also enjoyed the fact that she had been sent the picture of the items in question and asked for her opinions. That is, social grooming aspects are an additional motivator for this kind of social consumer behaviour. It is not just about receiving advice and reassurance that is important but also about providing opportunities for giving it to others.

4.1.2. *Permission seeking before purchase*

Permission seeking was an important feature of shopping behaviour and a further example of the underlying social nature of shopping and consumption activities. Sometimes this permission seeking was about financial considerations. In situations where limited financial resources are shared among a group of people, such as a family, there is a need for negotiation and co-ordination around how these resources are spent. While there are a range of different forms of how control over the budget is managed within the family group as indicated by previous research [e.g. 29], what is important here is that control over spending is not always in the hands of the individual in the retail situation. As such, there were numerous occasions where participants described transaction deferral due to the need to seek permission from others before making a purchase. This was particularly the case for those with less financial independence, such as the younger participants. They mentioned examples of having to phone up their parents to see whether they could buy a particular item or to negotiate some additional financial resources above their normal allowance.

Permission seeking also involved aesthetic considerations in situations where a particular purchase would have an impact on the living environment of others. For example, with some purchases (e.g. furniture, art work and other household decorations) participants were unable to make a purchase without discussing it with the other people affected by this decision and who might also likely to be contributing financially to the purchase. Sometimes a phone call was all that was necessary to obtain the permission, but other times it would require all the involved parties to see the transaction object or at least a representation of it.

4.1.3. *Collaborative need and monitoring*

In family situations, information about what is needed is distributed across multiple parties and so it is not always clear to any single person at any point in time what exactly is needed. For example, one participant described how she controlled the monitoring of household food provisions, but that it was difficult to do when other people became involved in this. As an example, she said that what normally happens in her household is that they have one loaf of bread in the freezer and one out. When she takes a loaf of bread out of the freezer that will be a cue to get some more bread. But what had happened in this situation was that her partner had taken the loaf out of the freezer and started using it, so only he was aware that more bread needed to be bought. As such, the need for a transaction was not discovered because of the distributed nature of the knowledge across the different members of the family.

4.1.4. *Leisure activities and social co-ordination*

Participants described many examples of deferred transactions based around social activities, such as visits to the cinema, going to the theatre, seeing a band, or weekend breaks with friends. They would often see adverts for events in magazines or on posters but would typically not respond immediately in terms of making a transaction. This was despite the fact that in many instances it was quite possible to use a mobile phone to book up there and then. The reason for deferral was that these events involved some form of social co-ordination with interested parties, to monitor their social availability, suggest appropriate times, dates and negotiate on issues about prices. One participant even deferred buying tickets for an event because it was too far in advance and she wanted to wait to see whether anything more interesting to do with her friends might come up in the meantime.

Such social co-ordination can be highly complex, involving consultation with multiple parties and which consequently can be difficult to do in-the-moment. However, one might be able to encourage the likelihood of subsequent transaction by perhaps allowing people to email or otherwise communicate the advert and associated information (performance times, prices, etc.) to a friend. For example, this could be achieved using a mobile phone to grab up a URL from a poster to send to a friend over email, or as an SMS message showing the advert and invitation message.

4.1.5. *Gift suggestions*

There were some allusions to the deferral of items because they seemed to the participants to be something that someone would buy for them as a gift rather than something that they would want to invest their own money in.

For example, one participant talked about a dressing gown that she saw in a catalogue and that she had wanted and needed one for two years but did not want to buy it with her own money. However, this was the kind of thing that she would refer on to someone such as her parents or grandparents as a possible gift suggestion. From a technology perspective it would be quite possible to submit product information from a shop to a personal gift list repository (perhaps available over the web) that friends and family could access for gift ideas.

4.1.6. *Social and collaborative shopping technologies*

The collaborative and social aspects of shopping and consumer behaviour point to an a need to explore technology mobile technology idea beyond the individualistic transaction based m-commerce solutions.

Technologies and services should look to facilitate the conversation and communication that takes place around consumer items and enhance the social experience. For example, technologies to aid the capture and sharing of consumer object representations would be an important space to explore. Likewise, it might be useful to explore some of the word-of-mouth activities and social navigation aspects of shopping. For example, shop-based services based on the notion of "tell-a-friend" or "send this story to a friend" models seen on web sites and mail order catalogues. So, shops could have a services where they encourage people to inform friends about particular items, promotions, etc using some form of communication technology, e.g. the shop pays to send of an offer message or image to a friend. Alternately, a commission-based service could be used in which the person sending the message receives a commission for purchase that result from them sending that message.

4.2. Information seeking

A common reason for transaction deferral involved the need to find out more information about the product or service generating the impulse. Indeed this is regarded as one of the most important areas where handheld and ubiquitous computing technologies and services can provide strong value to user while shopping in the physical world. By allowing people to access information in the moment, the argument is that they will be able to make more informed purchase decisions.

4.2.1. *Research and legitimisation*

While people sometimes engaged with assistants in the stores to obtain this information, there were examples of when participants expressed a low trust of this advice. This was a common reason for deferral, especially in instances where the purchase was an expensive, technical product, such as a computer or hi-fi. This was caused by a perceived lack of sufficient quality of advice and the low level of impartiality of the advice usually given. In these instances, the participants sought more information from other knowledgeable people or other trusted sources of information (e.g. Which Magazine).

The deferral incidents of some participants were also sometimes caused simply by social embarrassment factors associated with asking for information. In these circumstances, people either did not want to appear stupid, or simply did not have sufficient knowledge to know where to start asking questions.

For example, one participant was interested in buying a cheaper car in Denmark (located over the internet). However, she was too embarrassed to ring up and ask if they spoke English and was also disconcerted by the fact

that there would be a technical element in the communication. This goes beyond simply lack of information being available at the moment and is more based on lack of necessary knowledge to evaluate the information even if it were there. Asking for advice was also sometimes deferred because the social engagement would increase the pressure to buy because of the social embarrassment of not buying. Whilst retailers are well aware of this fact, consumers want to be able to avoid these situations through more anonymous information gathering methods.

While there are clearly deferral examples based around paucity of information at the point of stimulus and impulse generation which suggest a need for context-dependent information provision, there are some additional characteristics of this information seeking that have implications when thinking about technology and service design. For example there was often a strong sense that multiple sources for the same or similar information somehow legitimised the transaction object under consideration.

An example of this can be seen from a participant who saw an advert in the newspaper for a new service offering by a well known organisation that was not normally associated with this domain of service. In spite of the high profile nature of the organisation she decided to wait until the new service on offer came "more to her attention" through adverts posted through the door and seen on television. Multiple sources were also important from the point of view of opinions and recommendations to give them legitimacy, such as reviews, conversations with friends, association with celebrities, etc. Information, then, does not always stand on its own. Sometimes it is necessary to pool information from multiple sources to encourage transaction fulfilment. This could be supported by technology-based services that provide links to related information from a variety of sources.

The participant essentially wanted to be able to compare alternative saving accounts across different banks. As a consequence, he went out the next morning and bought a newspaper that had a multi-page section on the different banks and investment funds, with more detailed commentary and diagrams as well as providing information about the top 10 performing unit trusts. He annotated the newspaper to pick out the different banks and savings plans that he liked. He then spent about half an hour reviewing this information, during which time he would intermittently go back to his computer to work out what he would earn in interest over 6 months with a range of savings amounts. Once this calculation was complete, he selected a savings plan with a different on-line bank from the one initially advertised on the poster and set up the account on the Internet.

The above example illustrates a number of important features of information seeking behaviour. First, if we consider the length of time involved in this comparison task, it is clear that the task could not be done in the moment. So while it might have been theoretically and technically possible to deliver that information in the moment, it was not something that could be done in the context of the ongoing activities in which the impulse was

Mobile information provision from a trusted third party would be an ideal solution to this. Customers could then make an informed decision on the spot without having to do research elsewhere. They would therefore be potentially both be less likely to defer purchase (with a potential total loss of the impulse), but also to make a satisfactory purchase (with a concomitant improvement in customer relations, and less likelihood of product returns). In some cases, it might be in the shop's interests to pay for this service. This is an area in which local radio connectivity (through Bluetooth, for example) and mobile telephony might need integration with in the device so as to route calls through the shop's telecommunications system rather than the individual's mobile telephone bill.

4.2.2. Offline research

Occasionally, the research required for a purchase was more complicated than could be dealt with in that moment and required more time to process with than was possible without disrupting ongoing activities. As such, information gathering and processing was deferred until a more appropriate time and place.

For example, one of the participants saw a poster in a bank advertising a savings plan. This generated the idea seed that it might be good to open a savings account of some sort. The participant did not want to do it there and then because he needed more information to make the decision. This would seem like the archetypal situation for in situ information provision via a mobile device. This perspective however focuses too much on the high level need for information without really considering the nature of that information and the actual decision making processes that would be involve. An elaboration of the scenario will help illustrate this:

generated. Second, the amount of information being viewed was quite considerable and would be inappropriate for viewing and processing on a mobile device. The complex nature of the information processing across multiple media and information sources, and the types of transformations performed on the information turn it into a decision which could only be supported by media with better visualisation capabilities.

While this is perhaps an extreme example, it illustrates that impulse deferral through lack of information is something that, from a human-centred perspective, cannot be solved simply through in situ information provision. Characterising the situation in terms of the whole decision making task, rather than simply a lack of information, provides a more informative perspective from which to think about technology and service design.

The need to support the whole decision making task is further supported by instances in the data where information seeking in the moment was actually possible with current mobile technology.

For example, while reading a newspaper, one participant saw an advert for 'ACME Energy', informing her of the potential savings she could make on her energy bill. The advert had a phone number to call and she had a mobile phone with her that she could have used at the time to follow up on the advert. However, she chose not to. This was partly because she had not fully articulated the nature of her query and the additional information she needed. In addition, she was already involved in researching a holiday at that time and so did not want the additional cognitive effort associated with gathering more information on some other potential transaction, either on the mobile phone or by following up with the web site that was also shown on the page.

4.2.3. Information seeking technologies

What this suggests is that, while there is a need for people to have more information to inform their decision making when an impulse is generated, designers must look beyond the simple notion of transferring bits of information from a content provider to a mobile device. While such a solution may be appropriate in some circumstances it is clearly the case that this will not support a large proportion of peoples information seeking behaviour in relation to consumer items. Technology services and solutions should look beyond simple in-situ information provision and look towards the broader ways in which information is sought and analysed in order to make informed purchasing decisions. An alternative possibility to straightforward in-the-moment access to information would be to offer the simpler notion of gathering tokens such as URLs that allow the information need to be recorded and remind the user to follow up for subsequent processing at more convenient points in time and with more information visualisation potential appropriate to the information processing task.

4.3. Decision making over time

Rather than characterising consumer behaviour in terms of a simple transaction, it is perhaps more useful to think about it in terms of a consumption narrative that grows from an

initial impulse seed to (perhaps) a final transaction. There are a number of features of consumer behaviour revealed through the deferred impulse data that point towards this characterisation as being more useful for our aims to inform design.

4.3.1. Awareness Building

An important characteristic of user behaviour was the general awareness building of what kind of products were available, general information about pricing, and where certain types of products could be bought for future reference when their impulse to buy was stronger. For example, one of the participants photographed an artwork in a shop window that had generated an impulse he had subsequently deferred. He commented on how he was not really ready to buy the picture but that it was nevertheless useful to know where in the city he would be able to buy something like that. This would allow him to revisit the shop at a more opportune time to make that type of purchase.

Such behaviour also included things such as looking through catalogues, brochures, magazines and leaflets. The general awareness generated and pre-purchase consideration was of value in that it could lead to faster and more appropriate physical purchases. It is also important because it presents a different relationship between the consumer and the retailer than that seen in the more goal-driven relationship of the transaction-centric model.

4.3.2. Mental wish lists

A common notion across all participants was that of a "mental wish list" of desirable and aspirational items that was created and added to as they went about their everyday activities:

"There is always a sort of list in the back of your mind of things you want to buy ongoing and you carry it with you when you go shopping ... and then the list gets bigger and bigger as you go along"

These items are non-provisioning items and not really considered as necessities, ranging from items that could realistically be bought, such as clothes, books and furniture, to more aspirational items, like expensive cars and houses. What characterises this list is that the intention to buy any of its items is not formed sufficiently to the point of being able to act upon them. Rather, they are candidate ideas to juggle around the mind until they receive more serious consideration. New items are added to the list whilst others gradually drop off it. A shifting process of prioritisation also takes place according to contextual factors and personal circumstances.

For example, limited availability can influence perceptions of priority of certain items. Along these lines, one participant had been considering buying two CDs for some time, one of which was more difficult to find than the other which he knew to be constantly

available everywhere. When he came across two items in a music shop that were on his mental list, he chose to buy the rarer of the two CDs because the opportunities for buying it were fewer. The knowledge of constant availability of the other CD actually caused him to defer buying it until a later date when he could afford another CD. It appears that impulses exist over a certain period of time rather than simply at singular points in time, and that their priority is as much dependent on their context as by immediate need.

The periods of time over which impulses are maintained in mind is important, both from a strategic and experiential point of view. To elaborate, mental wish lists served four key functions:

1) Mental wish lists allowed the participants to search around for products that better matched their criteria or were better value. This involved deferral of decision-making but where candidate possibilities are carried around for comparison. Participants recorded several examples of where they had deferred purchase because they thought it possible that the item of interest would appear in the sales.

2) Participants were aware of the nature of temptation and how they can be wooed into buying things, which, while considered nice, were not considered as necessities. For this reason, many of the participants employed a "cooling off" strategy where they would leave the shop to reflect more objectively on whether it would be an appropriate transaction. In this sense it was a self-test and an economic filter. If the impulse persisted after this cooling off period then it was more likely to be a sensible purchase choice.

3) Utilising a lengthy impulse period provided a participants with the ability to organise convenient opportunities for shopping around other activities such as work, leisure and domestic life. Provisioning trips, for example, were typically not organised around individual item needs, since this would not justify the effort costs of making a visit to the supermarket. Rather, they were based around waiting until there was a combined need sufficient to justify a visit to the supermarket. This involved an increasing scale of urgency, as more and more product quantities became low. As such, impulses arising at different points over a period of time needed to be collected together at a single point in time.

Whilst people occasionally used lists for the purposes of organising these impulses together, they were not really typical for common or habitual purchases but rather were used for unusual items. More typically, mental lists triggered the participants to go shopping when they got long enough - as if the 'stack' of items had reached a critical size.

4) Mental wish lists served as an enjoyable and interesting resource for people for possible

future purchases. The creation and updating of mental lists formed the basis of numerous pleasurable consumer related activities such as window-shopping and catalogue browsing. This also formed the basis of discussions with friends; these were of interest not just simply in terms of knowing what each other wanted, but also because of what they reveal about personalities and also how they reinforce group affiliations.

With certain key items on the mental "list", such as more aspirational items, participants would enjoy looking for more information on the product. The research behaviour in these instances could persist for long periods of time and was not really a question of finding out more information but was more of a "flirtation" with the product. The act of reading about the product, seeing images, hearing sounds related to the object were enjoyable activities in themselves and a way of getting "close" to a product without actually fulfilling the transaction.

Technology may be able to help with this flirtation behaviour by, for example, helping to locate the object in question or any information related to the object. What this emphasises is that it is important to look beyond simply the notion of transaction fulfilment, and is one that is an obvious candidate for support by the Internet and in particular the Web.

From a technological viewpoint, the use of mental wish lists shows that designers need to respect the role of this consideration time and not simply look to reducing the gap between impulse and purchase. Mobile technologies might have some role here by marking or capturing impulses and allowing them to be "Kept Alive" over time - revisited and considered in combination with additional information about the products that could be generated on, or collected by the device.

4.3.3. Time, place and event based shopping

Time, place and events play an important role in stimulating impulses and as reminders to act, as well as influencing the deferral strategies people adopt in order to manage their consumer behaviour. Understanding these strategies and how time and events shape consumer behaviour can be important for understanding some of the possibilities of handheld and ubiquitous computing technologies, in providing, for example, context dependent reminders and alerts to overcome awareness discontinuities.

Many participants described what might be called event driven deferrals. Essentially these were impulses that were deferred because their purchase was dependent on the occurrence of a particular event criterion or the approach towards a certain event. For example, one participant talked about an impulse to buy a new suitcase as a result of seeing something in a magazine. While the impulse was generated,

the participant wanted to postpone making a purchase until he was next going to be going away on holiday or business. While the participant was able to verbally articulate this reason, it was nevertheless something that was too abstract to be specified in a lightweight manner for technological interpretation.

The timing criteria guiding consumer behaviour was sometimes possible to specify precisely. For example, one participant talked about the need to do his annual car insurance by a certain date. This meant that he had until that date to gather as many quotes as necessary to make a decision. This date information is something that is easily interpreted by appropriate technology, and many personal devices already cater for this reminding function. However, there were many other time driven impulse deferrals that were less easy to specify. For example, one participant talked about an impulse to buy a new carpet for the house. However, she wanted to defer the purchase until some non-specific time in the future that was defined by her baby being old enough not to ruin the new carpet. So again, while this time criterion is something that is understood in human communication, the criterion is too non-specific for direct support by technology.

An unsurprising reason for deferral was due to a lack of financial resources at the time of the impulse. However, of relevance to this lack of financial resources was an example that may illustrate some interesting implications for mobile reminding systems. In this example, one of the participants talked of a CD single that she really wanted. Every time she goes shopping she has already bought something before she gets to the music shop and its only when she gets to the music shop that she is reminded about it.

What is interesting about this is that it shows that physical shopping activities can be linear in nature, and as a result creates a first-come-first-served approach to financial resource allocation. Purchasing decisions in these situations are made without reference to future purchase decisions because the prompt (in the form of the shop front) has not yet cued the impulse to make a purchase. The implications of this from a technological point of view are that reminders based purely on proximity to the appropriate retail store are not always the most useful. Contrary to our implicit hypothesis that the physical world is a more useful resource than the electronic world to consumer behaviour, the physical environment can (in particular instances) be a hindrance to effective purchasing.

4.3.4. Problem-Driven shopping

Sometimes, shopping is not driven by the demand for a particular product, but rather is problem-driven. That is, people are driven by the need to solve a problem rather than the

need to buy a specific product. In this respect, purchases are deferred until a product is seen that matches the criteria for the solution – shopping itself is a key part of the problem solving activity.

In an example of this, one of the participants had to buy some 'everyday' items to help her adult students to learn basic arithmetic skills. However, given her particular financial and educational constraints, there were no off-the-shelf items readily available for purchase. She said that she would have to wait until she "came across" something at the shops that she could make use of. The difficulty faced in these situations is that a solution to a problem is sometimes difficult to define and specify until it is seen.

This solution seeking behaviour applies to the experiential aspects of shopping as well. Shops were not just seen as places where particular transactions were made. Rather, certain shops were seen as important in their function as style determiners. The participants were looking to certain stores as defining ideas of what was important to own, and went to the shops with nothing but the broadest problem statement in mind, such as, "I need some new clothes". They did not know the solution beforehand but only recognised it when they saw, felt or heard it.

4.3.5. Co-dependent transactions

Product transactions could not always be treated as isolated incidents. Rather, the study provided numerous examples of purchases that were dependent on the purchase of other items or services:

Product-Product chain: A product-product chain is the notion that the value of a particular item to a consumer was dependent on the presence of another item. For example, one of the participants was thinking about his computer, which led to follow on demands for additional software and peripherals that would be necessary to make the most of the device. The product was of no value to him in itself until all components of the product-product chain were available or affordable, resulting in purchase deferral.

Product-service chain: The purchase of a product was occasionally dependent upon an additional service to be of value. One participant was thinking about buying some an outside light fitting but knew that neither she nor her partner had the expertise to be able to fit it. This meant that she would also require the services of an electrician, which added cost and inconvenience to the purchase decision, and therefore was deferred. Mobile technologies could be used to make these links more explicit, for example, by recommending appropriate services.

Aesthetic coherence: These chains applied in particular to transactions that involved some form of aesthetic choice, for example, home improvements such as doing up the garden. One participant talked about different types of garden furniture he was considering. He was unable to make a choice at that moment the impulse was generated because it was dependent upon broader design decisions associated with the garden improvements that had not yet been made. Support for this type of activity could be simply the collecting together of these ideas into functional groups whose coherence (as a group) can then be evaluated later.

Necessary co-presence of related objects: There were a number of instances where a product or service transaction would have been made if another item had been present at the time. One participant, for example, saw some eye-glass cleaner for sunglasses which he felt was a good idea but because he did not have his sunglasses present, he did not buy it. Similarly, when he was in the chemist he was reminded of the need to process a film (i.e. deferred purchase of a service) but could not do it there and then because he did not have the negatives with him. In terms of design, collecting a list of these desired products in a mobile device of some sort would be useful. This could be used to remind the user to take the related object when they were about to go out shopping again.

4.4. Thrift

The act of saving has been characterised as one of the most important activities in shopping (Miller, 1999). Indeed, thrift was one of the driving forces for several of the activities discussed in the sections above. Buy-one-get-one-free (BOGOFs) offers are one of the important ways of changing buyers intentions and as we saw in the study, this led leading to deferral on one product and a transaction on the saver product.

Here lies an opportunity for mobile technologies that could inform their users about the thrift characteristics of related products both within retail stores and across retail stores. Indeed, people in the study already would inform others that there were thrift opportunities in particular retail shops. An example of this involved the use of a mobile phone in a shop to call a friend, asking if she wanted her to buy any of the offer items on her behalf. So, there is evidence that people already find it valuable to be informed about this kind of thrift potential, which suggests that there may be an opportunity here for further directed innovation in this area. Data from the study provide several examples of how strategies for thrift were achieved.

4.4.1. Substitution

Transaction impulses were deferred for some items because of the existence of substitute items or workaround solutions. Related to this was the practice of “making do” where participants would put up with a currently unpleasant or irritating state of affairs.

For example, one participant talked about her set of taps in the bathroom, which required a great deal of force to turn on because the thread almost worn away. She said that they really needed a new set of taps but had not yet bought them because they were still able to use them. Related to this was the high cost of fitting a replacement and the problem of a lack of knowledge about how to do the replacement herself. Her expected solution was to wait until her in-laws visited, as her father-in-law would be able to help. In terms of technology, there is an opportunity here for a similar solution to the *product-service chain* in which product related services can be recommended, or through collecting ‘bookmarks’ to items seen in the shops to show to knowledgeable others and to gather opinions as to their appropriateness.

4.4.2. Value comparisons

Price comparisons were a common and obvious thrift related reason for deferral of transaction impulses. Many participants would search around multiple stores for the equivalent items to check which was the best value for money. This kind of behaviour applied at the level of individual items but also at the level of the retail store, with certain stores known to be generally cheaper. A common strategy used by the participants for this was to compare catalogue prices against shop prices before they committed to a purchase.

There are already examples of mobile Internet technologies that aim to support this kind of need such as the Pocket Bargain Finder. The findings however suggest that much of the comparison behaviour that people are adopting goes beyond simple price comparisons. Rather, in many instances, the comparisons people are making are somewhat more multidimensional than simply price alone. For example, one participant wanted to buy a new set of ladders. He visited a number of different DIY shops within close proximity to each other in order to compare their different offerings. He looked at price as well as attributes such as size and perceived quality of the materials being used. As such the comparisons were more about best value for money rather than simply about the one-dimensional attribute of price. This suggests that mobile product comparison should look to explore additional product attributes over and above price and allow

exploration of a broader range of equivalent and similar items.

4.4.3. *Waiting for sales*

Part of people's thrift strategy seemed to involve waiting for sales. Many of the participants talked about impulses that they had to buy but thought they would wait until the item became available in a sale. Sometimes it was specific items that they would see before the sales that had begun but that they were not prepared to pay the marked price. As such they took a gamble that the item would become available in the sales in which case they would be more likely to purchase it.

Mobile technology could be used here to inform users about items being put on special offer or appearing in a sale, for example by receiving an SMS message about it. This could be implemented in a number of ways. In one scenario, the approach taken by Letsbuyit.com, in which people club together and bid at lower prices than those offered - when the number of people exceeds a set level, they are able to buy the product. This could be done at a physical level, rather than on-line over a static web terminal. In another simpler scenario, the user could simply electronically 'tag' the product so that if it became available, they would be alerted to return to the store.

Summary and Conclusions

In carrying out this study, the aim was to develop an understanding of shopping and consumer behaviour from the perspective of the user that would allow us to critically assess opportunities for handheld and ubiquitous computing technologies and services in support of the shopping experience. In particular, we were interested in understanding the potential for integrating this technology with objects and places in the physical world.

The evidence derived from the study would suggest that there are opportunities for these technologies and services. Impulses were generated by objects while out shopping, as well as locally in the home environment. The reasons for deferral elicited by the study point to potential areas for mobile devices and services to overcome these deferral reasons. But some caution must be applied to this conclusion. The relationship between stimulus objects and intended actions has been shown to be hugely varied and complex. This relationship is potentially a double-edged sword from a technology perspective. On the one hand, connecting objects and locations in the physical world to the vast information and services resources of the Internet would seem to be ideal for providing the flexibility and tailorability to address this variety of relationships. But on the other hand, it is this need for flexibility that introduces complexity

into the interaction. This may ultimately destroy some of the directness characterising typical usage scenarios of technologies that allow access to the digital services via interaction with physical objects.

While we have concluded that there are possibilities for handheld and ubiquitous computing technologies in this domain, we would want to argue that these perhaps lie within a different area of the design space than the kinds of applications we have seen emerging in the research community. In our opinion, the data suggests that perhaps too much attention is being focussed on trying to provide mobile support for those aspects of shopping and consumer behaviour related to the in-the-moment transactional aspects of shopping.

What we have seen in the study are important areas of shopping behaviour that are receiving less attention but which might ultimately be a more important part of the space within which to develop handheld technologies and services. Broadly speaking, these areas are more about non-transactional experiential values and the strategic ways in which people organise and think about their shopping behaviour, and the ways they manage time and resources in relation to other aspects of their lives.

More specifically, the findings have suggested that handheld and ubiquitous computing technologies and services may lie outside the characterisation of shopping and consumption as an individual activity. Rather, what may be more important to consider are the collaborative and social aspects of shopping and consumer experience. Thus, we would encourage technology and service innovation in areas that enhance the experiential aspects of communication, information sharing, social grooming, co-ordination activities, social norming and collaborative filtering.

We have also seen how there are important opportunities for information provision in support of shopping behaviour. However, in contrast to the assumptions embodied in current discourses about mobile information services, the study has highlighted the importance of information *use* as the key component to shape technology and service design rather than the simplistic notion of bit transfer from service provider to mobile device. When thinking more broadly about supporting mobile consumer behaviour in this way, we were able to, for example, identify 'bookmarking' of the environment as a possible variant on the traditional information-in-the-moment model underlying current mobile services in this domain. This variant would not have been possible to identify as a possible area for consideration without this shift in perspective.

We have highlighted the value of not viewing impulses as simply pinpoint phenomena existing at single points in space

and time. The 'pinpoint' perspective underlying many existing technologies and services has tended to emphasise the need to act in-the moment and the need to reduce the intention-action gap. What we have shown is that by viewing impulses as phenomena that exist over a much larger time and space window, we can open up a new area of opportunities for design. These relate to the need to nurture impulses in interesting and pleasurable ways, as well as supporting the strategic aspects of shopping.

It is also important to recast out notions of shopping away from a purely product-centric focus to a more goal-centric focus. That is, it is important to focus more on what the user is trying to achieve through their shopping and consumer behaviour - what are the problems they are trying to solve, and what are the values they are trying to attain, rather than what are the products they are trying to buy?

Further it does not always make sense to consider consumption items purely in terms of individual transactions. Rather, there are areas of the design space that can be considered by looking at the interrelatedness of desired items. How one purchase decision is affected by another purchase decision and how consumption possibilities are juggled in response to changing needs and limited resources. Again this would seem like an ideal area for support by the vast interconnected informational resources of the Internet.

Finally, what emerges from the study is that thrift, which was a driving force for much of the consumer behaviour observed, is achieved through several strategies, and is currently heavily dependent on purchase deferral. Mobile technology can provide either mechanisms to support thrift without deferral, or to support a delay but in a way that the deferred impulse is not lost.

In conclusion, what we have demonstrated are a number of key aspects of user behaviour and values in relation to shopping and consumption. In doing so we hope to offer a new set of perspectives and directions to be considered by designers of handheld and ubiquitous computing technologies and by services providers in the domain of shopping.

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Table 1. Table of occupation, age, gender, marital status and social status of the participants

Occupation	Age	Gender	Family status
Teacher	27	F	Cohabiting with partner
Design Engineer	29	M	Engaged - partner lives away
Sixth former	17	M	With Parents
Retired	61	M	Married with adult children
Sixth former	17	F	With Parents
Teacher	28	F	Married plus young child
Secretary	31	F	Parent, living with partner
Technician	32	M	Living with partner
Young professional	29	F	Living in shared house
Unemployment adviser	49	F	One child-adult living with partner
Graphic designer	31	M	Living with partner - no children
Voluntary worker	17	F	Single/ living alone in shared house
Community worker	35	F	Single parent living with child
Mature postgraduate student	28	M	Single
Housewife	60	F	Married
Electronic Engineer	29	M	Single

Fig 1. Graph of locations for deferred impulses.

