Structuring dependable on-line services: A case study using internet grocery shopping

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ABSTRACT

Whilst we are entering the era of the silver surfer, there are still many older people who do not have access to internet-based services. Grocery shopping via the internet, for example, is potentially very useful to older people with mobility problems. The standard model of internet shopping involves a do-it-yourself (DIY) approach; an alternative approach is to get someone else to do it for you (GSETDIFY). The GSETDIFY model has been implemented by the Net Neighbours scheme with the aim of providing social support and human contact with a volunteer. The DIY model and Net Neighbours implementation are compared and contrasted here in terms of how their structure affects the dependability of the service offered. Whilst the Net Neighbours structure is necessarily more complex, as it involves more stakeholders, it has been possible to achieve a high level of dependability by drawing on these stakeholders as additional resources.

Keywords

Structure, dependability, socio-technical systems, age concern, internet shopping, shopping by proxy

1. INTRODUCTION

While there has been much talk about so-called silver surfers—older people who regularly use internet services—there is still a proportion of older people who do not have access to the internet and the services that it can provide. This paper focuses on access to internet services, focusing in particular on internet grocery shopping, and how these services can be accessed by older people whether they have direct access to the internet or not. More particularly it compares and contrasts the dependability of what many would regard as the standard way of internet shopping with the more complex structure of an indirect method in which the internet access is provided by intermediary volunteers.

In section 2 the basic process of grocery shopping is described, before going on to consider two possible alternative mechanisms for grocery shopping over the internet: personally (i.e. directly), or via an intermediary (i.e. indirectly). Our main concern is with the second mechanism and how it can be implemented in practice to provide a service that is dependable (reliable, available, safe and secure). Section 3 describes Net Neighbours, a pilot scheme in York to designed to support indirect internet grocery shopping. This scheme adds intermediary stakeholders between the purchaser and the on-line shop. The relationships between these stakeholders need to be carefully monitored and, where appropriate, controlled if a dependable service is to be provided. In section 4 we consider the dependability issues of Net Neighbours and compare it to the direct internet shopping approach. In section 5 we discuss how explicit management of the extra organisational structures needed for the indirect shopping provide support for not only the shopping itself but also support other desirable consequences, for example social interaction for the older shopper.

2. GROCERY SHOPPING

The basic task of grocery shopping is simple when viewed at a high level of abstraction. It is simply a matter of:

1. Decide what groceries are required
2. Select the groceries
3. Pay for the groceries
4. Get the groceries home
5. Put the groceries away

This simple model also applies to internet grocery shopping with the difference that item 4 is carried out by the supermarket rather than the customer. If one views internet grocery shopping as a service, then the way in which that service is implemented will affect the dependability of the service. Here, two ways of implementing internet grocery shopping are described.

2.1 DIY INTERNET GROCERY SHOPPING

In the do-it-yourself (DIY) approach to internet grocery shopping, the customer is the person who decides what groceries are required, places the order by selecting the groceries from the supermarket website, and pays for the groceries using the supermarket website. There are some other subtle nuances to the process, however. The structure of the service is described as a Hierarchical Task Analysis(HTA) in Table 1.

In order to be able to order groceries over the internet, customers have to first register with the supermarket, by setting up an account. This will require the use of an e-mail account. This can be quite a hurdle if the customer is unfamiliar with online shopping as there is no equivalent in bricks and mortar shopping.

As part of the process of placing the order, the customer has to select a time slot in which the groceries should be delivered and must then pay for the order, typically with a credit card. The customer is sent a confirmation of the order by e-mail. The customer's credit card is debited by the internet supermarket and the order is collated and dispatched from a local supermarket. The groceries are then delivered to the customer, sometime during the

selected time slot (depending on the supermarket, this is usually a 1-hour or 2-hour slot). The customer then accepts or rejects any substituted items (if an item is out of stock, most internet supermarkets will substitute it with a similar in-stock item). Any rejected items are returned to the delivery driver. The driver is responsible for informing the store that the rejected substitutions have been returned and the customer's account should be credited. It is the customer's responsibility to ensure that the order is complete and correct and to check that the value of any missing items are credited back to their payment method, e.g. back on their credit card account.

Having summarised the structure of the service as an HTA it is then possible to list points where the service could go wrong, these can be thought of as exceptions.

1. Register with supermarket (provide personal details)
2. Shop on line
   2.1 Decide what groceries are required (shopping list)
   2.2 Select groceries (online)
   2.3 Select delivery slot online (online)
   2.4 Pay for groceries with credit card (online)
   2.5 Be in to receive groceries
   2.6 Check groceries and return unwanted substitutions/error
   2.7 Put away groceries
   2.8 Check credit card account against receipt
   Plan: 2.1 then 2.2 and 2.3 in any order, then 2.4-2.8 in that order

Plan: 1 only once, then repeat 2 as necessary

Table 1. HTA summarising structure of DIY service.

Cannot understand purpose of or jargon in 1.
Do not have email account for 1.
No suitable delivery slot available for 2.3
Do not have credit card for 2.4
Forget or unable to be in for 2.5
Delivery does not arrive on time for 2.5
Essential items not delivered in 2.6
Apparent error in 2.8

Table 2. Possible exceptions for an older person using such a service

2.2 GSETDIFY INTERNET GROCERY SHOPPING

The main benefits of internet grocery shopping, namely time and effort saved, as well as time and place independence [1] should make it an attractive means for people with limited mobility such as the elderly to do their grocery shopping. But according to [2], the proportion of people aged 65+ who shop online is relatively small – 1.7% in the US and 0.9% in Belgium (based on surveys in 2001). There are many reasons behind this, and the most frequently quoted ones are the difficulty with the interface and the lack of internet connection.

Get-someone-else-to-do-it-for-you (GSETDIFY) internet grocery shopping is an approach where an intermediary is used to insulate the customer (the elderly person) from the complexities and technical difficulties of internet exposure or when the customer does not have access to the internet. The intermediary facilitates the internet interaction of the DIY approach. This GSETDIFY approach is best illustrated with an example: the next section describes the *Net Neighbours* internet grocery shopping scheme that has been set up with *Age Concern, York* (ACY). The motivation behind the design of this service was to provide social contact at the same time as a shopping service. Neighbours scheme provides a socialising opportunity by establishing a befriending relationship between the volunteer and the client. Isolation is a major problem for older people, and for some the opportunity to get out and shop is an important opportunity for social contact [Blythe reference].

3. NET NEIGHBOURS

The Net Neighbours scheme [3] enables older people in the York region to effectively shop on-line without direct access to a computer. The scheme uses volunteers to act as an intermediary to on-line shopping at the main supermarkets based in York. The older people (customers or clients) are chosen by ACY [4].

In the Net Neighbours scheme the customers decide what groceries are required, the volunteers select the groceries from the supermarket website, and the customers pay for the groceries albeit indirectly (the volunteers pay the supermarket; the volunteer agency refunds the volunteers; and the customers pay the volunteer agency).

The stakeholders (client, agency, volunteer and supermarket) in the Net Neighbours scheme are separated in space and time. This makes the structure of internet grocery shopping more complex. In particular, the financial transactions that take place are more difficult to track, because it is no longer simply the case of the customer directly paying the supermarket.

3.1 Registering the volunteer

Currently volunteers are drawn from the *Active York* scheme [5]—this is a scheme that encourages staff and students at York University to contribute actively to the local community— they are put in touch with ACY. ACY then carries out the necessary background checks on the person, currently by taking up references. Once these are complete, the volunteer undergoes training from ACY. The development worker from ACY sets up the database so that it can be accessed by the volunteer.

3.2 Registering the client

There are two stages to registering the client. The first is that the client registers with ACY. Once this is complete, the development worker from ACY selects an appropriate volunteer who will act as the client's shopper. The development worker contacts the volunteer to pass on the relevant information about the client. A meeting is then set up between the development worker, the client, and the volunteer, which may simply be a telephone conference.

Once the meeting has taken place, the second stage is for the volunteer to register the client's details in the database. In addition to a standard pro forma, the volunteers can add notes which provide snippets of information about the client, such as the fact that they are expecting to have a grab rail installed on a particular date. This information can be used by the volunteer when talking to the client on the telephone, making the process more engaging for the client.

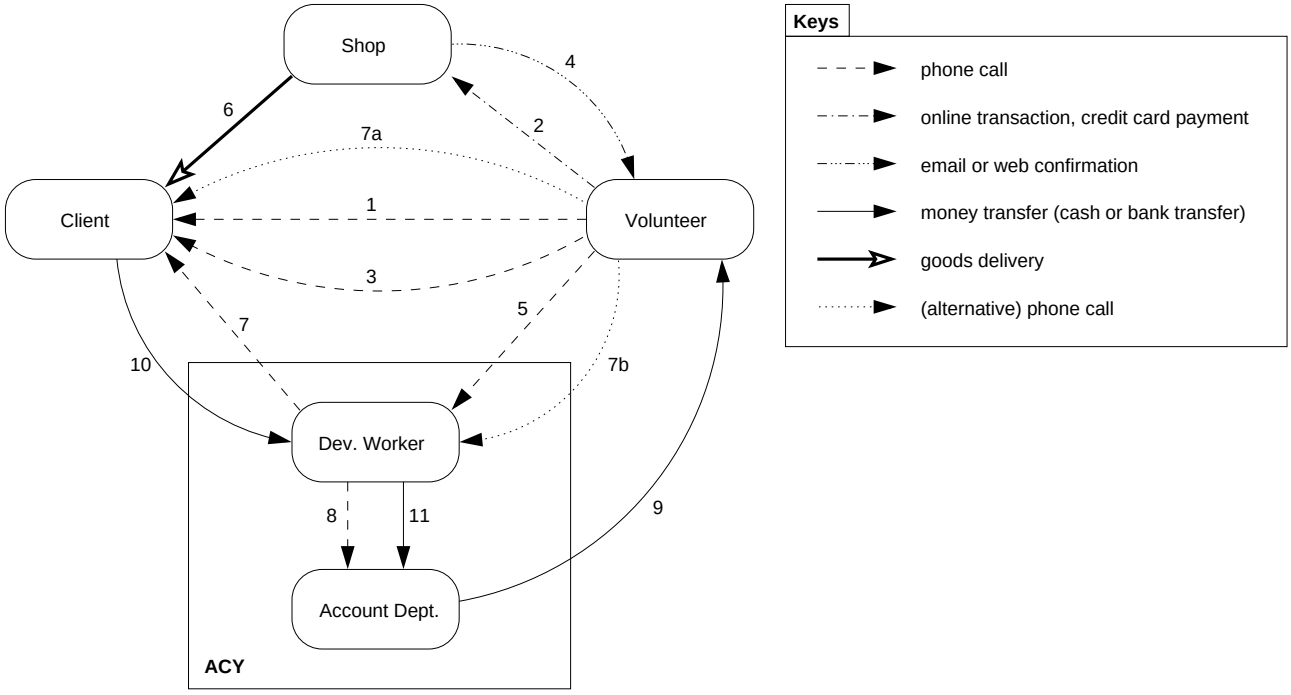

Figure 1: The GSETDIFY Internet Shopping Model as implemented in the Net Neighbours scheme

3.3 Placing first order for the client

Before the first order can be placed, there are several things that need to be set up by the development worker. They have to establish a free e-mail account (hotmail, yahoo etc.) for the client (if the client has an existing account, this should not be used, because the new account may need to be accessed by the volunteer). The development worker then accesses the client's preferred supermarket web site and sets up an account for the client using this new e-mail address.

3.4 Placing an order, delivery and after delivery of an order

The volunteer can then go ahead and place the order by carrying out a sequence of steps. The process is encapsulated in the HTA's below. This time the stakeholder(s) involved in each task have to be specified. The nature of these dependencies is also captured in Figure 1 where each of the numbers in the figure corresponds to a task step in Table 3.

1. **DW** Register Volunteer
   1.1 **DW** Get references
   1.2 **ACY** Train volunteer to work with older people
   1.3 **ACY** Train volunteer to use service
2. **DW** Register client with supermarket
3. **DW** Match volunteer to client
4. **DW, V, C** Introduce Volunteer to Client
5. **V, C** Shop on line
   5.1 **C** Decide what groceries are required (shopping list)
   5.2 **V, C** Select groceries (online)
   5.3 **V, C** Select delivery slot online (online)
   5.4 **V** Pay for groceries with credit card (online)
   5.5 **V** Send order details to development worker
   5.6 **V, C** Agree time for next call
   5.7 **C** Be in to receive groceries
   5.8 **C** Check groceries and return unwanted substitutions/error
   5.9 **C** Put away groceries
   5.10 **C** Send receipt and cheque to ACY
   5.11 **DV** arrange with accounts for volunteer to be reimbursed
   5.12 **V** Check credit card account against reimbursements
   Plan: 5.1 then 5.2 and 5.3 in any order, then 5.4-5.10 in that order, 5.11 and 5.12 when available
6. **ACY** Audit payments and receipts

Plan: 1- 4 only once, then repeat 5 and 6 as necessary,

Table 3. HTA summarising structure of GSETDIFY service.

4. DEPENDABILITY MATTERS

Jones and Randall [6] define dependability as "*…the ability to avoid service failures that are more frequent and more severe than is acceptable to the user(s).*" Here we broaden the definition slightly to make it apply to the stakeholders, rather than just the users. The main reason for so doing is that there are some stakeholders who may be affected by the service even though they do not directly use it. In the case of the Net Neighbours scheme, there are several stakeholders, and each of these will have a different view of the factors that contribute to dependability of the service. In other words, each will have different views on what are acceptable service failures.

Table 2 in Section 2.1 listed "exceptions", things that could make the DIY service not dependable from the point of view of the customer. It was obtained by systematically working through the structure characterised as an HTA in Table 1. The same thing can be done for the structure of the HTA for the GSETDIFY service as characterised as an HTA in Table 3, only this time three sets

for exceptions are generated, one for each of the stakeholders mentioned. Note, we have not considered the role of the supermarket, credit card companies and so on, in this analysis as it is assumed that they have their own procedures to ensure dependability that will not be compromised by the service.

No suitable delivery slot available for 5.3
Forget or unable to be in for 5.7
Delivery does not arrive on time for 5.7
Essential items not delivered in 5.8
No bank account for 5.10
Volunteer does not ring when agreed for 5.
Insensitive volunteer upsets client in 5.

Table 4. Possible exceptions for the client using GSETDIFY service

No suitable time for next call for 5.6 (e.g., on holiday)
Delay in reimbursement or apparent error in 5.12

Table 5. Possible exceptions for the volunteer using GSETDIFY service

Volunteer does not ring when agreed for 5.
Essential items not delivered in 5.8
Client does not return payment or receipt for 5.10
Insensitive volunteer upsets client in 5.
Payment error or delay causes volunteer to resign in 5.
Apparent error in audit for 6.

Table 6. Possible exceptions for the development worker and ACY using GSETDIFY service

Tables 4-6 give the possible exceptions for the three stakeholders mentioned in Table 3 (ACY and DV are put together for these purposes). Note that the number of exceptions for the client is reduced by one and the total number of exception not greatly increased. This section discusses how these exceptions are handled to ensure a dependable system.

The introduction of more stakeholders into the system in the Net Neighbours scheme creates dependencies. In the pilot scheme, the first clients were people who were part of the ACY hospital aftercare scheme. One of the conditions of early discharge from hospital is that the clients are able to fend for themselves. This includes the ability to be able to carry out everyday tasks, such as grocery shopping. The Net Neighbours scheme was seen as one way of fulfilling this condition. The introduction of the extra agents adds to the complexity of the structure, however, in that there is now much more communication required between the agents. There are also issues of trust that are raised, through the dependencies.

ACY, who have overall responsibility for the GSETDIFY scheme implemented by Net Neighbours service, have taken two measures to ensure that the service is viewed as dependable by all the stakeholders. The first is to define the role of the development worker in such a way that she can sweep up a lot of the exceptions. The second is through selection and training of the volunteers.

Clients and volunteers are encouraged to see the development worker as the first person to contact if something goes wrong, and there is a dedicated answer phone line monitored throughout the day. Thus if the volunteer does not call, the delivery is not on time or there are essential items missing the development worker can sort out the problem for the client immediately. On the rare occasions when the client has no bank account, the development worker can call to collect cash. When the volunteer is unable to make the call the development worker can step in.

Volunteers go through the standard Age Concern training for volunteers which explored the issues of ageism and other stereotypes we all have. This is designed to make volunteers sensitive to the problems older people have and can also act as a (self) selection measure. Volunteers are also required to provide character references. It has to be said that weeding out unsuitable volunteers is much less of a problem than getting a suitable number of volunteers in the first place.

5. DISCUSSION

The previous section highlighted the fact that even though the service being provided by the two different schemes is ostensibly the same, the dependability of the two implementations of the service has a different structure. What is important, however, is that the Net Neighbours implementation should be at least as dependable as the DIY scheme. Through an analysis of the structure of the service using hierarchical task analysis it was possible to identify exceptions, points in the structure that made its dependability vulnerable. We were also able to identify how the Net Neighbours Service has handled these exceptions by defining the role of the development worker and by the training and selection of volunteers.

The key part to the Net Neighbours scheme is the role played by ACY. They provide the volunteers and administer the scheme, making sure that clients and volunteers are meeting their requirements. ACY are experienced in these areas, and already provide a manual shopping service to clients as part of their hospital aftercare scheme. They are also used to carrying out checks on volunteers and provide training for them. Furthermore, they have experience of administering other financial schemes which they have to internally audit, since they are a non-profit making agency. The dependability of the service therefore hinges on the role played by ACY as administrators.

The structure of the Net Neighbours scheme offers some benefits over and above those provided by the DIY scheme. Grocery shopping can be one of the few social activities still available to some older people, so when they are unable to do their own grocery shopping they can become socially isolated. The DIY scheme reinforces the isolation, because the older person does not need to talk to anybody to order their shopping; on the other hand, it does mean that they retain their independence. The Net Neighbours scheme, however, incorporates a socialising activity, in that the volunteers, as well as taking the client's grocery order, chat to the clients about more general matters [8].

6. FUTURE WORK

The GSETDIFY model that is implemented by the Net Neighbours scheme could be used for other shopping purposes. The scope could be extended to include shopping for books, for example, or adapted to provide access to on-line services, such as train timetables. At present the scheme is being piloted using

volunteers from the University of York. There are plans in hand to extend the scheme to cater for more clients, using volunteers from other local businesses. There are some limitations on the size of the scheme, based on ACY's scheme of having a maximum of two clients per volunteer.

The Net Neighbours scheme as it currently stands uses a single implementation of the GSETDIFY model. Another possible implementation is where the person placing the order is a friend/relative who physically visits the older person to place the order and helps with the driver interaction on delivery day. This would mean a change to the structure of the system, so some further work would be required in order to assess how this affected the overall dependability.

7. SUMMARY

The standard model of internet grocery shopping involves a DIY approach. There is an alternative, however, which is the GSETDIFY approach. This alternative approach uses a proxy shopper to order the groceries. Whilst the alternative approach (which can implemented in at least two ways) is more involved, the Net Neighbours scheme shows that a judicious choice of the structure of the system can result in a grocery shopping service that is as dependable as the DIY method. In the Net Neighbours scheme much of the structure is provided by people, rather than technology. This does raise other issues, however, which means that the key to dependability lies in the way that the overall service is administered.

As the baby boomers approach retirement the demand for services like on-line grocery shopping looks likely to expand, and on-line retailers cannot afford to ignore this expanding market sector [8]. The Net Neighbours scheme offers an alternative way of providing such services in a dependable way.

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