

Towards an Ethnographic Study of Information Appliances: The Case of LG Internet Refrigerator

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ABSTRACT. This paper presents a technique for evaluating usability and effectiveness of information appliances, focusing on domestic technology in home – the case of Internet Refrigerator, from LG. The paper briefly describes the methodology approach to gather data, an ethnographic study including a technology biography, outlining key design implications, and presenting potential suggestions, which are intended to inspire or provoke designers. In addition it helps provide a background too the “new usability” studies agenda.

1 Introduction

As new technologies penetrate our lives at an increasing rate, we no longer know what functionality to expect from our refrigerator, our television, our car, our heating control system, etc. Unfortunately, present usability engineering methodologies provide little support in understanding how “use” develops right from the first meeting with the whole product till we later discover small facets of the technology and more importantly how this development in use may be supported by the design of the technology [PMK02].

Considerable effort has been invested towards making homes and appliances “smart”. Often this means that an appliance is networked to other household appliances or Internet. Many now available appliances such coffee machines, electric blankets, alarm clocks and refrigerators are able to share data in users’ homes and even place orders for food items [Boh02]. Also, modernity has witnessed the manifestation of consumer culture as a major shaping force for social structure and it is frequently judged by its ability to sustain desired ways of life and meet perceived expectations. The

consequence of this is that home appliances that were previously considered plain and utilitarian, become entertainment devices [RKM03]. The widespread adoption of Internet and mobile telecommunication technologies has triggered a seemingly transformation to the design of consumer appliances and it becomes paramount that for an effective design it is important to employ multidisciplinary expertise. This concludes that some information appliances are examples of a design philosophy approach that subjects “aspects of utility” to “aspects of intellectual pleasure” [Boh02].

In this paper I concentrate on the user interface and usability goals of crossing a fridge with a computer. The case is the “Internet refrigerator”¹ - a new product developed by Ericsson and LG (Electrolux), the two leading companies in telecommunications and electric appliances. The purpose of this paper is to discuss the Internet Refrigerator in terms of a usability evaluation and a potential improvement process, and they will be addressed in the following sections.

2 LG Internet Refrigerator

The product is designed to connect this hub of the household to a vast matrix of information and entertainment available through advanced multimedia-computer technology. The unit is designed to be more than simply a computer mounted onto a refrigerator door, but is intended to act as a residential gateway to the home.

The 26-cubic-foot refrigerator features a high-quality, 15.1-inch TFT-LCD display and its own LAN port to enable high speed Internet surfing and shopping. According to producer, the interface is designed for ease of use as showed Figure 2.

The refrigerator comes standard with a remote control for easy operation of its computer/television functions from any location in the kitchen. “LG has been refining the concept of 'smart' appliances for many years now”, said Simon Kang, president of LG Electronics, U.S.A., Inc. "Until recently the kitchen and home computer were kept in separate rooms in most households. While the Internet Refrigerator is not meant to take the place of the home computer, it does bring multimedia technology and Internet connectivity into the kitchen - the centre of home and family activity. The features are presented in Appendix and include [Ele04]:

¹ A similar product, Mealttime pilot from Home Alliance, is about to come on the market, available at: http://www.internethomealliance.com/pilots_projects/family/mealttime_pilot.asp.

By looking at the description of the product more customers may ask themselves: “Why do we need such a home appliance?”. However the intended purpose of the producer is to create a residential gateway. The plan is to take what for many is the “analog” version of the family server, the fridge (where we leave notes, hang pictures, and so on), and literally turn it into the home's hub. With a computer in the fridge's door, people will be able to achieve most of the tasks described before by using this appliance. However a lot of questions may be raised if the product has achieved its design goals and associated usability criteria. In the following sections I try to define a set of design goals and possible ways of conducting usability evaluation for this intelligent home appliance. Further I will try to describe an improvement scenario in case the product will not achieve its designated goals.



Figure 1.
LG Internet Refrigerator

3 Usability Evaluation

An interface has good usability if it can be learned quickly, is easy to operate and can be remembered [Sut95]. Usability testing process and assessments of usability may serve a number of different purposes and the purpose of a given evaluation determines the kinds of tasks, tests, performance measures and attitude scales, interview surveys, the designer or evaluator may decide to use. But today, the “appliance computing” paradigm presents immense challenge for traditional usability. What appliances represent is how computers are finding their way back toward being things that fit our physical, embodied nature, rather than only operating in the realm of symbolic processing [TMR02]. For an approach such as usability engineering, this presents considerable challenges. Usability is becoming a central issue in the design of a vast range of technologies, particularly handheld and mobile personal systems used away from the office, and in the new application scenarios, particularly Internet-based applications accessed from the home and the community [TMR02].

Established usability engineering methods and methodologies are “ill-suited” to these emerging technologies and application, and to the business

contexts in which they will be developed and applied to the market. Also the user is increasingly replaced by the “digital user or consumer”, and the existing usability paradigm is unable to handle all these complex definition and facets of new applications and appliances [Tre98]. Drawing from these potential problems associated with usability evaluation, I propose a method to conduct usability evaluation for LG Internet Refrigerator.

3.1 Design goals

Looking at various other studies done previously for ubiquitous computer or home appliances [MCSU00], I would approach in a similar way the usability evaluation for the Internet Refrigerator. The major goals of conducting a usability evaluation would be to understand if the product would be integrated into household activities and how the users’ access and use of refrigerator will differ from using a personal computer, or their normal and natural way of doing these activities apart from using the Internet Refrigerator.

Before presenting the description of the study, I’ll focus on defining some design goals with respect to LG Internet Refrigerator as major drivers of the usability evaluation. Usability criteria could not be defined as the author did not have access to a fully-functional product, only an online demo from <http://www.lginternetfamily.co.uk/fridgedemo.asp>. The following design goals are about to be tested in the study:

- Menu should be easy to navigate through
- The ability to perform a set of tasks must be based solely on consulting the user manual and help.
- Screen should be located at a height accessible for people with different age and size - it is the right height and would a person be able to stand there for long periods of time, when checking emails or browsing Internet?
- The menu should be easily interactive and without too much maintenance required when entering new or update data (i.e. groceries to be added, or update the details of existing products).
- The receiving messages function should be effective and alert in a way people when new messages are left, and users are not around the refrigerator.
- The time spent using the refrigerator for diaries and memos instead of post-notes must be considerable less than using the old-fashioned way.
- The time spent using the Internet Refrigerator must be shorter than adding-up times for the functional tasks done in “analog” way.

- The refrigerator should be an enjoyable and helpful device to be used.

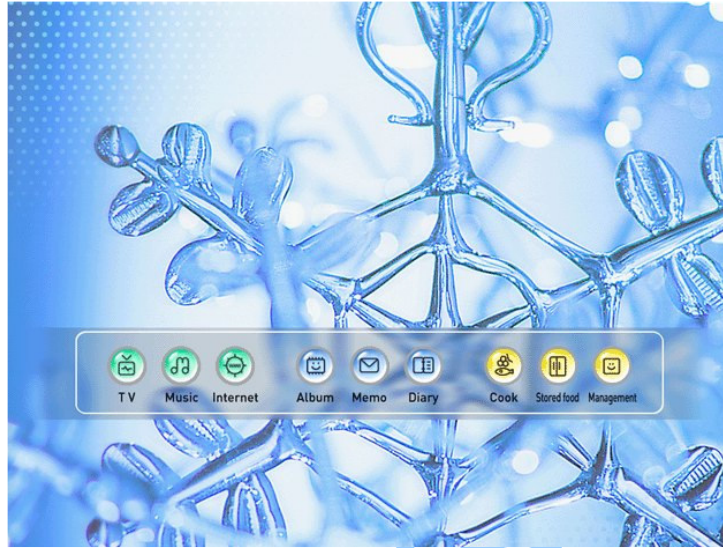


Figure 2. Main navigation menu

3.2 Usability study

The proposed method study will involve the use of ethnographic and other usability methods to understand how the appliance will work in a real environment with real users, based on a previous study [MCSU00]. I choose this method because it is very useful in getting a deeper understanding of the uses and limitations of domestic technologies or appliances especially when a new product is still in development or just launched on the market. Although, ethnographic studies are used in pre-development phases, I would consider appropriate, especially when the product is new on the market and will serve for later design improvement. The study will consist of a mix approach: a technology biography [BM02] part of the ethnographic study and task-based scenario laboratory testing. Conducting such a mix approach will ensure that both qualitative and quantitative data will be available, and provide better insights and more accurate usability diagnostic.

Selecting the participants would be mainly based randomly from a sample of Internet broadband or cable subscribers, who have at least one PC at home, located in various suburbs of the city. The households are checked for family compositions, level of experience with PCs, and type of dwelling. The households will vary demographically: with or without young or adult

children. Households' income are important to be high enough as the appliance is an expensive one, probably within a range of more than AU\$50,000. This is because participants can have being against the refrigerator, as a result of their inability to buy it). A set of 15-20 households would be appropriate.

Firstly a Technology biography will be conducted, designed to generate critical and creative responses to questions of home technology development and focuses on past, present, and possible future domestic products. It helps in identifying past development and historical trends that are of personal importance to the respondents; current uses, problems and concerns; and, by implication and elicitation, desirable future developments. Usually it includes the following elements:

- Technology tour – where participants show the researcher around their home;
- Last time questions – adapted from the Critical incident method (i.e., when is the last time you really enjoyed a domestic task);
- Personal history interview – focusing on the technologies and routines that participants remembered from their past experiences with refrigerators, phones, answering machines, messages left on papers, computers, or tell us what are the tasks they really do when in the kitchen etc. Interviews will cover topics about family dynamics, household schedule, activity mapping of the home, as well as specific questions related to the use of technology in home, TV, Internet, refrigerators, answering machines.

The purpose of conduct this first step is to identify what are users domestic habits, what they like in using current devices, what would they expect for improvement and also identify the next participants in ethnography study. Some examples of outcomes may be: “I would prefer to have a device that offer me the possibility to leave messages when I’m in the kitchen, as I spent most of the time there” or “Personally I wouldn’t have such a refrigerator, because I don’t think does the job I want”.

The continuing participants will be selected from the technology biography and/ or adding new households if some of the previous ones are not interested in continuing the study. It will consist of conducting the ethnographic trial study by providing households with LG Refrigerator for a period of time of approximately 3-4 months. It will also include the trial followed by in-depth post-trial semi-structured interviews² (around 3-4

² If new participants are included, a similar pre-trial interview with these new ones will be conducted as well.

hours in total, with some potential questions are presented in Appendix). The description of the way the study will be conducted is explained below.

3.3 Data collection

To calculate the actual use of Internet Refrigerator and an existing PC in the household, a computer tracking program will be used. This program will save information in a central database, and will record the captions and start/stop times of active windows, as well as the tasks executed on the windows. Also a video-camera will be installed in households' kitchens to track participants' actions. Participants will start tracking the usage on their primary PC for two weeks before receiving the Refrigerator and will continue throughout the trial, as well as the video camera will start recording their habits of using the refrigerator, using cook books, leaving notes on the fridge etc. This is because we need to understand participants' behaviour and habits before and after having the new appliance. At the mid-trial, the data will be collected and analysed in order to build the post-trial interviews. Also the tracking data at the end of trial will be collected for a complete picture.

When the refrigerator will be delivered, a brief demonstration will be performed. Participants will be required to use the refrigerator for 15 minutes after, while their actions will be observed and they can ask a limited number of questions about major functionalities. Participants will be asked also about their first impression and reaction to the device. Throughout the trial, participants will be asked to take photographs when the appliance is considered to be the major performer in the house (parties, etc.), plus the way of collecting extra data as required via some alerts. The alerts will be monitored by using a method from psychology called "Experience Sampling Method" [CW03] – that other researchers found to be effective for learning about situations and person-situation interactions. The technique compares most closely recall-based self-reporting techniques such as interviews, traditional surveys, and diaries. The alerts will be triggered when the central database receives a signal that users have worked with the device. Alerts will arrive via phones or emails and participants will be asked to answer to some questions regarding the task they have just performed. The collection and answering to these alerts will be via calling a designated number or replying to the email, they have just received, or on existing paper-questionnaires provided at the beginning. The data would be preferred to be collected in electronic format because it can be used in a data-analysis tool.

The third step will consist in testing users using task-based scenarios for identifying high-fidelity usability problems. This will be performed in a usability lab and consists in performing specific task as part of scenarios within a certain period of time. Examples of scenarios are presented in Appendix. Scenarios will be developed based on data collected from the previous two steps, and will cover tasks that found to be difficult for participants. The participants in this test are different than the ones in previous studies. A post-questionnaire will help collecting demographics and their attitude at the end of the test.

3.4 Potential outcomes and improvement recommendations

Despite entertainment functionalities, that seem to be appropriate and easy to manipulate, potential outcomes may evidence: if there is any difference in households' habits and if the rate of using Internet and other functionalities of the device have increased significantly, if they were considered enjoyable activities, and are easier to be performed than "analog" ones. Some ergonomics and usability data can be derived: is the form of the device is appropriate, is the style different than similar devices, is the text entry appropriate, and is the screen deigned appropriately (size, height)? Some potential problems may be:

- In order to be interactive with the refrigerator to have it working efficiently there would be too much maintenance required and too much spent, for example - when entering groceries after they have been bought, user is required to stand at the fridge and enter the expiry date of every item user has purchased, also has to enter details when items are used (i.e., how do you determine how much milk is left in the container?).
- It seems to be great to be able to leave video messages for family members to read as they enter the kitchen, however will they receive the message if they forget to check the fridge?
- Email and Internet is great, but is it the right height, would a person be able to stand there for long periods of time?
- Fridge is built to last 15-20 years, but the screen and technology of the fridge would need to be updated every 2-5 years.
- How long users would be willing to stand in front of the fridge and watch TV for example, as TV watching requires a more pleasant place to sit down.

- The purpose of having remote is mostly for controlling audio-video functions, as people would not check their emails, browsing Internet or do food management being far away from the refrigerator.

The internet refrigerator may not be very practical in all its functions, but the idea of having a refrigerator that keeps track of food and stores shopping lists is great, and still needs to be re-thought and refined. Area of improvements will consist of refining some functionalities and make them easier and more enjoyable to be used (i.e., listening to the recipes instead of staying in front of fridge and then cooking at the same time). Also the designers must consider the willingness of users in spending time in front of refrigerator. The potential HCI issues identified include:

- May be difficult to initially learn how to use;
- Making the refrigerator being a “good habit” in household;
- Physical usability issues – ergonomics and kitchen location to be accessible for long tasks;
- Teaching the rest of the household how to use the functions.

The improvements we considered were:

- Some functions are more practical than others (entertainment versus food management);
- An adjustable screen for each user;
- A different screen that last longer or that can be easily upgraded eg thermal screen that is hard;
- Be able to easily include software updates;
- Plug-in/wireless/infra-red keyboard and mouse for proper use of the Internet, checking emails or doing management.

The process of improvement will be based on the outcomes from the mix study and may involve people from art and drama to help with the prototype. Their help will consist of developing audio-video features in case new functionalities will be added or current ones will be updated, for evaluation purposes. The improvements will be performed and tested via an iterative design without user participation, and evaluation performed with both experts and real users to ensure the success of the product.

Conclusions

People spend a lot of time in the kitchen and around the refrigerator. The refrigerator would be used by most members of the family, so the idea of having the fridge remind family members of scheduled events, relaying video messages, checking emails, browsing Internet, having information about refrigerator content and being able to watch TV is a great idea. However the idea of developing such appliances seem to gather ground, usability problems are not properly addressed. The major challenges are considered: the degree of effectiveness, learnability, flexibility in performing functions, and attitude towards these information appliances.

The paper suggests that information appliances will eventually fill a special role in people's daily lives. These appliances can make information entertainment accessible without demanding focused attention. To optimize this type of use, the functional design characteristics of LG internet refrigerator must conform to the way people conceptualize and use it.

Appendix – Refrigerator Features

General:

- Built-in stereo speakers, CCD camera and microphone for entertainment, interactive and messaging services information
- Electronic calendar for keeping important dates
- Electronic nutritional fact file for tips and information on food products purchased
- Track foods and their storage time in your fridge freezer
- Electronic user features and maintenance manuals
- Self diagnostic system for highlighting faults
- Phone Number Management
- External Management
- Cooking Recipes
- Weather Information
- Handwriting Recognition

Entertainment:

- Built-in TV tuner for watching TV broadcasts
- Built-in MP3 player for downloading music
- Internet Radio for listening to radio stations
- Built-in video camera for taking still photos
- Built-in CCD camera

Communication:

- Full internet access
- E-mail, video mail, voice-only and on-screen text messaging services

Appendix – Sample Questions from Questionnaire³

1. **What is your current experience with an internet appliances?**
High Average Low
2. **How often did you use the refrigerator a day?**

3. **What are the most frequent activities you performed? Please write down the order starting with 1 for the most used one:**
Internet
Email
Video or audio messages
Food management
Taking pictures
Watching TV
Consulting diary
4. **How satisfied are you with LG Internet refrigerator in terms of:**
 - a. **its overall satisfaction?**
Completely dissatisfied Dissatisfied Neutral Satisfied Completely satisfied
Comment: _____
 - b. **its learnability of using?**
Completely dissatisfied Dissatisfied Neutral Satisfied Completely satisfied
Comment: _____
 - c. **its enjoyability during use?**
Completely dissatisfied Dissatisfied Neutral Satisfied Completely satisfied
Comment: _____
 - d. **its appropriateness for a kitchen?**
Completely dissatisfied Dissatisfied Neutral Satisfied Completely satisfied
Comment: _____
5. **Task specific questions (for after scenario-based test or as a response to an alert):**
 - a. **How easy or difficult was it to complete the task? (Circle your answer)**

³ This is just illustrative at this stage, the final form will be developed after performing the ethnographic study.

- Very Easy Easy Neither Easy nor Difficult Difficult Very Difficult
Comment: _____
- b. Did you use the help or manual to complete the task?**
Very Easy Easy Neither Easy nor Difficult Difficult Very Difficult
Comment: _____
- c. When did you use the help or manual was it easy to understand?**
Very Easy Easy Neither Easy nor Difficult Difficult Very Difficult
Comment: _____
- d. Finding the feature in the menu was?**
Very Easy Easy Neither Easy nor Difficult Difficult Very Difficult
Comment: _____
- e. If you would compare with the natural way of doing the task how would classify it?**
Very Easy Easy Neither Easy nor Difficult Difficult Very Difficult
Comment: _____
- 6. What would you consider the best functionalities of the product:**
List or explain your answer: _____

- 7. What would you recommend for re-design or improvement?**
List or explain your answer: _____

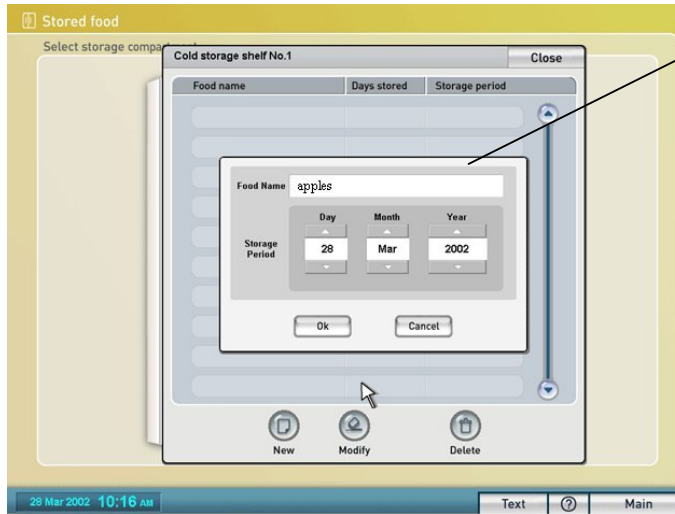
Appendix – Scenario testing

Scenario 1:

You have just arrived home with a trolley full of items after a shopping day into the supermarket. We know that is important to track all items you bought and know exactly when they are going to expire. Also you have just won the new LG Internet Refrigerator as award, and you will be interested in using the refrigerator food management by storing all information for the foods that need to be kept in the fridge.

Your task is to fill in the refrigerator food management section with all details of the items you want to keep a track in the fridge. Also make sure that you update the data for the remaining items.

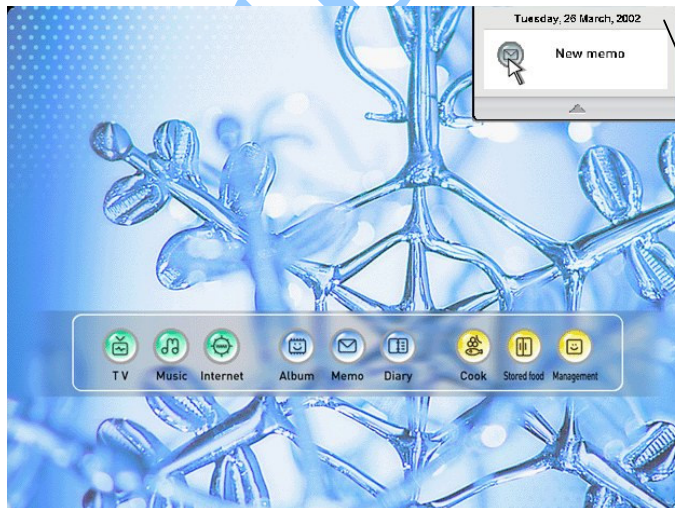
Note: Time to complete the task will vary depending on the number of items we provide the participants with, and after observing the users working in environment during ethnographic study. Below is an illustration of doing the task.



Details to be entered for each product: name, expiry date.

Scenario 2:

You have just arrived from home from a long holiday. In the meantime your parents decided to make a surprise for you and they bought an LG Internet Refrigerator as a birthday presents. They have set you email connections to the new refrigerator as well, and left a video message and some pictures for you. You did not know anything about this surprise, but they have left a video-message telling you the story. Your task is to listen to that video message and browse the pictures, and delete the message after re-playing.



This is the way you'll be signalled of a new message.

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