



Future Mobile Computing

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mobile computing,
e.messaging
concepts,
mobile devices,
mobile appliances,
mobile e-services

Two main trends of development in the mobile computing area can be characterised by the development to enhance communications by mobile network computers and how manufacturers add more and more functionality to small mobile computers.

Mobile network computers have a continuous connection with a main system to use the server's capabilities to become less expensive and with fewer parts, moving parts more reliable. Some manufactures of mobile computers are adding functionality to mobile computers to make them more appealing to consumers, but most of all more complex. Needs and expectations of wireless mobile users are actually about easy to use, simple products. These two trends have been chosen to investigate possible products.

By selecting sales executives as a key user group of the mobile market it was possible to investigate potential mobile clients with limited functionality. A mobile email device was selected as a potential device to access email on a server.

Two concepts are the result of the investigation for e. messaging devices:

- A read-only e.messaging device that allow sales executives to be aware of timely important messages. This device is called the e.me pager.
- A read and write e.messaging device that allow sales executives to synchronize with other people who aren't at that place at that time. The name for this solution is e.me tablet.

Subjects have evaluated the two concepts during concept testing. As a result it became clear that many subjects had no need for a e.me pager, because it is already possible on a mobile phone. Carrying a second device to read their messages better was not appealing.

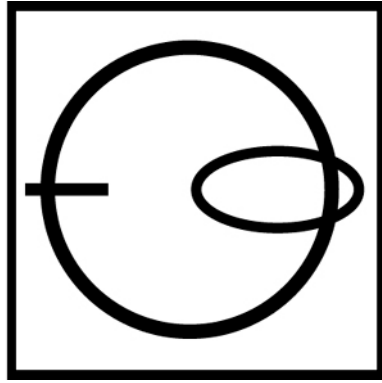
The e.me tablet was found appropriate for subjects because it allowed them to make and receive messages when mobile. But because of the shape of the device subjects expect that it has organiser functionality.

To become an actual product the e.me tablet has to be developed so that it communicates to users what the functionality is and so that it is more tactile in use.

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e.messaging solutions



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Research report
7.4.2000



A graduation project at **Hewlett Packard Laboratories Bristol**

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Sub faculty of Industrial Design Engineering

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Preface

This is the research report of my graduation project at Hewlett Packard Laboratories Bristol.

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Abstract

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The e.me tablet was found appropriate for subjects because it allowed them to make and receive messages when mobile. But because of the shape of the device subjects expect that it has organizer functionality.

To become an actual product the e.me tablet have to be developed so that it communicates to users what his functionality is and so that it is more tactile in use.

Introduction

Hewlett-Packard Laboratories in Bristol are the European Research Laboratories of Hewlett-Packard. Hewlett-Packard Laboratories has, as part of their research activities, a focus on mobile computing to leverage electronic services and appliances.

This report describes an investigation of two main trends of future mobile computing and related user values. It is divided in three parts. The first part is about the mapping of the design space by identifying main trends and a user group. This is described in chapter 1. The second part investigates potential devices to meet the needs of my user group (chapter 2). Chapter 3 to chapter 5 discusses the outcome of the investigation for product concepts. To conclude the report I have written a product proposal for HP to indicate possible directions for the further investigation of the product concepts.

0

project description

The aim of my project is to generate a vision for future solutions in mobile computing and develop a portfolio of conceptual designs. One (or more) concept(s) have to be chosen from the portfolio to develop it into a product design.

The starting point for the project is the identification of trends in mobile computing technology together with potential user values. The activities in the area of mobile computing are so broad that it is required to focus on one trend. By focusing in on an identified trend, and choosing a specific user group, it then becomes possible to map a design space.

The outcome of the investigation will be a portfolio of possible solutions to meet the needs of the selected user group. Product concepts will be developed to a level that will enable their evaluation using simulations or models. After evaluation the project will be concluded with a proposal for product development for HP.

1

future mobile computing

1.1 Introduction

It is possible to detect two main trends of development in the mobile computing area. These main trends operate alongside the ongoing optimization of mobile computers.

Research and development is taking place in every subset of mobile computers to enhance people's need to communicate and distribute information. It is possible to distinguish this trend of development from the original forms of these products.

The other trend can be distinguished in adding more and more features to mobile computers in an attempt to make them appealing to more customers.

Figure 1 will describe the two main trends in the mobile computing area

1.2 Enhanced communications

Mobile computers have been developed to allow users to take some of the functionality of a desktop PC with them. The problem that arises is that you need to synchronize the data production on your main system of data. Otherwise two sets of information have to be maintained. Synchronization of a mobile device with a main system can be done when the user takes the mobile device back to base, where it can be connected to the main network in e.g. a docking bay.

Solutions have been developed to allow users to synchronize a mobile device with their main base without having to go "back home". Periodic distribution and retrieval of up-to-date information is then possible whilst a person is mobile.

It is already possible to connect a handheld device or a Notebook PC via a mobile phone to the Internet to send and receive email and possibly browse the Web. Mobile phones were originally just used to talk to people, but are increasingly used more as an information distributor. New mobile telephone systems allow people to receive more information such as emails, stock prices or weather reports. Even some palmsize PC are able to connect themselves, for a certain amount of time, to central servers to retrieve timely information.

**high
availability**

Research for notebook PCs is focused on delivering a mobile client in a broadband world. The aim is to allow users to have quick access and optimal interactivity with e-services and web-based applications when mobile. This is called "High Availability".

The future of mobile computing is about streamlined synchronization between a mobile device and a main system via networking. The aim is to maintain a continuous connection between the main system and the mobile device.

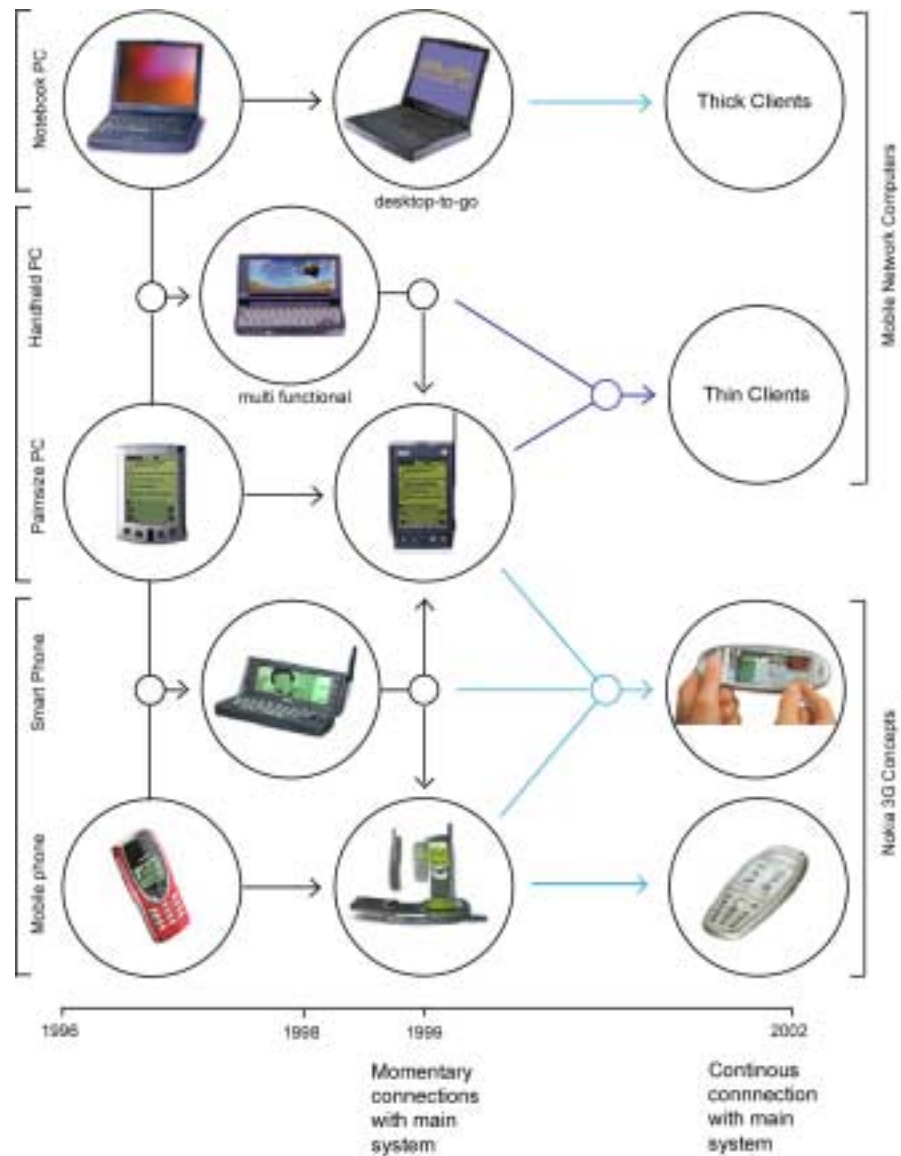


Figure 1.1 Vision of the future of mobile computing

mobile network computer

The mobile device can then become an “anywhere, anytime” portal to applications and information at the database, for example email at the mail server. The portal would be a (network) client to a (network) server, also called a Mobile Network Computer (MNC). According to the Business Research Group, October 1996, a mobile *client* device can be as follows:

- A Thin Client with limited capabilities on the system but with access to parts on the Internet
- A Thick Client with large hard drive and numerous applications on the system

thin client

A thin client will support users that frequently use a few applications and do not need a large hard drive. “For example, a field service representative who may log into the corporate intranet to update product inventory may use a thin client. Business travelers who need access to spreadsheets,

graphical presentations, word processing, and other applications will likely use a thick client that they rely on as their primary computing device" [1]

In *The next-generation app* by PCWeek they claim that clients will become much thinner and many more kinds of client products will be launched on to the market, from PCs to smart phones [2]. The particular functionality of a thin client will determine its form and use model.

The Yankee Group calls these devices *Network Appliances for Network Computing*. They claim that these next generation devices will consume less power than traditional mobile computers as data processing and storage and battery intensive operations will reside on the server rather than on the device. "With enhancements to network performance and stability mobile computing will become less expensive, and with fewer moving parts, more reliable" [3].

The success of existing mobile products has proven the strategic competitive advantage for mobile business users. The Yankee Group believes that the mobile user will benefit even more from mobile network computers because they provide improvements such as competitive pricing, wider coverage, and better throughput, which can be coupled with advanced mobile middleware designed specifically for those data transactions. The Yankee Group claim that mobile network computers are ideally suited to mobile professionals who spend time both in a corporate office and on the road, such as those working in sales and support.

1.3 Limiting the functionality

In terms of mobility there is a common need to take as little as possible with you. The increasing number of mobile computers that people carry with them (mobile phones, pagers, organizers) drives this desire for multi functionality. In addition, smaller devices are appealing because they will decrease the weight that has to be carried. The end result will be a small device with too much functionality therefore too much complexity.

multi-
functionality
versus ...

Early handheld computers had core organizer functionality: calendar, organizer, address book and notepad. Now handheld computers are about multi functionality. Manufacturers are adding more and more features as if it is a mobile desktop PC. They are integrating color screens, word, power point, audio player, video players and much more. Some handheld devices running Windows CE actually tend to consume nearly as much memory as notebook PCs running Windows 95.

In *Designing Interfaces for Handheld Computers* Shoemaker [4] claims that the frequency of access and duration of these access times show one of the key differences between handheld and desktop PCs. Desktop PCs have a small frequency of access and will be used for long durations. Handheld computers have a high frequency of access and will be used for small durations. This is for several reasons, of which the main ones are the form factor and the interaction style with these form factors. Given that these computers are used differently, expecting that functionality on a handheld computer should be the same as on a desktop PC is not appropriate. Even the difference between the usage of a palmsize PC and a handheld PC indicates that functionality should be designed appropriately for the form factor.

Adding features is a general trend on the mobile computing market. Mobile phones are getting increased functionality while the core functionality ironically seems to be going into the wireless headsets. Future concepts for mobile (smart) phones look like over shaped mobile phones or very small palmsize PCs. Notebook PCs are becoming desktop PCs-to-go can only be used for 2 to 3 hours because of these redundant features.

**... needs and
exectations of
mobile users**

In reality there is a contrast between what appeals to mobile users and the actual needs and expectations of mobile users. According to the WAP White Paper [5], users of wireless mobile devices will have the following set of needs and expectations:

- Wireless computing devices have to be very easy to use because potentially they will be owned by people that have no desktop computing experience;
- Wireless devices will be used in a dynamic environment where the user is engaged in multiple activities;
- Another driver for ease of use is that the user may not be able to concentrate on the device in a mobile setting as well as they might if office-based;
- Applications should be instantly available and should be designed to be used for a low duration of time;
- Information needs and desires change when mobile: users will have small, specific tasks that need to be accomplished quickly. For example: browsing through email is more likely than reading it in detail.

Wireless communication and computing devices can be distinguished by the following characteristics [5]:

- Simple Interface;
- High frequency of usage;
- Low duration of usage;
- Limited CPU;
- Limited memory;
- Limited battery life.

Mobile Network Computers also have to deliver streamlined connectivity with a server. Fundamental limitations of power, available spectrum and mobility constrain wireless data networks with the following factors [5]:

- Low bandwidth;
- High Latency;
- Unpredictable availability;
- Less connection stability.

This is further exacerbated by the following facts [5]:

- As bandwidth increase power consumption of the limited battery life will increase as well;
- Power availability is the crucial factor of effective throughput to and on a mobile network computer.

Mobile Network Computers are therefore much more highly constrained than desktop computers.

The issues discussed above indicate a need for extremely simple to use devices. Such a device can be delivered if the product design has limited functionality. Only then it is possible to create a meaningful, simple network device for mobile users.

1.4 Populating the design space

User group

I believe that Mobile Network Computers (MNC) will have a significant influence on mobile computing. I will therefore focus the project on investigating what Mobile Network Computers could look like. An investigation of Mobile Network Computers to satisfy all users is not possible. To be able to invent solutions for a meaningful market segment I will need to narrow down the scope of the project by specifying a user group and its usage profile.

mobile professional

A Mobile Network Computer (MNC) is most suitable for a user group that has high information and communication needs and who needs to be aware of changes in information in his environment. Mobile professionals spend 20% or more of their time away from their immediate workplace. Surveys have indicated that mobile professionals rather than consumers are the driving force of the mobile computing market, especially in the PDA market. One survey pointed out that more than 70% of consumers owning a PC had no intention of purchasing a handheld PC, because of the lack of compelling applications of these products in relation to the price (between \$250 - \$1000). The growth in shipment to the world of companion size PCs (handheld PCs) is around 30% per year driven mostly by corporate users [6]. Corporate users account for 70% of U.S. mobile computer shipments and they are therefore the most important group for manufacturers [7].

sales executives

It is impossible to identify meaningful products for a user group as broad as that of mobile professionals. Sales Executives are a subset of mobile professionals for whom timely access to information and communication is very important. They are also highly mobile both within the office and away from it. The project will therefore concentrate on investigating MNCs for this group of users. Their user profile will be discussed in detail in chapter 2 Sales Executives.

design theme: design for purpose

To put more emphasis on delivering limited functionality my graduation committee and I incorporated a design theme called “design for purpose”. The design theme embodies the aim to design meaningful products that are easy to use by focusing on one particular purpose. Although a small multi-functional device is appealing to people it compromises usage a great deal. Additionally, the frequency of use will increase frustrations about usability every time, which is not the way to create long-lasting, usable products. It might be possible to add functionality in a modular way if the users have got used to the device.

The “design for purpose” theme implies that only Thin Clients will be included in the investigation of Mobile Network Computing solutions due to fact that these are suitable for only a few applications.

1.5 To conclude

During the Future Mobile Computing project I will try to identify possible solutions for Mobile Network Computers, which will meet the mobile computing needs of Sales Executives. These Mobile Network Computers will only have focused functionality due to the “design for purpose” theme and technical restrictions. MNCs in this case are called Thin Clients.

In the next chapter characteristics and needs of sales executives will be discussed to identify needs of sales executives.

chapter 2

sales executives





2

sales executives

2.1 Introduction

The chosen user group at the development of mobile computing solutions is Sales Executives. A sales executive is a modern version of salesman. The change of job description is to increase the image and status of the salesman.

First, a user profile of Sales Executives shall be discussed. Second, the user needs of Sales Executives shall be identified, after which possible solutions for these needs will be described. It would not be possible to investigate all possible solutions and a selection of one solution is needed to develop concepts to meet certain needs. This selection will conclude the chapter.

2.2 Sales Executive User Profile

Sales process characteristics

**communication
and
information
management**

The sales process is about having access to the right information at the right time. Communication and information management is the key to success. Sales people have to use communication tools in order to build and maintain relationships collect and distribute information and explore sales leads.

**relationship
management**

The demand from customers for more personal advice and service requires sales people to be relationship managers. Winning and keeping customers is one of the most important aspects of the sales process [8].

In order to be able to compete with other sales companies effective information and communication management between colleagues is essential.

Sales executive characteristics

Sales executives are responsible for direct and personal sales and have to build up long-term relationships with customers.

They can be working wherever they are: at home, with customers, in the office and in the car.

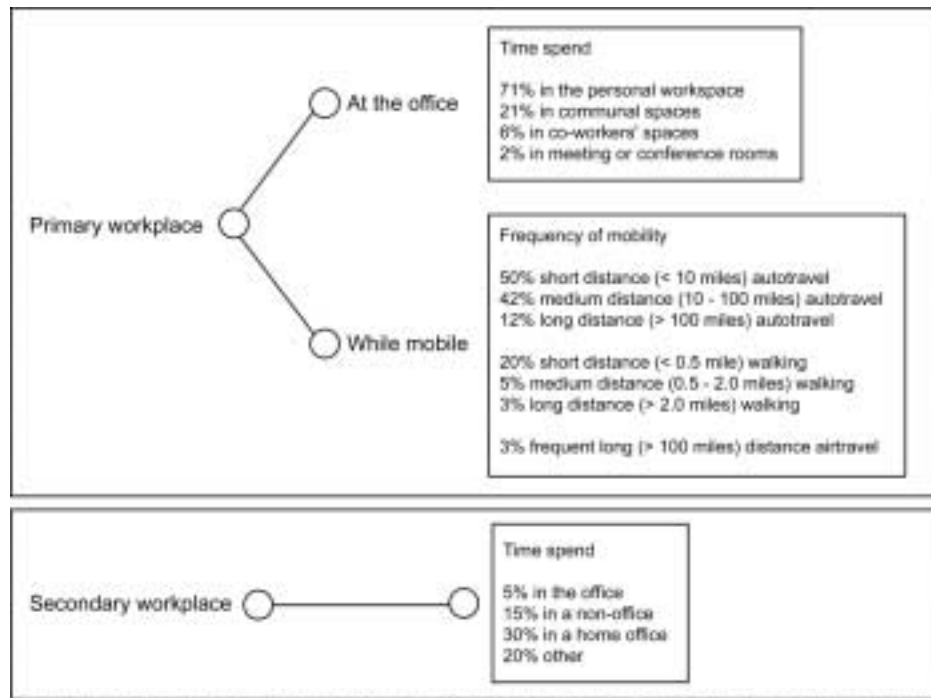
Sales executives want to offer a quick response to colleagues and clients to demonstrate their professionalism

One of their main tasks is to identify and solve customer's problems and create long-term solutions

They have to be able to work both independently and with others, inside and outside the company, possibly internationally

Sales Executive working patterns

A salesperson spends most of its time at the primary workplace. The primary workplace is at the office or while mobile. As work increase sales people increase their time working at their primary workplace or extending their day at secondary workplace [12]. Where time is spent at the primary or secondary workplace is indicated in figure 2.1. The figure describes that sales people work in all sorts of workplaces and need mobile tools to support that.



Source: The Yankee Group, Mobile technologies and the Consumer 2000, The Mobile User Survey Companion: Developing a mobile User Index for Market Segmentation, 1997

Figure 2.1 Time spend at primary and secondary workplaces and frequency of business travel

mobility characteristics

For mobile users including sales executives, the majority of business travel is within 100 miles of the home office. Business-related travel is about even, divided between those who remain in a city or urban area and those who travel throughout a small geographic area, state or region. Nationwide and international travel is less usual for this user group [13].

localized usage

If a mobile worker is away from the office and within the metropolitan area this will be indicated as being mobile in the metro area. The majority of wireless voice usage and paging is done within the user's metro area. 85% of cellular calls are made or received inside the local metro area [12]. The majority of meetings are held in the metro area and most mobile calls are placed from the car or outside. This means that products and services can be designed for more localized use and that the car is a likely location for mobile device usage.

The tools and materials typically used by sales executives are:
 High Mobile phone use (high usage);
 Pager;
 Personal Digital Assistants (for to-do lists, contacts, calendar, etc);

Paper notebooks;
Paper project files;
Notebook PCs (for access to corporate database and email);
Fax machine.

Sales Executives tend to be attracted by small, lightweight devices and like these to enhance their usage in terms of professionalism and being up to date. They like durable, modern, stylish devices, which improve their productivity.



2.3 Sales Executive Needs

Introduction

People and information are the major focus of salespeople. They have to interact intensively with customers and colleagues and need to have access to the correct information during the sales process. The needs of sales executives will therefore be based around communication and information.

To identify their mobile communication and information needs, various mobile communication and information characteristics will be discussed. Those specifically related to the needs of sales executives will then be identified.

How mobile workers use communication technology

Mobile workers use a variety of technologies to keep in contact with the office. IDC/LINK claims in *Mobile worker profile: Demographics and Technology use* [14] that voice mail is the most frequently cited technology used while traveling (42%), followed by e-mail access through conventional phone lines (40%). About 30% of mobile workers have true remote access, connecting to their company's computer network.

The reasons for connecting remotely to company networks are varied. 80% of mobile workers call in for email, with 30% sending documents, files, or other information and about 25% download information from corporate networks rather than sending information up to network [14].

Although these statistics are from 1997 it is possible to conclude that accessing email is one of the major reasons that mobile workers use communications technology whilst traveling.

In *Mobile technologies and the Consumer 2000* [7] the Yankee group claims that portable computer users were interested highest in email and fax to perform these applications wirelessly when away from their primary workplace. However, accessing the Internet and corporate database was not far behind (see figure 2.2 below). The greatest interest of handheld device users was for notification of email and voicemail and in sending and receiving email.

Salespeople demonstrate higher interest in corporate database access. They expressed slightly *higher interest* in *sending* than receiving *fax*, but *higher interest* in *receiving email* than sending email.

interest in
remote access
to wireless
applications

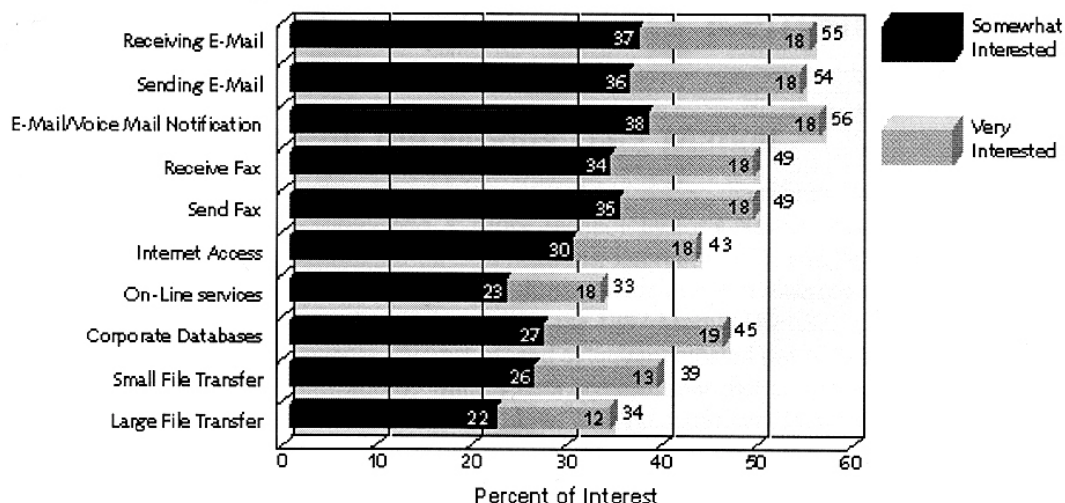


Figure 2.2 Interest in Wireless Applications When Away from Primary Workplace

“VoiceMail: Deal with it Here and Now! User Interface and Technology Opportunities” by Geelhoed et al [15] states that mobile professionals keep in touch with their message environment via voicemail and email. The message environment is a network of mobile professionals and administrative support. The surveyed intensive users prefer email for receiving messages and voicemail for sending them. The reason for this is probably because people want to deal with voicemail right away, which prompts more immediate action than email does. The survey also indicated that the technology that most in demand is 100% accurate speech-to-text. While the intensive user uses voice messaging intensively they do not use speech for making notes. I believe that the immediate reaction of sales people to receive messages comes from the urge to deal with a situation anytime/anywhere, which is related to task distribution, achieving task closure, professional courtesy and task flexibility. Sales executives want to offer quick response to colleagues and clients to demonstrate their professionalism.

email characteristics

In the Study of People’s Information Gathering and Communication activities During Business Travel by O’Hara et al. 1999 [16] claims that the most frequent method of delivering information was email, accounting for 54% of all messages sent (compared to 39% hand delivered and 7% fax). However, out of the 14 participants only 4 used email during business travel. Four participants owned a notebook PC and 3 of them used a notebook PC and modem set up for email. Only 50% of the participants used email at all in their work. O’Hara et al. states that the high proportion of email overall demonstrates how frequently it was used by those who took advantage of it. Many of the participants said that they were reluctant to carry notebook PCs on trips, because of size and weight.

In sales organizations, faxed information plays a big part in documenting actions. O’Hara et al. [16] indicates that work processes and actions, in many organizations, and certainly when crossing organization, still involve some form of paper, e.g. invoices and receipts. Perhaps a document management device would need to allow documents to be distributed as fax, but fax will diminish in PC centric environments, which are more likely to use email

The *Notebook Activity Logging Study* by Loughran [17] indicated that email is the central application on a notebook PC during meetings. One reason for this could be that salespeople wants to keep on top of the incoming emails during the meeting as a form of workload distribution or that emails are used as prompts for discussion.

Communication and information needs of sales executives

The following have been identified as central to sales executives communication and information needs.

1. The need to reduce ambiguity or build a context around a document while telephoning on the phone

The document concerned can be shared by using a telecommunicating shared workspace, during a phone-based discussion. Shared notations can then be made. The shared frame of reference can than reduce the ambiguity in communications and improve task closure.

2. The need to be assured that a document has been received and can be accessed

In the Study of People's Information Gathering and Communication activities During Business Travel [16] and the studies of mobile document work by Eldridge et al. 1999 [18] it is clear that "beaming" documents in a face-to-face situation could support this need, as it informs the sender that it has been received accurately. However handing over paper documents is not only extremely low cost but also allows immediate discussion around the document within the context of these activities. Then the need to print the document out directly from a thin client also has to be supported, depending on printer availability.

3. The need to access documents and technologies when away from the personal workstation

If a sales executive is in a meeting and needs particular information, which is not available in paper format, he or she needs to access documents from the corporate database. If a sales person cannot succeed in getting this information it is possible that he or she will not achieve sales closure. To assist a sales person in these instances a device is needed that could access all the most important resources and documents. To facilitate access, links on the documents at hand can be used to access related documents or information.

4. The need to report and communicate information to others

When a sales executive wants to transfer documents in a face-to-face situation the ability to transfer information from one device directly to an other devices without going via the corporate network is highly desirable.

5. The need to anticipate unpredictable document needs when away from the desk

By using Internet and intranet connectivity documents could be made accessible at any place at any time through a document handling device, if it is possible to access the corporate database through the firewall. In the studies of mobile document work by Eldridge et al. 1999 [18] a prototype of a system is discussed that provided streamlined access to documents and documents services, called Satchel. In the studies it was indicated that several people felt more at ease when they were away from their PCs because they knew that Satchel could be used to access documents they hadn't anticipated needing.

Electronic information can be sent & received from one device to another device by wireless connectivity at short distances (e.g. bluetooth). For longer distances email can be used. This information can then be (re)-used and linked for example to other resources or contacts.

6. The need to make notes

The need to make notes, while on the move is associated with difficulties. Voice recordings, voice-to-text interpretation or speech control are possible solutions. A device that can facilitate note making by using one or more of these technologies can play an important role in mobile situations.

7. The need to capture specific information from pre-existing documents

Linking By Inking: Trailblazing in a Paper-like Hypertext by Price et al [19] states that collecting information involves: searching, browsing, skimming and deep reading. "New information can be collected through browsing or through directed search. Readers tend to skim documents to select the most useful information or to get a rough sense of content. Finally readers use deep reading to understand how they can solve their problem." [19]. Deep reading, also called active reading, is a way of critical thinking, learning and organising information. In this process of collecting information the computer is used to search, browse and skim, after which the information is printed out for active reading.

active reading

Beyond Paper: Supporting Active Reading with Free Form Digital Ink Annotations by Price et al [20] shows that active reading involves reading, underlining, highlighting and making notes. They discuss the disruptive nature of the transition from searching, browsing and skimming on the computer to reading from paper. The time that it would take to print and start reading disrupts the activity. "They can lose their focus while waiting, or may switch to an unrelated task to fill the time" [20]. Then if the information has been read and new information has to be searched a transition has to take place back towards the computer. Moving back from paper to the computer loses valuable information, which is stored on paper versions of documents and in paper notebooks, because the computer cannot capture this additional information.

disruptive nature of the transition from the computer to paper while active reading

Price et al. [19] describe an electronic document reader that would enable notes to be made on top of a document much as you can on a paper version.

2.4 Potential devices for sales executives

Having identified the needs that sales executives have as regards mobile access to information and communication, the following potential solutions have been identified:

Mobile web browser

A mobile web browser can be used for web browsing to search for specific information. The information can be location sensitive, which would require the device to assist in location related searches, for example, as a travel guide

Link assistant

Link assistant could be a device that assists salesmen in the active reading process by capturing certain information out of pre-existing documents and linking it for further search. It could also retrieve contact information by capturing specific information on a document and retrieving, for example, a business card of the originator of the document

Active reader

This could be a device that allows salesmen to read documents and enable pursuit all of the active reading activities. It could be used for browsing and skimming pre-existing documents or allowing sales executives to making notations on top of pre-existing documents. Requirements for the Active Reader would be:

- Graphical quality of the screen should be as good as paper
- Paper affordances need to be included
- Notating on top of documents need to be possible
- Linking of notations to improve search

Mobile shared workspace

A device that allows sales executives to use it as a shared workspace at the office or while being mobile

Document manager

A sales person could use a document manager to access documents and document services. A document manager can also be used to transfer documents from a document manager to another device, for example a printer.

Email device

An email device would be possible, on which a sales executive can only read email. By increasing the functionality a little bit we can also think about a device that can send and receive email. The features that could be imaginable are:

- Sending handwritten messages

- Support while driving by hands free operation capabilities of the car e-services
- Speech-to-text and text-to-speech interpretation, using speech-to-text interpretation is could be possible to send an email instead of voicemail
- Transform telephone calls to emails

2.5 Evaluation and selection

Introduction

The identified solutions will be evaluated below and one solution will be selected for further investigation.

Evaluation

Mobile web browser

Different companies have launched different mobile web browsers on the market. The purpose of core web browsers could be to assist a salesman to look for specific information on the web while away from the desk. These devices are already on the market.

Active reader

An active reader would have to maintain paper affordances to mimic paper use. This means it at least needs to have an A4-size, while a two-page overview is preferred. The problem with viewing displays is still that you need to have the right viewing angle to match paper quality. Most of all IT-possibilities, integrated in an active reader, has to be that beneficent that it counter-balances the positive aspects of paper: easy to read, cheap, light, able to use multiple at once, easy to notate on, easy to cross-reference with, etc.

Mobile shared workspace

A shared workspace is a way to reduce ambiguity during a conversation on the telephone.

Document handler

Salesmen have stated interest in a device that can access documents and document services at the corporate database. It is a device that can support unpredicted document needs and can play an important role in sales closure. Also it can support in distributing and collecting electronic information, for example in a meeting. This is already been investigating by the Xerox Research Centre from 1993, called the Satchel project. Considering they have more substantial information than me, I believe that doing a further investigation on this device is not the most interesting direction for HP or me.

Email device

It is clear from the many papers and reports that discuss it that email is growing in importance and usage. It is even likely that in a PC centric world fax is going to be taken over by email.

At the moment, sales executives usually use a notebook PC or a palmsize PC to access email. If using a palmsize PC they have to wait before a message is downloaded because of the restricted connection. If using a notebook PC sales people have to wait even more until the PC is ready and then have to make a connection to the network. It is possible now to read email on your mobile phone but only on a slightly bigger screen.

A device that enables people to check their email quickly and easily should be very attractive for anybody who wants to keep on top of incoming messages all the time. The interest in only email and voicemail notification confirms that.

Such a mobile email device is not only interesting for business users such as sales executives but also to many other consumers, which makes it more interesting to investigate.

Selection

I believe that investigating how an email device can improve the communication and information needs of sales executives is the most interesting direction for this project. The results of this investigation could be an important input to HP in thinking about future mobile computers. Investigating mobile email solutions is even more interesting because it can be of great interest to a large number of consumers, not just my target group.

e.messaging solutions

Instead of focusing on how mobile email could be done today I would like to investigate how electronic messaging could be done in the future. This requires looking for other ways of sending and receiving electronic messages in a mobile context. Deliberately, I will no longer use the term email because it refers to a specific way of sending electronic messages.

In the next chapter, chapter 3 *e.messaging solutions*, I will discuss the outcome of my investigation mobile electronic messaging solutions.

3

e.messaging solutions

3.1 Introduction

Access to information and communication is a major requirement for sales executives. In their dynamic environment they have to be on top of new information all the time. When working in his personal workspace a salesman will surround himself with tools that allow him to be in touch with the rest of the world. From the point he leaves his personal workspace his needs and expectations change. He needs instantly available, easy to use devices that enable him to do multiple activities in unpredictable circumstances. A sales executive wants to be reachable by his customers, colleagues and relations by direct and asynchronous communication. A mobile telephone can leverage this flexibility, because it has become “ubiquitous” for immediate use of direct communications. It is another story for asynchronous messaging.

My challenge is to generate mobile messaging solutions that meet the e.messaging needs of sales executives.

In the next paragraphs the main aspects of mobile messaging and messaging tasks will be discussed. Messaging tasks include notification of messages, reading and creating messages.

3.2 Nature of e.messaging

asynchronous character

Information that will be distributed by messaging is not so urgent in nature, because otherwise a synchronous way of communication would have been used. For example, telephoning a person will make certain that the recipient has received the information. If the person you want to reach urgently cannot be reached, asynchronous messaging is a solution. *A study of People’s information Gathering and Communication Activities During Business Travel* by O’Hara et al [16] states that urgency in relation to sending information was not as critical to participants as their need for *immediate receipt* of information. It also found that the phone was generally the technology used for dealing with urgent situations. The reasons for this are the immediate feedback and the ability to discuss and agree when using synchronous communication.

urgency

It is possible to re-evaluate urgency in terms of flexibility in performing tasks. “Urgency can be defined in terms of the ability to carry out work as, and when, periods between meetings or whilst travelling arrive. If the work is not done during these periods then it gets delayed until the next period, so this is what creates a sense of urgency” [16]. Many participants spoke about taking the opportunity of a free moment to phone up clients, check messages etc. “Because when I am sat in the car for an hour, I’m normally doing some – I’m normally phoning customers – especially if there’s something going on in my mind that I’ve got something particular to sell...I had a hour available and I thought I could sell one or two of the bits of equipment, or at least get the information out to the customer – but it happened that I phoned the customer and they were interested in it” [16].

exploiting free time

O'Hara et al claim that this example illustrates urgency in terms of taking advantage of free moments and not necessarily in terms of when the recipient receives information.

Reaction to received messages is also less immediate than synchronous communication. If an immediate answer is required it is more likely that a person will be approached by telephone or face to face. O'Hara et al [16] claims that participants expressed concerns about professional courtesy, wanting to offer quick response to colleagues and clients to demonstrate their professionalism. Professional courtesy is therefore part of urgency in terms of exploiting free moments. Being able to give responses anytime and anywhere allow them to do that.

Sales executives would like to create and send a message when it comes to mind. An anytime, anywhere messaging solution can then reduce cognitive load and allow sales executives to manage be flexible in task management and opportunistically exploit free moments.

Relationship between a messenger and a mobile telephone

A message can trigger telephone use to clarify or to ask for clarification. Telephone calls can also lead to messaging. While telephoning, a message can be used as a reference or as a prompt for discussion.

In *A Study of People's information Gathering and Communication Activities During Business Travel* [16] participants claimed that they could sometimes understand the gist of a message but not enough to be able to act appropriately on it. "Sometimes it would be much clearer with a phone call because sometimes you find you've done six e-mails back and forth when one phone call would have got it all out and consequently....well it was because it would have taken forever to just keep e-mailing back and forth, its much quicker just to have a conversation" [16]. Using the telephone allows people to discuss, negotiate and agree immediately.

Conclusion

**anywhere/
anytime
solution**

It is possible to conclude that sales executives have a need for an anywhere/ anytime solution for mobile e.messaging. Key benefits of an anytime/ anywhere e.messaging solution cannot be characterised as supporting urgent information distribution, but as supporting professional courtesy, and performing messaging tasks when they come to mind and when these messaging tasks occur. An anytime/ anywhere e.messaging solution would increase flexibility in doing messaging tasks.

3.3 Messaging contexts

The messaging needs of sales executives differ according to the context of communication. Communication is done in a sales group (workgroup) context, in a customer context and in a social context, and these sometimes overlap. Communication in a sales group context is communication that occurs in a working environment, in this case a group of salespeople. Communication in a customer context is communication that occurs

between a sales executive and his customers. Communication in a social context is communication that occurs between a sales executive and his friends and family. These contexts will overlap, for example, when a colleague is also part of the social context.

Messaging in a sales group context

Sales executives have to find ways to access colleagues within an environment of high mobility. Accessing colleagues and coordination of workgroup communication can be done efficiently it will be of great benefit to salespeople.

informal nature of e.messaging

Sales executives want to distribute information to colleagues. This may be done synchronous (by phone or face to face) or asynchronous (by messaging). If a colleague cannot be reached by phone or face to face it is possible to wait and hold the information until the colleague can be reached. Holding the information is a form of cognitive load, which can interfere with work. Creating a message and leaving this at his desk or sending it via email are other solutions. The relationship between colleagues will result in messages that are more informal of nature. When these messages have to be written away from the personal workspace they are probably short and direct.

In a field trial to investigate the value of pen based information technology and its utility in a workgroup setting by Stott and Stenton (1993) [21] a device called the Piglet Prototype was tested in a workgroup context for a two-week period. The Piglet is a prototype for a small low cost pen driven device with two functions: a communication function and a note taking function for storage and structuring of information. Communications was enabled via cordless telephone technology. The device was portable and messages could be sent between six participants who were moving around on site. The device was used primarily as a communication device. "It was that I could send messages to someone like John or Chris, who is the scarlet pimpernel most of the time, you cannot find him, so at least I could send messages". "It's convenient I suppose. A convenient way to get messages to people....At least you can have a go at finding someone, you can say oh I'll try them on the old Piglet at least you'll get an answer..." [21]. Although the participants were only mobile on site I believe the findings are representative for my target group.

In order to coordinate shared activities they need a way to communicate, which can be asynchronous. This can require a form of e.messaging, which is immediate in nature from the sender's side. The sender wants to send quick messages let his colleague know what he is doing and perhaps what he has done. Colleagues can send e.messages with quick questions, which do not require an answer right away. If coordination is needed a salesman can send a message with this request to a colleague and call the other by phone on the agreed time.

The field trial describes the benefit of a communication device for such needs: "Currently I think it is the email like features, the synchronisation between two people who aren't actually in the same place at the same time..." [21].

Some messages were about: “Points of information about things that I was doing, sort of by the way, I’ve just done so and so, or don’t do such and such because I’m in the middle of this. That sort of thing. More sort of immediate things so that he knew where we were with any particular thing. Because of the way in which we overlap with what we do like delivering programmes to the system, we both do that, it just depends who has the most time or who’s had the most involvement. Quick questions where I don’t necessarily need an immediate answer” [21].

Messaging in a customer context

**messaging is
considered
inappropriate**

Customers need to be dealt with in a more formal way. O’Hara et al [16] describe an example of a laboratory equipment supplier. The salesman considered messaging inappropriate, particularly with new contacts, because they don’t have a two-way social interaction. It is necessary to create a social situation with clients because then it is more difficult to refuse a meeting or refuse what he is trying to sell.

Some relations with customers can be so good that informal messaging is possible. Overall, formal messages are required for asynchronous communication and distribution of information.

Sales executives want to be notified of incoming messages from customers. Notification of incoming messages has the highest level of priority. This is possible when at the personal workspace but need to be addressed when mobile, on site or off site. When away from the desk it would be better if he could also read a message or even browse through a message and print it to read it properly. The response to an incoming message would be more formal and possibly be done using a mobile telephone. The alternative would be composing an email on a desktop PC depending on the relationship with the customer.

Messaging in a social context

Sending and receiving messages to and from friends and relations is in principle informal. These messages can be direct and short. It is a way of touching base asynchronously. As indicated in the mobile professional literature study (appendix 3), the telephone is normally used to touch base. The ways of messaging in a sales group context are valid for a social context, but with a more informal character. To access friends and relations, distribute information and coordinate shared tasks informal messaging can be used by sending short, direct messages. Messaging in a social context is less important to sales executives than messaging in a workgroup context or in a customer context.

Conclusions

The use of synchronous communications, be it via the telephone or face-to-face, is the most important form of communication for sales people. Messaging in a customer context is not as important as two-way communication, particularly with new customers. The next level of priority is sending formal messages, which can be best done at a desktop PC.

**informal
e.messaging
solutions**

Informal messaging would be of a lower level of priority but can be used very well to enhance communications in a sales group and in a social context. I believe that mobile e.messaging solutions for sales executives are more suitable for informal messaging than for formal messaging.

The value of pen based information technology and its utility in a workgroup setting by Stott and Stenton [21] indicates that a pen based communication and information storage device was understood and used primarily as a communications device that incidentally stored information. They claim that the utility of such a device in a work context is that it [21]:

- Replaces the usual methods of asynchronous communication
- Supports and enhances existing communication patterns
- Improves workgroup coordination and efficiency

They concluded that the device should be developed as a communication device.

I believe that the utility of a pen based communication device is that it supports informal messaging by sales executives.

In terms of messaging, it is possible to indicate levels of priority. The first level of priority for messaging is the notification of messages. The second level of priority would be to read those messages. And the possibility to react on these messages by creating informal messages would be on the third level of priority.

**categories of
e.messaging
solutions**

If we look at the priorities for messaging tasks it is possible to divide messaging solutions into two categories:

- Solutions that give notification of new messages and allow sales executive to read these messages
- Solutions that give notification of new messages, allow users to read these messages and offer the possibility to compose informal short, direct messages

These two categories will be used to develop product ideas.

3.4 Types of e.messages

The nature of messaging can be characterized by the following important elements:

- Informal nature of messages;
- Support urgency in terms of exploiting free time.

Solutions for e.messaging have to support those two elements. To support urgency in terms of exploiting free time solutions have to be found that allow users to input messages naturally, quickly and without disruption. Typing in messages “quickly” will require a 70 to 100% size keyboard. The size of such a keyboard will increase the size of the device. To create the type of message that would combine ASCII text with captured images, diagrams or charts would require large display size and complex interface to manipulate these media type. I believe that this kind of message does not support the two elements that are required for mobile messaging.

**server
conversion**

More natural and easy ways to input a message include using handwriting or voice. Direct conversion by using handwriting-to-text or speech-to-text interpretation is possible but slows down and possibly disrupts the process of creating messages. This process could be taken over by the server, so that the sender has sent a message, in for example handwritten text, and the recipient receives it, in for example ASCII text. A recipient could indicate in what kind of medium he or she would like to receive a message. This kind of conversion will be called: server conversion.

In order to browse and skim quickly through a message I believe that reading is more suitable than listening. Voice messaging is already possible by using a mobile telephone and would be redundant for a sales executive.

screensize

Determining the screen size for the creation of pen-based messages is important. It needs to be large enough to support the creation of short handwritten messages and the reading of ASCII messages. This can be derived from the Post-it notes. 3M offer consumers with the following (smaller) sizes of Post-its: 38x51mm, 76x76mm and 76x127mm. I believe the smallest size is too small to be used for an adequate short message and perhaps a sketch. Writing on a touch pad does not allow you to write as small as is possible on paper, so some allowance has to be made. 76x76mm is probably adequate for creating a message and a small sketch. 76x127mm size screen with landscape orientation would mean it is no longer possible to hold the device in your palm. The device would also be too big to fit into a side or inside pocket. Being able to scroll down a message also while creating it can simulate a 76x126mm size screen with portrait orientation.

Read only messages

If composition of messages is not required there are different implications by the screen size. The screen can be reduced to the minimum a message is readable. I believe that when different types of messages be received (handwritten or ASCII text) a small display becomes an issue for readability. Filtering and conversion are of course possible. It reduces the value of the message but if the recipient only wants to be notified and skim through the message this could be a possibility. ASCII text can be formatted to the frame length and read by scrolling as well. If a message is too big, a summary could be sent, and by printing the whole message it could be read on a piece of paper.

Conclusions

**types of
e.messages**

Types of e.messages to be supported on a read-only device are:

- Hand produced information (length 76mm LCD frame size)
- ASCII text, formatted to the LCD size

The server will filter messages that include media, which are not suitable for a read-only device. The remaining ASCII text can then be read on the device. Because of limited screen size a read-only device will have to enable scrolling down through the message.

Types of messages to be supported on a read-and-write device are:

- Hand produced information created on a 76x76mm LCD frame size display
- ASCII text, formatted to the LCD size
- Pictures etc, bigger than the screen size.

The system will recognize when something doesn't fit on the screen and it will automatically show a "hand icon" to move it around. The user can also instruct the server not to show these messages.

Hand written and drawn messages to 76x76mm can be produced on the read-and-write device. A touch screen and stylus are therefore required.

3.5 Technical specifications

Stylus and touch screen specification

According to *Investigation of Task, Screen Interactions on the subjective Preference of Pens* by Stott and Geelhoed (1993) [22] a soft screen with anti-glare surface using a blunt pen with no spring is preferred by participants for freehand writing tasks.

Use related specifications

An e.messaging device has to be able to be taken with a sales executive in order to be an anywhere, anytime solution. It has to be able to fit in a side or inside pocket of a jacket of a suit and the size need to be within an area of 150x150mm. The weight has to be as light as possible so that it will be as ubiquitous as possible when carried around.

A messaging solution needs to be able to be operated when resting on a surface, e.g. a desk, or when resting on the palm and the hand.

It is possible that a sales executives is performing tasks on an e.messaging device and performing other tasks, e.g. telephoning or writing. Interaction with other devices and people require that an e.messaging solution needs to be able to rest upon a surface or in a hand. When held in the hand it needs to be possible to operate some functions with that same hand.

When a person is driving he needs to focus upon driving. Physical manipulation of an e.messaging device needs to be prevented or reduced to a minimum. I will assume that certain car e.services will become pervasive in the near future. Sales executives will probably be early adopters for car e.services. Car e.services could include speech control, speech-to-text interpretation or location-aware-sending. The car could also become a mobile network client to allow people to use e.services.

car e.services

By using services of the car it is possible to integrate functionality in the car and exploit those services. Speech control and text-to-speech interpretation are suited to perform tasks while driving. A connection between a messenger and the car is enough to use message functionality by using the car's functionality.

Feedback and filtering

An e.messaging device would only be effective if it gives the user efficient feedback about changes in their functional state. Changes in functional state could occur when, for example, the battery is low on power. Cues for task completion and confirmation of tasks are required just as mode changes [23].

The functional state could change when the message server pushes a notification of a new message to the device. I believe that if an e.messaging device would notify their users like all of the other devices (mobile phones, pagers, organizers) that the unobtrusiveness of asynchronous messaging would be lost.

Many auditory cues of devices occur without being aware of user's tasks and "environmental" circumstances. The user's activities will be disrupted by such notifications and could cause annoyance for the user but also for people in the environment. *Nomadic radio: Scaleable and Contextual Notification for Wearable Audio Messaging* by Sawhney et al. [23] claim that users shift their focus from the primary task to interact with the device because of auditory cues that do not convey the nature of incoming messages. They claim that the lack of coordination and synchronization of notifications are the main cause. "Messaging requires development of a model that dynamically selects a suitable notification strategy based on message priority, usage level and environmental context" [23]. An e.messaging device has then to monitor the users activities and the context the user is in. Messages have to be filtered to attach a particular cue for its priority.

dynamic
notification
strategy

I believe I cannot make any appropriate claims to implement such a system for feedback and filtering. I believe many issues concerning context dependant altering and filtering needs to be investigated. How does a device know in which type of meeting it is and how can it alternate feedback? Usability issues have to be investigated as well as user preferences have to be investigated. I believe that a solution have to be found that is suitable for the unobtrusive character of messaging. Intrusive and ambiguous feedback is not preferred.

Power Consumption

The battery power will restrict the level of availability of the messaging device. Power consumption is related to bandwidth of data transfer, the duration of full connection and power requirements of the display. Using a monochrome display it should be possible to have battery power for approximately two weeks where a push mechanism is used to connect to a mobile phone. A Palm V with a Lithium-ion battery has a battery life of one month. The Palm III with monochrome display has a battery life of almost two months (more battery space) and the Palm III with colour display has a battery life of only two weeks.

monochrome
versus color
displays

In the case of e.messaging devices color screens will only improve contrast, while increasing battery supply tremendously. I therefore choose to use monochrome displays.

Docking cradles can be used to recharge up the batteries. A docking cradle at the desk and in the car can keep the power supply up to a sufficient level.

Communication Specification

Communication model

Connectivity needs to be streamlined to gain seamless and constant connection with a server. This can be done by GSM technology either integrated in the device or by using a mobile telephone. Wireless LAN will increase the price dramatically. A Wireless LAN card will cost \$75-100, which only provides LAN access on site. Wireless LAN is therefore no option and communications will be based on GSM technology.

imbedding GSM module

Embedding a GSM module will increase size, price and weight. For example a GSM module from Wavecom has a size of 64x46x7.6mm [11] and weights 30 grams. Apparently a GSM solution that is integrated in e.messaging device can have 2/3 size of this module: 42x30x2.5mm. A raw estimate suggests that a GSM module would cost \$30. It is possible that a messaging device will compromise connectivity of the mobile telephone when it is used. Embedding a GSM module prevents that.

connection via mobile phone by using Bluetooth

If only notification and reading messages is required connecting it to a mobile phone could set up communications. When using a mobile phone to connect to a server, usability can be improved by providing a wireless connection. Ericsson has launched its first Bluetooth product. A headset is wirelessly connected with an Ericsson mobile phone. Bluetooth works then as a short-range cable replacement. I will adopt this concept although Bluetooth is still unproven.

The read-only device will probably require not as much from a mobile phone to be connected as a read-and-write device. I will therefore embed a GSM module in a read-and-write device and use Bluetooth to connect a read-only device to a mobile phone.

General Packet Radio Service (GPRS) can deliver seamless connectivity to a server. It is an extension to the GSM system that provides a system that is made for continuous connection. The billing structure is only based on the use of services. It was implemented in the last quarter of 1999 in parts of Europe and the roll out continues.

Communication protocol

Hand-produced information is Image-based information that will require a format to send and receive this kind of information. To support image format on the limited bandwidth I believe it would be beneficial to use the Wireless BitMaP image format (WMBP). WMBP is a Wireless Application Protocol (WAP) solution to send and receive image-based information between devices. WAP is an open protocol for wireless communication. The WAP forum claims that WAP specifications solve the transport and content problems of the constrained wireless environment today [5] and can be used on top of GPRS. The WBMP image is organized in pixel rows. To be able to use WBMP, WAP has to be adopted for the delivery of wireless information on wireless devices.

WAP and its wireless BitMaP format

**push
mechanism**

I believe that WAP is very suitable for data transport between wireless devices such as e.messaging devices and will therefore be adopted to send and receive information by.

WAP also defines a push mechanism that will allow any Web server to send information to the client. A complete wireless push solution is being developed. A push mechanism enables the server to push a notification to the user instead of the messaging device having to check up if there are messages at the server, which is the case today. Having a wireless push solution means that it allows a sales executive to be alerted when time-sensitive information changes. Applications such as traffic alerts and stock quote triggers already make use of wireless push solutions.

Network Specification

Connection level has to be reduced to the minimum. A push solution to notify salesman can do that. Sales executives also have to be able to reach the server from outside the firewall. This will require a messaging server outside the firewall, which will communicate through a pinhole back to the company's main server.

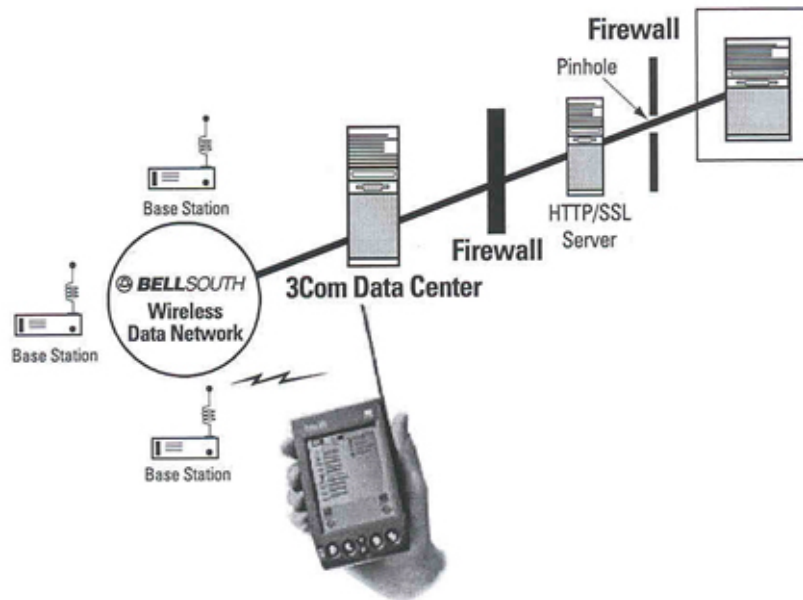


Figure 3.1 Example of how Palm VII is accessing enterprise data [I2]

**network
example**

The example shows how a Palm VII is connected to the enterprise system. It is wirelessly connected with base stations [I2]. The base stations will transfer the data packet over the Internet to the company through a set of firewalls.

This messaging server will have to be a server that will protect the pinhole in the Firewall.

A push solution allows a server to punch through the firewall to send notification to the user. To read messages from the server a request is send to the messaging server that will respond by setting up a connection through the pinhole. Power consumption should be considered as much as having a telephone call.

Price specification

The display will be the most expensive component of the device and therefore will be the main determinant of cost. The following estimations are based on information from different sources [24,25,26].

Estimate of cost price of a read only device

Display	\$10
Casing	\$5
Battery cost	\$7
Connector	\$6
Electronics	\$40

Total	\$68
-------	------

GSM module	\$30
------------	------

GSM enabled	\$98
-------------	------

Estimate of the cost price of a read and write device

Display	\$30
Touch screen	\$10
Stylus	\$1
Casing	\$5
Battery cost	\$7
Connector	\$6
Electronics	\$40

Total	\$99
-------	------

GSM module	\$30
------------	------

GSM enabled	\$129
-------------	-------

An e.messaging device will be positioned in a price sensitive area where a slight price difference can be very significant in the purchase decision. I believe the consumer prices should be low priced, around \$75 for a read only device and \$150 for a read and write device.

3.6 Product Requirements

Introduction

The categories of e.messaging solutions and types of e.messages are described respectively in paragraph 3.3 and 3.4. Using the technical specifications it is possible to make a list of product requirements per

category. These product requirements will set the boundaries for the idea generation to create product concepts.

e.me read-only

User Interface

A read-only device:

- Has to be instant on so that tasks can be accomplished quickly;
- Has to notify the user of incoming messages
- Needs to have the following modes:
 - Off mode
 - Standby/ notification mode
 - Read messages mode
- Needs to have the following controls:
 - Mode selector
 - Item selector
 - “Go Back” button
 - Message scroller in order to go from top till bottom
 - Print button
 - Delete button
- Needs a notification window so that new messages can be presented during the standby mode
- Needs an item window to present the name, time and date of received messages
- Needs a message window to present hand produced messages and ASCII test messages
- Needs a frame size of 76mm of length

Connectivity

A read-only device:

- Has to be able to connect to a server to get notification and read messages
- Has to maintain seamless communication with the message server when connection has been established
- Needs to be able to connect to a GSM network
- Needs to have the following components to maintain connection:
 - IR-sensor
 - Cradle connector

Power supply

A read-only device:

- Needs to have a power socket
- Needs to have sufficient power to be used for 10 hours or more
- Needs to have a stand-by function where it will save power
- Needs to be able to connect to a docking cradle

Docking cradle

A docking cradle:

- Needs to be connected to the cars services in order to use its services
- Has to be able to supply power to a read-only device

External design

A read-only device:

- Has to be as compact as possible and within 150x150x15mm
- Has to be as light as possible, around 150 grams
- Has to be robust and has to be able to withstand shocks
- May protect the display when it is not in use

Pricing

- An read-only device has to be have a cost price of around \$75

e.me read-and-write

User Interface

A read-and-write device:

- Has to be instant on so that tasks can be accomplished quickly
- Has to notify the user of incoming messages
- Has to be able to connect to a server to get notification, read or send messages
- Has to have the controls on the left and display on the right
- Has to have a display size of a frame size of 76x76mm
- Has to have an item window which has to present the name, time and date of received messages
- Has to enable users to read hand-produced messages, ASCII text messages and if preferred messages that are bigger than the screen size
- Has to have a touch pad and stylus
- Needs to have the following modes:
 - Off mode
 - Standby mode
 - Read messages mode
 - Compose messages mode
- Needs to have the following controls:
 - Mode selector
 - Item selector
 - “Go Back” button
 - Message scroller in order to go from top till bottom
 - Send button
 - Reply button
 - Print button
 - Delete button
- Has to enable that making a message has to be as simple as writing a Post-it note

Connectivity

A read-and-write device:

- Has to be able to connect to a server to get notification, read or send messages

- Has to maintain seamless communication with the read-and-write device server when connection has been established
- Needs to be able to connect to a GSM network
- Needs to have the following components to maintain connection:
 - IR-sensor
 - Cradle connector

Power supply

A read-and-write device:

- Needs to have a power socket
- Needs to have sufficient power to be used for 10 hours or more
- Needs to have a stand-by function where it will save power
- Needs to be able to connect to a docking cradle

Docking cradle

A docking cradle:

- needs to be connected to the cars services in order to use its services
- Has to be able to supply power to a read-and-write device

External design

A read-and-write device:

- Has to be as compact as possible and within 150x150x15mm
- Has to be as light as possible, around 150 grams
- Has to be robust and has to be able to withstand shocks
- Has to have a display which may be protected when it is not in use

Pricing

- A read-and-write device has to be have a consumer price of around \$150

**next
chapters...**

The idea generation of product concepts is described in appendix 5. the outcome of the idea generation will be presented in the next two chapters. Chapter 4 explains the outcome of the read-and-write device, called e.me tablet. Chapter 5 explains the outcome of the read-only device, called e.me pager.

future mobile computing



e.me tablet

Synchronisation between people
who aren't in the same place



4

e.me tablet

4.1 Introduction

The e.me Tablet concept will be described by discussing a use model and a scenario. To assess the value of this concept people have evaluated the concept during concept testing. The set-up and acquired data are described in appendix 6. The concept's interface is also evaluated by using a paper about designing interfaces for handheld computers. The evaluations and conclusions will be discussed in paragraph 4.4.

4.2 Use model

- An e.me tablet is a handheld e.messaging device that allows users to read and write e.messages, anytime and anywhere
- It allows people to synchronize who aren't in the same place at the same time.
- It supports and enhances existing communication patterns between people within work or social groups. It improves workgroup coordination and efficiency
- When new messages have been received on the main system, the message server will push a notification to the e.me device
- The user will get notification of received messages to alert him or her for timely important messages
- To read the received messages users have to change the function mode from "Stand-by" to "Read messages". The received messages can then be selected to read them, while the device can instantly set up a full link with the message server.
- After reading a message it is possible to reply on the message by pushing the reply button and writing a message. The recipient is automatically selected. It is also possible to delete it by pushing the delete button
- A message will be written by making a handwritten message. This is done with a stylus on a 76x87mm touch screen. The message will not be converted in ASCII text but will be sent to the recipient as a handwritten message.
- It is possible to compose a quick message by using handwriting as a way for input and possibly draw a sketch or graph.
- To compose a message the mode of the device has to be changed to "Compose messages". This allow users to select a recipient from their address book and write a message
- The left hand will hold the e.messaging device, while the right hand makes the message. The left hand can then also operate the main

buttons on the left side of the device. This will allow users to switch from “Stand-by” mode to “Read Messages” mode or to “Compose Messages” mode

- It is possible that a message will be composed when the device lies on a desk. It needs to be possible to operate the control when it lies on a desk.
- If a message needs to be printed it is possible to beam a message via Infrared to a HP “Jetsend” printer. The message can then be printed without any need of a desktop PC.
- While driving a user can concentrate on driving by using the car e-services to listen to messages. Possibly he or she can record messages by using speech-to-text interpretation. Speech-to-text interpretation is a car e-service that can be activated by another car e-service speech-control. On its turn pushing a button on the steering wheel can activate speech control.
- The e.messaging device will be a mobile window to the message server. The messages will remain on the server just like you read messages at your desktop from the server.
- The anytime/ anywhere connection is provided by an imbedded GSM module, which maintains connection with the message server, as long it is possible to have a connection

4.3 Scenario

Introduction

In the scenario below a story is told about a day in the life of Paul the sales executive. In the scenario I have made the assumption that Paul’s car has car e.services.

“A day in the life of Paul the Sales Executive”

The day of Paul the sales executive starts with waking up and having breakfast. Paul ignites his e.me tablet and enters his Personal Identification Code on his tablet. The code is accepted.



The screen changes into the stand-by/ notification window and indicates that the Message Server has received two messages. Instead of reading them he wait until he has to drive to work.



As he gets in his car he docks his e.me tablet in the docking cradle attached to the dashboard. While driving towards work he is able to listen to his messages as they are connected to speech.



The e.services of his car interpreters his text messages into voice messages. Also the car e.services allows him to use speech control to operate the messaging device so that he can concentrate on driving. To activate and deactivate speech control he has to push a button on the steering wheel. The car e.services will be connected to the message server via GSM connectivity. It will be an assistant to listen to messages stored on the message server.

Paul commands: "Read messages out loud!" A voice starts reading out the messages. If Paul wants to call a contact he can use car e.services to phone him or her up. When Paul is finished reading a received message he says: "Delete message!", with the reply: "Message deleted". When Paul arrives at work he commands: "Quit messaging service!" and puts the e.me tablet on stand by.

At work, on site

Arrived on site, Paul walks to his personal workspace, docks his e.me tablet and starts working on his desktop system. Later, at 10:15, he has a meeting. He grasps his tablet, puts it inside his pocket and walks to the meeting room. On his way he gets notified of new messages. He takes it out of his pocket and it notifies that the message server has received two messages. He clicks the mode button to the "Read Message" mode. The "Read Message" window indicates that the messages are from Chris Smith and Jack Small.





While reading the messages he received another message. It is a message from Fred: "Paul, I have interesting information about Starck & Co. Drop by during the day. Fred." He clicks the reply button and writes that he will come and see him after the meeting.



After sending the reply he takes his mobile phone and calls Chris Smith to get back to him. He deletes the message of Chris.



After their conversation he walks into the meeting room. In the meeting he gets another message. This message contains a lot of information about Starck & Co. When the meeting is over he beams the message to a printer and walks to Fred to talk about it.



They discuss the information and he walks back to his workplace. Paul calls some people at Starck & Co about a possible meeting. They say that he will get a message with possible dates for appointments. At 12:30 he has another meeting.

Paul is still waiting for the message, but the meeting is just going to start. This meeting is with other colleagues and is rather informal in nature. During the meeting he gets notified of a received message. The notification is unobtrusive so that his colleagues are not being disrupted. He checks the "Read Messages" window, but the name of the company or customer is not between the messages. He ignores the messages for the time being. Minutes later he receives another notification: the awaited name appears in the window. He reads the message and has to make an immediate phone call to set an appointment. He excuses himself for leaving the meeting and makes the phone call at his desk.

At work, off site

He confirms his appointment and Paul has to prepare project related documents. He sends a quick message to let Fred know his appointment is confirmed and that he is going to Starck & Co.



He checks his project files and prints out some documents to update the document. He takes his jacket with his mobile phone and e.me tablet in it and his briefcase with his paper organizer and project files and goes to his car.



In his car he grasps in his pocket for the tablet and docks it in the cradle. Incoming messages will be notified right away.

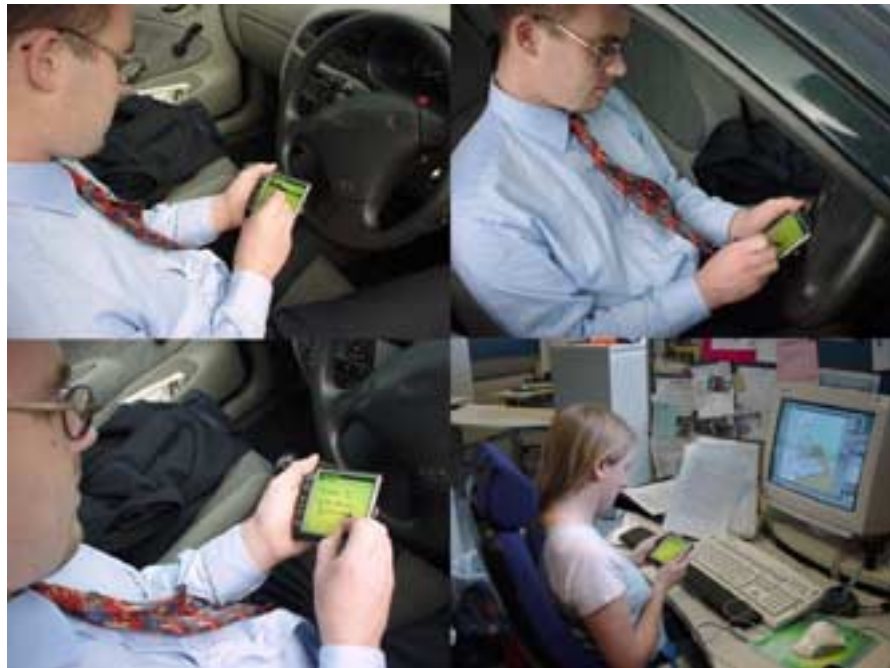
After listening to new messages, while driving the car, Paul would like to respond to a certain email. He already has the speech control function activated so he commands: "Record message!" The agent of the car e-service reacts: "To whom do you want to send a message?" After selecting the recipient the device reacts again: "What would you like to record?" So he starts reading up the lines he wants to record. At the end he says: "End recording, speak out the message." The e-service reads out the message. The message is good enough to prevent difficult manipulations so he commands the service to send the message.

Paul has arrived at the site of the customer and has some time left. He sits in the car and looks through some project files. He has received a message and he wants to react on to it. It is a message from a colleague trying to get a hold on him. Paul takes out his e.me tablet, writes a small message on it to tell him that he is off site and he will be back in a few hours, sends it away and proceeds with reading some files.

Paul is at Starck & Co in the reception. He gets notified of an incoming message. He takes out his e.me and sees it is a message from Fred. Paul

scrolls through the message and browses through the content. It is a pretty long message with important information that is related to the meeting so Paul decides to print it out. He asks at the desk if he can use the printer and beams the message to the printer. He points his message device towards the printer and pushes the print button. Printing can only be done by beaming the message to the printer. When received the printer prints it and the message rolls out. Paul gets it from the reception clerks and sends Fred a quick thank you message. He reads it while waiting for the meeting.

After the meeting he sends his girlfriend from the car a message that he will be back in a few hours and asks if he needs to get some groceries on his way from work to home. His girlfriend checks their stock and sends him a small list. When Paul gets the message he keeps the list to use it in the shop.



4.4 Evaluation of e.me tablet

Introduction

The evaluation of the e.me tablet is divided into two parts. The first part is the evaluation done by testing the concepts on 12 subjects. The second part is an evaluation of the concept's interface by using the Computer Human Interaction Paper: *Designing Interfaces for Handheld Computers* by Shoemaker.

Results of concept testing

The following questions are research questions that I wanted to find answers to during concept testing. The answers are constructed from the data acquired during the tests [Appendix 6].

1. How do subjects react to the concepts without any explanation? What are their first associations with these concepts?

In general, subjects that are aware of palmsize PCs and other organiser devices expect organiser functionality. I believe that the shape of the eMe Tablet is too similar to the prototypical shape of an organiser, although the orientation is different and buttons are situated at a different place. The form of the eMe Tablet communicates to users that it will have organiser capabilities.

2. How do the subjects hold the models and what do they think of the shape?

The e.me tablet is considered too wide to hold properly. Subjects realized that the screen size was largely part of the width, but also realized that the size of the screen is of benefit. Subjects were asking for a slightly smaller size device with the same size of screen.

Next to the width I believe that device is not considered to have enough grip to hold it properly. The lack of tactile elements could be the cause of this. Perhaps other materials and grip aids, in terms of shape and friction, would increase

3. What is their view on functionality and usability after the concepts have been explained?

Although it is difficult to indicate a proper opinion from a not operational model for this question, the subjects have rated usability 79 points from a possible 100 point, which is mainly related to the perception that the focused functionality of the device would increase usability.

The subjects state that they would like to have more functionality in the device. The need for more functionality in one device is the result of a need to take as few devices with you as possible. I believe that multi-functionality appeals more to people, although they indicate that focused functionality would increase usability.

Some subjects asked if it could be a phone as well. Because it has GSM capabilities it could operate with a wireless headset or a wired earpiece. One subject stated that she wouldn't mind having to use a wire if it was possible to use it as a mobile phone as well.

4. Where do the subjects expect to buy such a device and what would they pay?

In general they expect to find such a device in electronic shops, possibly in phone shops. The concept is partly perceived to be part of the mobile phone market.

It is difficult to analyze a specific verdict about how much subjects actually would pay for such a device. The question is too vague to analyze properly and therefore the verdict could be interpreted in 3 things:

- How much they would pay for it;
- How much they expect the price will be in the shops;
- How much they think it should be sold.

The verdict therefore varies from £60 to £200.

Subjects have also confirmed the assumption that it has to be priced sensibly because of its limited functionality, possibly around £100. I believe that if the product is offered like a service instead of paying for the device it would be more interesting to consumers. Several subjects confirm this.

5. What do subjects think of the scribble-input method and do they perceive the size of the screen adequate?

In general it was perceived as okay as a way to give input. Some subjects prefer it, some do not like scribbling and one would not want to send his handwriting to others.

One subject indicated that he did not like scribble. He liked speech better and finds it quicker. He indicated that *tap&talk* of Microsoft would be an interesting feature. You could tap and speak in a part of the message, draw a graph, finish the message with speech and sign it with a real autograph.

I believe that it could be beneficial if different kinds of input are possible,.

The screen size is perceived as good for writing a small message on.

7. What do subjects think if they have to make a trade off between grasping the device better and having a slimmer but longer screen than the screen on the concept?

In general people wanted to trade screen size for improved grip.

“With the smaller screen ... everything would fit so much better...somewhere in between would be good...size like a police notepad.”

8. Is the concept appropriate to you?

In general the concept was rated appropriate, but more functionality was a common request.

“I actually really like this one and I am not a gadget person. The fact that it is handwriting and not typed. I can’t stand electronic diaries where everything has to be done in at a key of a miniature keyboard... It is good... This is the kind of thing you could use in the train or something like that, instead of the mobile phone. I hate people who talk on mobile phones in the train...”

Conclusions to be taken after concept testing

**expected
(multi)
functionality**

The e.me tablet is expected to have organizer functionality because of its form. The shape resembles the prototypical form of palmsize PCs, although orientation of buttons and screen are different. A change of form has to take place to enable an e.me tablet to communicate to users that it does not have organizer functionality.

The width has to be reduced in order to improve grip. Tactile form elements have to be implemented, which will improve grasping and usability. To improve these aspects a trade off has to be made with the screen size. I believe that an 86x66mm or 96x76mm size screen (instead of a 76x76mm screen) would work. This will depend on what width allows people to ergonomically wrap their hands around back of the device.

Scribble input is claimed to be sufficient to compose messages by most of the subjects. It might be interesting to implement a “tap&talk” system for input. By using speech-to-text interpretation pieces of text can then be “recorded” in the message. This will enable users to compose messages how they see fit and possibly according to the situation. A “tap&talk” system will require a microphone, while the server will deal with the interpretation.

A problem is still the number of devices that have to be taken with a person. An e.me tablet would expand this number. If the core functionality of mobile phones is making a transition from the device to a headset or an earpiece would it be a logical step to use an e.me tablet as the part that will enable connectivity. The e.me tablet would then enable communications while a headset is used to talk to people. Speech control could be used to indicate the person that has to be called. The headset can then also be used as the device that allows users to compose a message by speech-to-text interpretation.

An e.me tablet that allows people to make voice messages or use it as a the telephone it would actually be more in line how mobile workers use communication technology (paragraph 2.3). The interest in receiving email and sending voicemail would then be addressed.

An additional effect would be that an e.me device could more accurately be placed on the communication market instead of the PDA market for what is actually enables: asynchronously communications. I believe that this is a suitable solution for the “design for purpose” theme.

Interface evaluation

Designing Interfaces for Handheld Computers is a paper that is made to inform designers about tips and techniques to design effective handheld application [4]. I have filtered out tips that are of value to improve the interface.

Tips:

- Limit the amount of features;
- Applications can be launched by pressing a hardware button;
- Pressing a button or a speed key simply executes that function, again without a wait;
- Place infrequently used features deeper in the product.
- Use words in the design of handheld applications rather than icons
- Expect users to use their finger to work with your application. Never assume the stylus is being used, nor require it.
- Clearly indicate where the user is all the times
- Justify every pixel

The e.Me Tablet has a very limited amount of features to do messaging. I do not believe that reducing features is going to help the user. On the other hand three hardware buttons - delete, print and reply - only launch an activity or an application when the device is in “Read messages” mode. In the other modes they don’t work. One hardware button, the send button, only works when a new message is composed or when a reply has to be sent off. When users press the button they expect the launch of an application. If the buttons don’t work they will provoke confusion. These buttons have to be placed in the screen at a suitable level.

Delete and print are features that are related to reading messages and need to be shown in the “Read messages” screen. A message can then be selected to delete or print. Showing these applications while reading a message would compromise the screen size and therefore are only shown in the window where messages can be selected to read.

If a message needs to be replied a user wants to do this when reading a message or after reading a message. Implementing this in the window where a message is shown, would again compromise readability.

I therefore believe that this feature also needs to be shown in the window where the messages can be selected to read it.

The three features – delete, print, reply – can be placed on the bottom of the screen so that the selection of messages receives the most attention.

If a message needs to be replied a user can do so by clicking the reply button. The recipient is then already selected and after writing a message it can be send away. The send button can be placed to the right of the title bar of the reply application, which leaves us the most room to compose a message. To increase consistency this needs to be implemented in the “Compose message” mode as well.

The hardware button that selects the mode indicates the user where it is. Possibly because of its size it needs more emphasis. I believe there is a need to give a more tactile feel to go down one level in functionality. When you select a message you would especially go down one level to the message window to read it. When you select the "to:" box you go down one level to activate the address book. When you select the writing area you would have the complete area to write a message. These selections to go down could be supported by a physical "click in, click out" button. Click in to select and go down, click out to deselect and go back up a level. In that case you would not need a "go back" button and it would also be more tactile.

future mobile computing



e.me pager

Being aware of timely important information



5

e.me pager

5.1 Introduction

The e.me Pager will also be described by presenting a use model and a scenario. Concept testing has taken place to evaluate the value of the concepts. The set-up and acquired data are described in appendix 6. The evaluation and conclusions will be discussed in paragraph 5.4.

5.2 Use model

- An e.me pager is a device that allows people to be reached by time sensitive information
- It allows people to leave their main system and still be aware of incoming messages.
- An e.me pager lets people be notified of newly received message and enables it to read them. Allowing users to delete or print their messages on the go supports message management.
- The function mode has to be changed from “Stand-by” to “Read messages” to select and read messages. When a message is selected a full link is set up with the message server
- The tactile scroller allows people to scroll through the messages as natural as possible
- If a message is too big it can be printed out by beaming a message to a HP “Jetsend” printer, without any need of a desktop PC.

5.3 Scenario

Introduction

In the scenario below again the story is told about a day in the life of Paul the sales executive. In the scenario I have made the assumption that Paul’s car has car e.services.

“A day in the life of Paul the Sales Executive”

The day of Paul the sales executive starts with waking up and having breakfast. Paul clicks his e.me pager on "stand by" mode and it indicates that the Message Server has received a couple messages this morning.



He does not check his messages right away, but reads his newspaper. After breakfast he gets into the car and docks his e.me pager in the docking cradle attached to the dashboard. While driving towards work he is able to listen to his messages as they are connected to speech.

The e-services of his car interpreters his text messages into voice messages. Also the car e-services allows him to use speech control to operate the messaging device so that he can concentrate on driving. The speech control is activated and deactivated by button on the steering wheel. The car e-services will be connected to the message server via GSM connectivity.



Paul commands: "Read messages out loud!" A voice starts reading out the messages. When Paul is finished reading a received message he says: "Delete message!", with the reply: "Message deleted". When Paul arrives at work he commands: "Quit messaging service!" and sets the e.Me Pager on stand by.

At work, on site

Arriving on site, Paul walks to his personal workspace, docks his e.me pager and starts working on his desktop system. Later, at 10:15, he has a meeting. He grasps his Pager, puts it inside his pocket and walks to the meeting room. On his way he gets a notification from his e.me. He takes it out of his pocket and it notifies that the message server has received two

messages. He clicks the mode button to the "Read messages" mode. The "Read messages" window indicates that the messages are from Chris Smith and Jack Small.



While reading the messages he received another message. It is a message from Fred: "Paul, I have interesting information about Starck & Co. Drop by during the day. Fred." He takes his mobile phone and calls Chris Smith to get back to him. After their conversation he deletes the message and walks to the meeting room.



In the meeting he gets another message. This message contains a lot of information about Starck & Co. When the meeting is over he beams the message to a printer and walks to Fred to talk about it. They discuss the information and he walks back to his workplace.



Paul calls some people at Starck & Co about a possible meeting. They say that he will get a message with possible dates for appointments. At 12:30 he has another meeting

Paul is still waiting for the message, but the meeting is just going to start. This meeting is with other colleagues and is rather informal in nature. During the meeting he gets notified of a received message. The notification is unobtrusive so that his colleagues are not being disrupted. He checks the "Read Messages" window, but the name of the company or customer is not between the messages. He ignores the messages for the time being. Minutes later he receives another notification: the awaited name appears in the window. He reads the message and has to make an immediate phone call to set an appointment. He excuses himself for leaving the meeting and makes the phone call at his desk.

At work, off site

He confirms his appointment and Paul has to prepare project related documents. He checks his project files and prints out some documents to update the document. He takes his jacket, puts his mobile phone and e.m.e pager in it and takes his briefcase with his paper organizer and project files. In his car he grasps in his pocket for the tablet and docks it in the cradle. Incoming messages will be notified right away.

Paul has arrived at the site of the customer and has some time left. He sits in the car and looks through some project files. He has received a message and he wants to react on to it. It is a message from a colleague trying to get a hold on him. Paul takes out his mobile phone and calls him.



Paul is at Starck & Co in the reception. He gets notified of an incoming message. He takes out his e.me and sees it is a message from Fred. Paul scrolls through the message and browses through the content. It is a pretty long message with important information that is related to the meeting so Paul decides to print it out. He asks at the desk if he can use the printer and beams the message to the printer. He points his message device towards the printer and pushes the print button. Printing can only be done by beaming the message to the printer. When received the printer prints it and the message rolls out. Paul gets it from the reception clerks and sends Fred a quick thank you message. He reads it while waiting for the meeting.

After the meeting he phones his girlfriend to ask if he needs something to take with him from the supermarket. His girlfriend is not at home, has no mobile phone and cannot reach her. He decides to try later....

5.4 Evaluation of e.me pager

Introduction

The evaluation of the concept is divided into two parts. The first part is the evaluation done by testing the concepts on 12 subjects. The second part is an evaluation of the concept by using the Computer Human Interaction Paper: Designing Interfaces for Handheld Computers by Shoemaker.

Evaluation of concept testing

The following questions are research questions that I wanted to find answers on during concept testing. The answers are constructed from the data acquired at the tests [Appendix 6].

1. How do subjects react to the concepts without any explanation? What are their first associations with these concepts?

In general, subjects perceived the e.me pager as a email device for reading email only.

2. How do the subjects hold the models and what do they think of the size and shape?

Subjects considered the e.me pager to be very tactile.

“I want to turn that little bit at the end, I want to turn that and I want to see this scroll around...It feels like it is going to scroll when you twiddle at the end.”

The overall opinion was that it is slightly too big and difficult to carry. I believe that subjects, while imagining using it liked the size and screen size to handle it, mainly because of the screen size. Also while imagining using it subjects felt that it is too big to be carried in a pocket or without any strap or accessory.

3. What is their view on functionality and usability after the concepts have been explained?

Subjects perceive the e.me pager as an interesting device for its tactile design. In terms of usability they considered it easy to use, because it has very limited functionality. Because of its limited functionality subjects consider the e.me pager to be more of gadget than a device. The purpose is not considered to be useful.

Some subjects do not want to use it because it is possible on a mobile phone. A subject does not want to use it because it is possible to do it on her Palm. Carrying two or more devices, while it could be done with less is not appealing.

“It is all going into the phone. It’s got to have everything.”

Other subjects claim that they would like to be able to respond with the same device. They claimed that it would be annoying to have to switch to another device in order to react.

A few subjects saw the e.me pager to be beneficent if it is possible to use it separated from the mobile phone.

When I asked the subjects if they would mind having it as a gift, they claimed that they would not mind having it. This does not indicate that it actually would be used all the time, but indicates that the e.me pager is appealing as an accessory.

4. Where do the subjects expect to buy such a device and what would they pay?

Subjects expect it to be found mainly in electronic shops or phone shops. Some subjects could imagine it finding in fashion shops being sold as a fashion accessory.

Again the price evaluation can be interpreted differently. The main issue is that it is perceived as a gadget – possibly a toy – and therefore it has to be cheap, approximately below £50.

5. Is the concept appropriate to you?

Subjects do not perceive this as appropriate because they cannot see a real benefit above other possibilities. They like it as a gadget, though.

Conclusions to be taken after concept testing

The e.me pager cannot live up to the competition with a mobile phone. Mobile phones allow people to be notified and read messages, although it is on a smaller display. A solution that has to use a mobile phone to read messages on a slightly bigger screen is not able to compete with the appeal of multi functional mobile phones. The need for this read only device is low. The perception of subject to label it as a gadget confirms that. If it has standalone connectivity it would be of use to people who do not want a mobile phone but wants to be notified of incoming messages; a product for a niche market. If the technology is developed for the e.me tablet it could be used in an e.me pager, which would reduce development cost. Still I believe that the competition is too big, the need is too low and therefore I will focus on the e.me tablet as a product proposal.

Interface evaluation

One redundant button is the "go back" button. It is possible to use a button that physically clicks in and out which would communicate selection and deselection to the user. By using such a physically button it is no longer needed to have a "go back" button. As an improvement of the mode selector it is possible to change it for a "twist" button. The device has to be handled by two hands. The right hand controls the scroll button and the left hand controls the mode selector. The left hand also controls the delete or print buttons. The left end of the device could click in three positions to control the mode.

The positive reaction on the scroll button indicates the need for more tactile design. Products are being developed for multi functionality on a too broad market. The products are so divers that tactile design has disappeared from handheld devices. This needs change because I believe that people are tactile oriented.

6

Directions for future development

As a conclusion to this report I will suggest directions for future development.

Develop e.me tablet in three versions:

1. e.me tablet in its core form

The e.messaging use model would be as it is described in chapter 4.

It needs to have a new tactile form, through which it is possible to create its own form factor.

2. e.me tablet with voice messaging functionality

The e.messaging use model would expand with a possibility to send voice messages

This requires speech input on the device, which could be done by using a microphone and push-to-record functionality.

Then speech-to-text interpretation could be used as a way to give input for messages

The microphone could be separated from the e.messaging device by using a head set or wired/ wireless microphone

3. e.me phone

An e.messaging device which is connected wireless or by using a wire with a headset or an earpiece

The e.messaging device enables mobile telephone connectivity for headset or earpiece

It virtually keeps the functionality down by splitting the functionality into different parts.

The headset or earpiece would be the mobile phone interface, while the e.me device would embody the messaging device.

Overall design themes:

- Design for purpose
- Design the product how users need it to have
- Differentiate from your competitors not by increasing the amount of features but by creating more easy to use and compelling designs
- Product differentiate the same concept in different appealing products. Design a certain package that is compelling to specific user groups. The design requirements are different while the concept and technology is the same.

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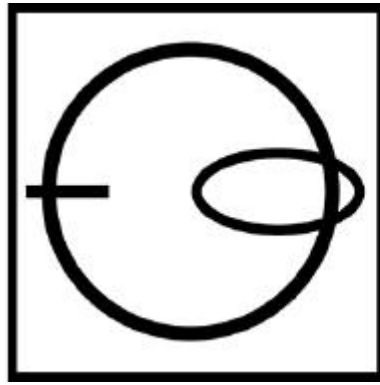
Scanned figures

- Figure 2.2 Interest in Wireless Applications When Away from Primary Workplace scanned [7]
 Figure 3.1 Example of how Palm VII is accessing enterprise data from [12]

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appendix
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Appendix
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A graduation project at **Hewlett Packard Laboratories Bristol**

Faculty of Designing, Engineering and Production
Sub faculty of Industrial Design Engineering

Jeroen Bijsmans

Professor: J.M. Hennessey
Company supervisor: Erik Geelhoed
Faculty supervisors: P.J. Stappers
J.P.L. Schoormans

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A1 graduation assignment

Future Mobile Computing

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Start date: September 1999

End date: February 2000

Introduction

Recently, the Hewlett Packard Company has been reorganised into two companies: Agilent Technologies and Hewlett Packard. As a result of this reorganisation the new Hewlett Packard Company has reinvented itself and set a new direction for the future. HP will focus on capitalizing on the opportunities of the Internet and the proliferation of electronic services, in terms of e-services, appliances and infrastructure.

Hewlett-Packard Laboratories in Bristol are the European Research Laboratories of Hewlett-Packard. Hewlett-Packard Laboratories has, as part of their research activities, a focus on mobile computing to leverage electronic services and appliances.

Problem definition

The world of mobile computing is a very dynamic area in terms of product development. Hewlett Packard Labs Bristol is interested in future possibilities for mobile computing products to leverage e-services and appliances. Because future mobile computing is very wide area a visualisation of the design space has to take place, after which an area within the design space will be chosen to focus upon.

Assignment

Identify the design space within the mobile computing area. Indicate the most interesting area of the design space and generate a portfolio of conceptual designs for future products within this area. Design one of the conceptual designs into a product design.

Project scenario

First, the design space has to be visualised by identification of mobile computing technology, market perspectives and user groups. Second, focus points within the design space will have to be indicated, which are interesting for further investigation. One focus point will be selected to investigate and the outcome will have to be a portfolio of conceptual product designs. One product proposal will be chosen and developed to a level that will enable an evaluation of the design. At the end of the project there will be a presentation of the results at the Hewlett Packard Labs Bristol and the sub faculty of Industrial Design Engineering in Delft.

A2 technological developments and market perspectives

2.1 Cellular Roadmap

The roadmap beneath is derived from the cellular roadmap made by the FSI. The roadmap presents the different generations of mobile telephone systems and the possible applications.

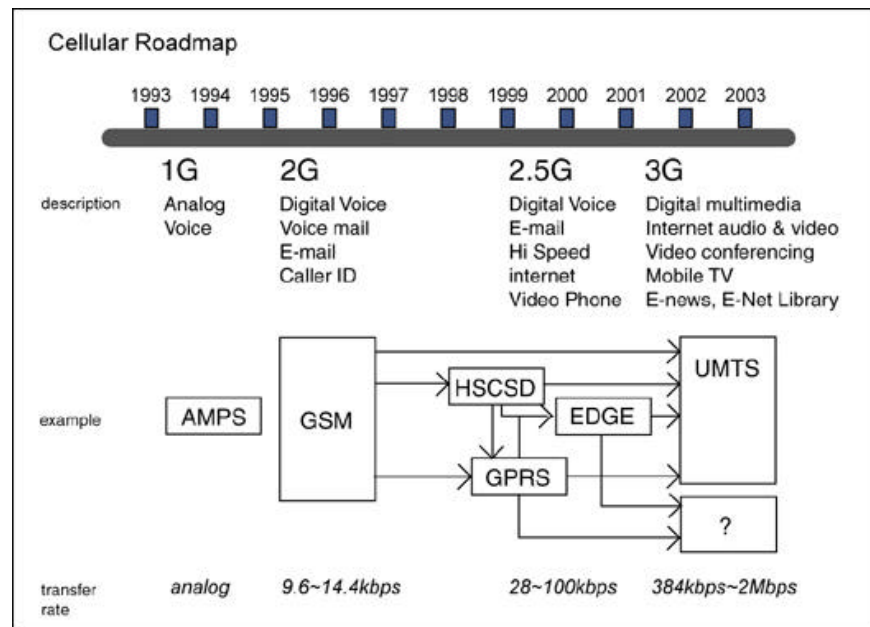


Figure 2.1 Cellular Roadmap

Generations [30]

1G The first-generation mobile phone systems were different systems, which used analogue voice transfer. Advanced Mobile Phone System (AMPS), which was installed in 1982 in the US, was one of the most important 1G mobile phone systems. Later it came in use in England under the name of TACS and in Japan, where it was called MCS-L1. The AMPS-system had a bandwidth of 30 kHz: with a channel of 824 to 849 MHz to send and a channel of 869 to 894 MHz to receive.

In Europe it was possible to have five different analogue systems in different countries. Therefore it wasn't possible to use for example a French mobile phone in the England. Security is another big problem of the analogue mobile phone system: the analogue-system has such an architecture it is easily to be tapped by a radio-transmitter.

2G The second generation of mobile phone systems are digital systems. The European developed Global System for Mobile Communications (GSM) is a digital telephone system, which made it possible to integrate voice, data and fax transfer into one system. It is possible to use less

bandwidth because better algorithms for speech compression are being developed. It is also possible to use error-correcting codes to enhance the transmission quality and to secure digital signals by encryptions.

GSM is actually a non-legacy mobile telephone system choosing for non-backward compatibility with the 1G mobile telephone systems. The American and Japanese mobile systems are designed to be compatible with the analogue mobile telephone systems, making it possible to use every AMPS-channels for analogue and digital communications. The transfer rate is 9.6 to 14.4 kbps, which makes it just possible to use e-mail.

2.5G The 2.5G of the mobile telephone systems represent the integration of features and solutions to develop the 2G mobile telephone system within the existing infrastructure. These developments are generally designed for the 3G but because they are implemented incrementally they have become the 2.5G. The goal to develop the 2G networks is to gain high speed data transfer and increased voice capacity at much lower cost. To develop an existing network further is much less expensive then to develop a totally new 3G infrastructure.

For example: General Packet Radio Service (GPRS) is being designed to work within the existing GSM infrastructure. It uses a packet-mode technique to transfer data and signalling in a cost-efficient manner over GSM radio networks and also optimises the use of radio and network resources. The reason for this is that GSM is the most advanced cellular system for the implementation of packet switched data transmission. The transfer rate of GPRS can handle bit rates from 9 up to 150 kbps. With this data transfer rate all types of transmissions can be handled: from slow-speed short messages to the higher speeds needed when browsing Web pages. High-speed circuit-switched data (HSCSD) and Enhanced Data Rates for GSM Evolution (EDGE) are other developments within the 2.5G.

Another important factor of 2.5G mobile telephone systems is that is not only uses radio technologies, but will also use the networking infrastructure. To allow users to roam from network to network Mobile IP standards will have to be implemented. Using Mobile IP it is possible to support WAP services and IP-based packet data. Wireless Application Protocol (WAP) services make it possible to access the Internet directly and use the Internet as a communication infrastructure. WAP is a communications protocol and application environment and is similar to protocols used in Internet technology. WAP protocols are optimised to operate on limited and narrow bandwidth like the GSM network. To use the Internet as an information provider WAP will provide a problem. It does not read the sort of HTML code that is normally used to design Web pages. WAP can only support Web pages that have been designed with the Web language WML (Wireless Markup Language). By using WAP consumers can only view the WML-designed sites.

3G If the 2.5G is part of the development of the 3G mobile telephone system, at which point does it become a 3G system? The International Telecommunications Union (ITU), the global standards body for communications, has mandated the standard for 3G mobile telephone systems. The International Mobile Telephone 2000 (IMT-2000) mandates data speeds of 144 Kbps at driving speeds, 384 Kbps for outside

stationary use or walking speeds, and 2 Mbps indoor. Again the actual achievable data rate will be 60% and has to be shared with all of the users. For example one of the 3G solutions is Universal Mobile Telecommunications System (UMTS), which will probably be useable in outside stationary use or at walking speeds with a transfer rate of 100-200kbps. The 3G solutions are combined developments of the 2.5G infrastructures like EGPRS (combining GPRS and EDGE) and Wideband-Code Division Multiple Access (W-CDMA) a further development of the EDGE and CDMA infrastructure.

Product wise

The development of the cellular product wise is dividable into two main directions. The first direction is the ongoing development of 2G mobile telephones by adding more features to it as a result of the wider bandwidth. The features can range from built-in modem to videophones. The second direction is the integration of the PDA with the mobile phone. Every manufacturer embraces connectivity with a PDA as a product concept. Some companies think integration is the solution while other companies think that optimisation of the connection between a mobile phone and a PDA is the solution in order to keep the phone’s traditional size, flexible and “ubiquitous”. The last opinion about connectivity will place these manufacturers and their solutions in the first direction category.

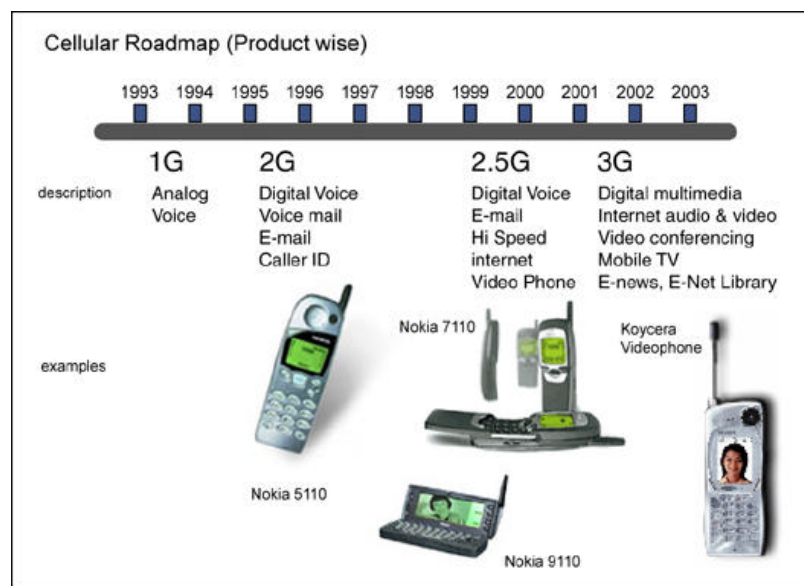


Figure 2.2 Cellular roadmap (Product wise)

Features

The formula to connect your notebook PC with the Internet would require your notebook PC or PDA, a PCMCIA modem and a mobile telephone. New developments simplified the set up by integrating modems into the mobile telephone, connecting the mobile with your notebook PC through infrared data transfer. The developments concerning Bluetooth should make connectivity with the notebook PC and other devices even easier.

As a result of developments on 2.5G and 3G mobile telephones system cellular will be able to add a lot more features on the basis of increased data transfer. Using WAP it is possible to use a traditional size mobile telephone and being able to access the Internet to view the WML-designed sites and to read your e-mail (e.g. Nokia 7110). This can evolve into on-line shopping, banking and entertainment services. Eventually as a 3G mobile telephone application it will be possible to transmit real-time video images, which will leverage the mobile videophone (e.g. Koycera VisualPhone VP-210).

Integration

The four different solutions for smart phones represent the different ways of thinking about integrating the mobile phone into a PDA (e.g. Nokia 9110 Communicator). It shows the area of tension within the concept of integration and the divided opinion between manufacturers.

Nokia, Ericsson and Psion have formed a joint venture called Symbian. Symbian will develop products for wireless connectivity using future mobile telephone infrastructure to get connected. These future product concepts are actually smart phones, which will include technologies as WAP, Bluetooth, GPS navigation systems, digital camera's, web browsers, digital radios and TV viewers into one device. These devices can be called Wireless Information Devices or Personal Multimedia Devices. "Symbian's mission is to set the standard for mobile wireless operating systems and to enable a mass market for Wireless Information Devices"¹²². Wireless Information Devices are the embodiment of the integration of features, cellular and PDA.



Figure 2.3 Nokia's vision on 3G products: Wireless Information Devices

A technical problem that arises from integrating of mobile telephones into any mobile computer is the generation of interference between the internal components.

Conclusions and discussion

The technological developments of the mobile telephone systems are in trend with the need for better connectivity and faster data rate. The 3G mobile telephone system will raise a lot of solutions for this need and will leverage an increase in features and types of form factors. These solutions will depend on the available power and are therefore focused on mobile telephone systems and on the form factors within this power area.

The trend of adding more and more features in mobile telephones raises the question about optimal interface design. Will this lead to bigger interfaces with larger displays, which can enlarge the mobile telephones to the size of palmsize PCs. Will adding more and more features, increase usability for this form factor?

The area of tension raised by the concept of integrating the mobile telephone into the PDA is parallel to the feature-adding concept: will it increase or decrease usability and flexibility while all of the solutions will contribute to better connectivity.

2.2 Palmsize & Handheld PC Roadmap

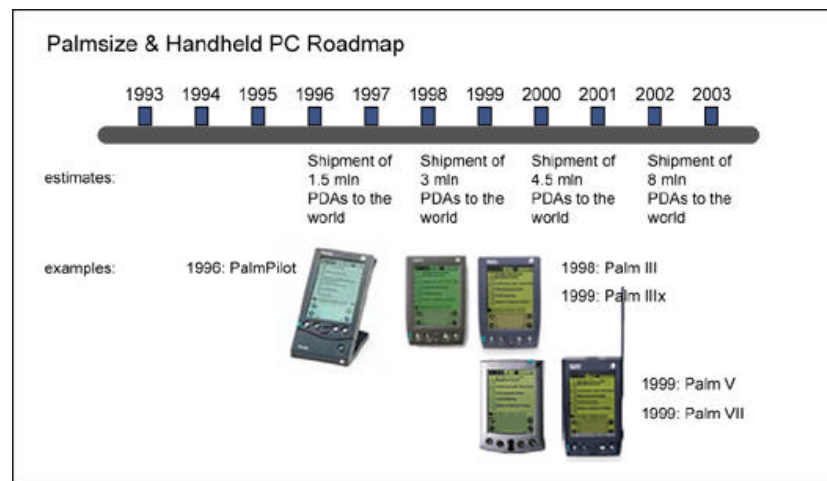


Figure 2.4 Palmsize & Handheld PC Roadmap

From 1982 palmsize and handheld PCs have been brought onto the market [6,31]. The market started to grow in 1996 when the first palmsize PCs came on the market, which included only the basic features for an electronic organiser. During 1996 Microsoft launched Windows CE 1.0 contributing to several devices (e.g. Philips Velo 1, Compaq PC Companion). The shipments to the world were about 1.5 million palmsize and handheld PCs. From that time the palmsize and handheld PC market developed itself to a fertile market with a shipment of 3 million products to the world in 1998. The PDAs are now available with all sorts of features like with colour displays, wired add-on modems, built-in modems, infrared data transfer, word processing and keyboards. They are able to retrieve some information from the Web by mobile telephone connections to the PDA or direct PC connections.

The next step is wireless connectivity to support Web-based applications. The Palm VII is now only available in the US and is designed to provide fast Internet access. It uses “Web clipping” a way to extract necessary data from a Web page and filter out data which will slow down the data transfer (e.g. images). It is possible to subscribe to the Palm.net network and have

the possibility to use 22 Web based applications, controlled by using the icons on the display. These applications include for example MasterCard and Visa ATM locator service or USP package tracker.

According to Dataquest's Product Analysis on personal computers in Europe [6,31], March 1998, the "companion notebook" segment will grow significant because companion notebooks can anticipate to the needs of users for a mobile assistant in way a notebook PC cannot. The "companion notebook" segment represent the handheld PC Pro's which use windows CE to deliver the base-level functionality of familiar desktop devices (e.g. pocket word, pocket excel), next to making notes and basic data communications capabilities with an 85 percent keyboard. Because these handheld PCs differ from current notebook PCs or mini notebook PCs in terms of weight, battery life, screens, price (sub-\$1000) and performance they can give the user the portability and usability to support their primary desktop computer while being mobile. The target user is therefore somebody who uses a desktop as a primary computer and is occasionally mobile in a campus setting, moving from office to office or from building to building. The target user can also be a student who is interested in a desktop companion to support him or her while being mobile. In the future it can be possible that students migrate to a companion alone, using campus Ethernet facilities for more advanced computing and backup. Dataquest's most important reason for their market perspective is that the cost of a desktop and companion will be a better value, in terms of usability, portability and costs, than a single, \$2000 - \$3000 notebook for these users.

Conclusions and discussion

Again the wireless connectivity concept is on the move. Next to the development of the standard palmsize and handheld PCs by adding more and more features, the direction is set to develop wireless PDA models for Internet information retrieval.

The question remains to whether integrating of wireless connectivity is the solution for palmsize and handheld PCs. It is also questionable if adding more and more features to PDAs is the best solution for user needs.

Philips has declared to halt the production of the Nino, Philips' palmsize PC, because the ongoing development of advanced/ smart mobile phones have made the product increasingly redundant. According to Philips' spokeswoman the palmsize PCs are coming under pressure from ever-smaller and lighter laptop PCs [Het Financiele Dagblad, Dutch newspaper, October 8, 1999]. It is reasonable to assume that Philips took this decision, because their market share on the palmsize PC market is too small to hold in the future development of these markets.

The market perspective on handheld PC Pro's is an interesting view, which seems to be confirmed by the growing amount of handheld PC Pro's on the market.

2.3 Notebook PC Roadmap

Evolving notebook PC for "High Availability" seems to be of the highest importance, which is in line with the overall trend for wireless connectivity and communications [30]. From the directions of research the FSI have planned to investigate it is possible to see important consumer needs for future mobile computing:

- Reliable availability of e-services and Web-based applications
- Quick access
- Fast data transfer rate
- Mobility

The product requirements to satisfy these needs are:

- Instant On
- Seamless Internet communications
- Power efficiency
- Fast Operating System

These factors go hand in hand and amplify their outcome of result. Collectively it is called: High Availability. Pursuing High Availability will be the basis for the development of notebook PCs and other form factors in general.

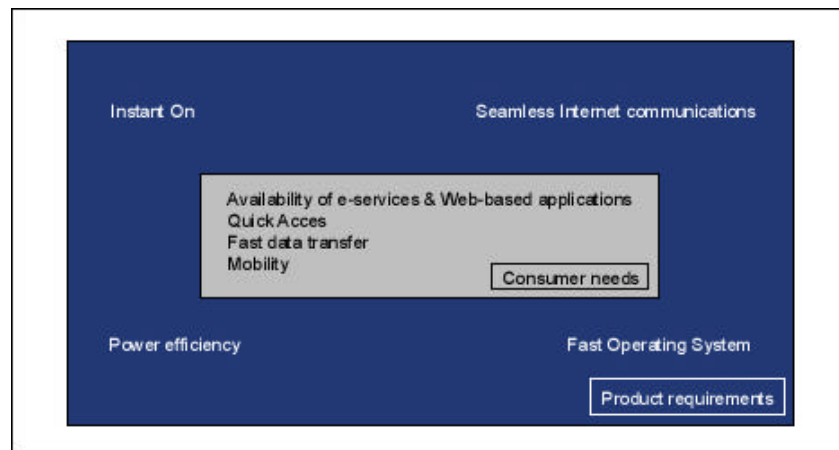


Figure 2.5 High Availability

A3 mobile professional literature study

3.1 Scenario of the mobile professional activities

Taxonomy of activity contexts

The activities can be divided in the following contexts:

- During work
- Before meeting
- During meetings
- Post meetings
- During “dead time”

“During work” includes the activities at the workplace except for preparations before meetings, meetings itself and post activities of meetings. A face-to-face interaction will be considered as a meeting. The most meetings need to be prepared before, which is part of the “before meetings” context. After a meeting, activities need to be performed, which are part of the “post meetings” context. “Dead time” is considered free time that occurs, while away to engage meetings. Returning to the workplace during that time is considered inefficient and is most likely to get used to distribute workload. A more elaborate explanation of these contexts will be discussed at sub-paragraph *Activity contexts*.

Important factors that influence the activities of Mobile professionals are *urgency*, the means or the situation the MP is in. The definition of urgency will be used from the Study of People’s Information Gathering and Communication activities During Business Travel by Brown et al. 1999 [16]: “Urgency can be defined in terms of the ability to carry out work as, and when, periods between meetings or whilst travelling arrive. If the work is not done during these periods then it gets delayed until the next period, so this is what creates a sense of urgency”. It is the ability to leverage flexible task management in terms of exploiting free time, distribution of workload (tasks) and not being constrained by technology. Mobile professionals expressed in the Study of People’s Information Gathering and Communication activities During Business Travel [16] a need for the purpose to act professional at unpredictable moments. Professional courtesy could increase the need for *urgency*, because MPs in some occasions need to be able to carry out requests of clients in a professional manner in the available periods of time they have. To get closure without the request to be delayed too much, the MP needs to be able to tackle these requests as flexibly as possible. The availability and flexibility of means will influence the way to engage activities. The possible situations of MPs can be clustered in: On site situations, off site situations and mobile situations. The availability of means will depend on the situation and when flexibility is required. The most used means are the ones that can be used in any situation.

Activity contexts

During work

During regular work the mobile professional will conduct its tasks (workload) in order to gain task closure. The MP will manage its tasks, information and communication at its workstation. The MP's workstation is the personal working area where he or she probably has all of the technologies and resources to gain task closure. Tasks, for example, can include contact management, diary tasks, and recording, reading and reflecting on information. Mobile professionals will discuss, refer, and negotiate to gain mutual understanding from its workplace. This would require synchronous telephone communication, because of the unpredictable and reactive nature of these interactions. Face to face communications is considered a meeting, which is discussed at "during meetings". While reading a collected document it can be possible that the MP would require an explanation or a verbal response from the sender by using different means of communications.

At the workstation it is most likely that the mobile professional will use a high performance computer (desktop or notebook PC), connected to the company Local Area Network. The Notebook Activity Logging study by Loughran [17] indicates that LAN connection is used for many network shares. Microsoft Office applications are used the most for long periods as well as email and web browsers. It also shows that extra devices as a mouse or a monitor are connected to the notebook PC and AC power gets used to power the notebook. The study also indicates that email and Microsoft Office applications are very common to be used at home, next to entertainment applications such as music and games. Extra devices as a mouse or monitors are not much used at home. At home "dial in" is the most used to get connected to the network. When the MP is on line the connection gets used to retrieve email and surf on the Web, but is not used to share files.

Before meetings

Before meetings mobile professionals prepare meeting activities by distributing and collecting information relevant to this meeting. The information can be used for discussion or to refer to during meetings. Prepared handouts can be distributed at the meetings, while electronic slides can be distributed before the meeting. The electronic slides would most likely to be printed out for the preparation of the meeting and to record annotations and scribbles. The collected information can be sorted, collated or restructured in project files. Project files are most likely to be paper-formatted files containing all of the project relevant information, because it makes it possible to collate different documents (e.g. word documents, spreadsheets, email) into one unifying, easy to use format. The studies of mobile professionals [16] indicates that the documents, that are taken to a meeting included documents, which are essential for the meeting, many documents were taken "just in case" they were required and some of them out of habit.

To anticipate on "dead time" the mobile professional has to prepare means and documents to perform tasks, which don't have to be relevant to the meeting(s). Documents are collected and sorted for these periods of free time.

Communication is used, for example, to ensure a document have been sent accurately, or the recipient has been able to access it properly. Means of communications are used to elaborate on the documents or to build a

context around the purpose of the document. The mobile phone is much used for these purposes while away from the desk. It leverages flexibilities and possibilities to access required documents and technologies by telephoning a colleague from a distance.

“Before meetings” can take place at the MP’s workstation or in situations where the MP can prepare for a meeting, e.g. airplane, car or in a workplace at the company where the meeting will take place.

The technologies needed to support the MPs, while away from its workplace, has to be in order and possibly needs synchronization with the main computer. In the Notebook Activity Logging study Loughran [17] indicates that the system usage of notebook PCs changes dramatically when the MP is on travel. The unpredictable nature of travel makes usage during travel unpredictable as well. The network has to be dialled in and LAN connectivity is intermittent. The battery pack gets very low, because AC power little availability by day and is powered up mostly at night. The applications that will get used are email and office applications, but are not so predictable.

During meetings

During meetings the activities are face-to-face interaction centred. Mobile professionals will have to communicate with others by sharing and showing information, discussing and negotiating about the information and recording the results of these meetings along to other activities. Meetings can take place in different situations such as at their own workplace, common places or in their client’s conference room. The means, meetings are centred on, is paper-formatted documents. Mobile professionals rely heavily on paper documents and are clearly preferred by them. Paper-formatted documents are easier to notate, easier to review with others and easier to reflect on. Notation takes place by making formal notes, annotations and scribbles. Formal notes are a way of selecting and transforming information during a meeting. Annotations are notes that are made on top of pre-existing text or documents and scribbles are informal and temporary recordings of, for example, reminders on any document that was quickly to hand. Also forms were used to collect information. Forms allow information to be unified and restructured from different sources in one appropriate format. The use of forms would be part of organising information.

The MPs tend to take all sorts of paper documents with them to support unpredictable nature of meetings: prepared handouts, promotional material, and project-based files filled with for example: emails, spreadsheets, or copies. The studies of mobile document work (Eldridge et al. 1999) [18] points out that many documents are carried unnecessarily. The amounts of documents MPs take with them depend on different things. For example: how close is their workspace to the meeting place, the unwillingness to take too many documents with them, or relying on colleagues to bring specific documents with them. While travelling far from the workplace and the concern of carrying too many documents with them would increase the importance of the prediction of document needs. But studies on mobile professionals [16,18] made clear that mobile professionals in some cases couldn’t accurately predict their document needs, which can result in non-task closure. Electronic documents are rarely used in face-to-face meetings, although the exchange of electronic documents is preferred by MPs, according to the studies of mobile document work [16].

In the Notebook Activity Logging study (Loughran S., 1999) [18] a key finding was that notebook PCs are primarily used during meetings to use email with Microsoft Office format attachments. Also a result of the study was that from the email application, a word processor, a presentation application, or a spreadsheet application was accessed. The notebooks are mostly off line, but when they are on line a web browser was also accessed from the email application.

The documents MPs carry with them while being away from its workplace is centred on meetings. Other reasons for carrying paper documents became clear by a hallway survey at the Xerox headquarters office [18]. The MPs wanted to deliver the documents urgently or they wanted to be sure the documents had been delivered. They didn't trust to send documents electronically and as a result the MPs brought the documents themselves. To trust documents are send electronically, it can be resolved by a suggestion made in the studies of mobile document work (Eldridge et al. 1999): "exchanging electronic documents while face-to-face mimics the immediacy and confirmation of delivery that occurs when handing over paper documents"[18]. Xerox have been pursuing user studies with a smartphone that enabled the possibility to browse for a needed document and send them to the printer near by to print it out. The user trails with the Xertox Satchel browser pointed out that several people felt more at ease when they were away from their personal workstations, because they knew Satchel could be used to access unanticipated documents. In a same way the mobile telephone give people the ability to make flexible appointments, because they know they can reach each other anytime at anytime to adjust to the unpredictable nature of situations. Flexibility gives people a better sense of control and ease.

Post meetings

After meetings the mobile professional has to deal with collected information and tasks. Information has to be re-used, archived, sorted, collated or restructured. Recorded tasks have to be managed and information has to be communicated to others. By capturing information in a specific way and with a specific means, the post meeting activities will be influenced and visa versa.

The situations where post meetings activities take place are various. This can be in the conference room after the meeting, in the train or back at the personal workstation of the MP.

The means that have been used to collect information has to be able to communicate with workplace technologies after return. This requires compatibility of the technology that will be collected. The usage of notebook PCs has the same qualities as before meetings and while travel.

During "dead time"

Dead time is the available time that originates while away from the workstation for a meeting and can be used efficiently to gain task closure. Urgency is a very important aspect during "dead time". Dead time is a period of time, which can be taken advantage of. If work isn't done in the available time it gets delayed until another available period, which makes it urgent of nature. Dead time can take place in the other four contexts, but is separated from the other context because of the *urgency*.

To take advantage of “dead time” a mobile professional has to be prepared in terms of available means and resources to do so. Before meetings the MP has to think off what he wants to do during “dead time” and prepare the needed means and information. But the unpredictable nature of “dead time” makes it possible that the MP is going to do different activities than planned. If professional courtesy is required it can take up all of the free time that is available. To take advantage flexibility of means are needed. The mobile telephone is an asset to leverage flexibility, because of its ubiquity in different situations. Devices that can support *urgency* are very important to mobile professionals.

Dead time is also used to touch base and keep in touch with the activities and things going on professionally and socially while away.

Professionally, the MP touches base to get notice of urgent matters and to help with the catch-up period on return. If the MP gets back at work he or she does not need to be being totally informed about what is happening at the “base”. Socially, the MP touches base to keep up with the things going on at home or with colleagues and to inquire if there are urgent matters. Professionally and socially, touching base is performed by synchronous interactive talk, because of its social nature. The Study of People’s Information Gathering and Communication activities During Business Travel by Brown et al. 1999 [16] pointed out that other forms of social communication were possible (e.g. email, fax messages) but were not typically used in mobile or off site situations, because of the “personal” characteristic of verbal contact.

“Dead time “ can occur at off site situations such as conference rooms and in a (non-moving) car or at mobile situations such as in a train or airplane.

Using this broad scenario it is possible to make an inventory of the activities, situations and means of mobile professionals. This inventory is presented in the next section.

3.2 Inventory of activities, situations and means of mobile professionals

The inventory is divided in 3 clusters: activities, situations and means. These clusters are divided into sub-clusters and are presented in figure 1. *Inventory of the activities, situations and means of mobile professionals.*

Activity cluster

The described activities are the activities a mobile professional has to perform to gain task closure. The sub-clusters communication, organisation and information activities are related to each other and in many occasions have to be performed simultaneously.

Means cluster

Means are the aids to get an activity done. Means are not the devices that can leverage these aids in order to accomplish an activity. The sub-cluster means of communication can be divided in synchronous and asynchronous communication. Synchronous communication means are: (face to face) talk, telephone, tele- and video conferencing and some chat lines. Asynchronous communications are: email, voicemail, fax, post, some chat lines and web pages.

The sub-cluster means of information can be divided in paper-formatted, whiteboard-formatted and electronic formatted information. Paper-formatted information includes: paper documents, living documents, prepared handouts, promotional material, forms, formal notes, annotations, scribbles, images and copies. Whiteboard-formatted information includes living documents, annotations and scribbles. Electronic formatted information includes electronic documents living documents, forms, email, voicemail, images and clips.

Situations cluster

The mobile professional can work in different situations. The situations cluster is divided in on site situations, off site situations and mobile situations. The on site situations are situations in the building or situations in connected buildings of a campus. Every on site situation contains aspects, which have influences on the mobile worker. Off site situations are situations where the mobile professional is off campus. Mobile situations are situations where the mobile professional is mobile by means of transport.

The situations will have its influence on what kind of devices that can or will be used to leverage the means to perform an activity. The mobile professional wants to pursue any activities, but is constraint by the situation and the situation will influence the usability of a device. That is why the mobile professional needs flexible and ubiquitous devices to leverage the means and perform the activities without being affected by the situation.

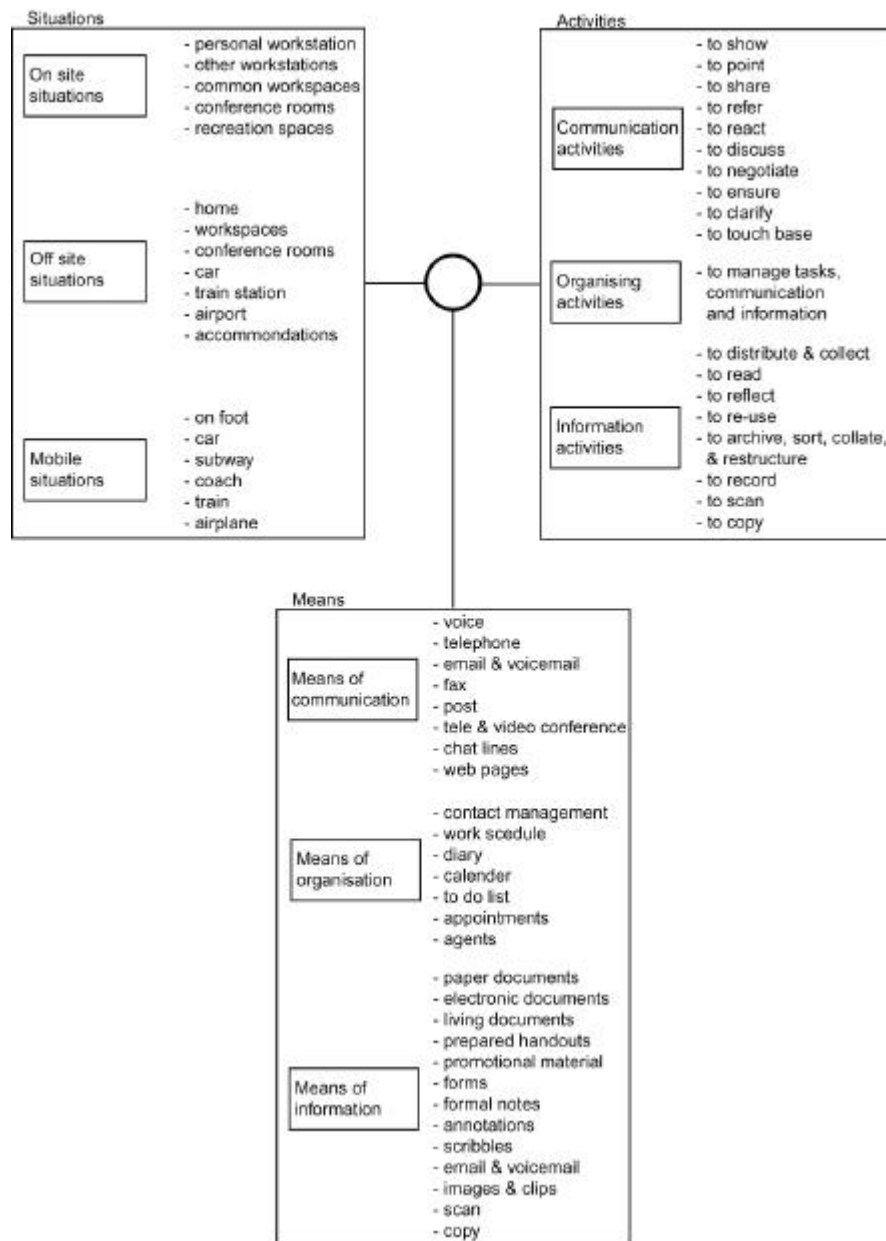


Figure 3.1 Inventory of the activities, situations and means of mobile professionals

Using the inventory of activities, situations and means and the studies relevant to mobile professionals it is possible to make an overview of needs of mobile professionals.

3.3 Overview of needs of Mobile Professionals

Communication and information based needs

- *To share, point and show information*
- *To discuss, refer, negotiate, and gain mutual understanding*
- *To give a further explanation or to build a context around the purpose of a document*
- *To clarify or require a verbal response, triggered while reading a document*
- *To ensure a document have been accurately sent, the recipient has received or have been able to access the contents*
- *To access documents and technologies when away from the personal workstation*
- *To report and communicate information to others*
- *To touch base, professionally and socially*

Organisation-based needs

The functionality of organisers is: contact management, diary management, to-do lists and notation. A paper organiser of a PDA, while away from the desk can leverage this functionality. At the desk the desktop system can synchronize with the PDA to increase this functionality by a bigger display and more memory. Mobile (smart) phones are being developed to take over this functionality, but display and memory can restrict the possibilities.

Information-based needs

- *To anticipate unpredictable document needs*
- *To (re) use information*
- *To capture the thoughts about actions, items, clarifications, contact details and discussion items*
- *To support more in depth discussion by a simple glance in reference information*
- *To make formal notes*
- *To mark actions, items, clarifications, contact details and discussion items*
- *To unify different formats of documents*
- *To organise information into workable packages of files*
- *To retrieve specific information in the future*

A4 the sales executive

4.1 Introduction

A salesman's work is about people and information. The nature of their work is shifted towards a consultative nature in order to anticipate to customers' need of personal advice. An important aspect of sales is building and maintaining relationships with customers, in which *relation management* plays a valuable role.

Salespeople can control aspects of the sales process by managing two elements: information and communication. Using these two elements correctly is the key to success.

Salespeople have to be mobile because they have to maintain personal relations and pursue direct sales with customers. But on average they are mobile inside the local metro area. While being mobile they have to keep in touch with their colleagues, customers and home, they have to look for sales leads and pursue other information-based tasks, while preparing for meetings. As indicated by the Yankee Group in "*Mobile technologies and the Consumer 2000*" [4] it is possible to conclude that they are more likely to carry tools to help them stay in touch and be more productive on the road.

In order to discover which tools they would like to bring along, their needs have to be identified. To do so the characteristics of the sales process and needs of salesman have to be identified.

PS. The general content of this chapter is derived from *Business marketing* by Gelderman et al [8].

4.2 Sales process

Introduction

The aim of salesman is to sell products to customers. One important way to do so is personal sale to customers. Personal sale is focused on pushing products to consumers during a communicative and psychological process. Convincing customers is an important element during this process. Winning and keeping customers is another element, which is becoming more and more important in the sales process. Customers ask more and more personal advice and service, especially in business-to-business markets. The result is that tasks of sales people have to adapt to this need, which makes tasks more of a consultative nature and has shifted the nature of personal sale from traditional transaction marketing to relation marketing. The role of a salesman is changed to a relation manager. One of the major responsibilities of a salesman is to safeguard the relationship with a client and obtain continuity in this relationship.

Salesmen work in a team of salespeople with whom they have to compete in order to keep the amount of sales on a high standard. Also the competition between other companies is getting bigger and tougher. In

complex sales they have to work with other people of the organization, which makes interaction, communication and information crucial.

Because personal sale of salespeople is very costly, in relation to sale interaction via telephone or correspondence, this market instrument will be used selectively. Information and communication technology and products can facilitate these aspects of sales people tasks by anticipating to information and communication needs, while consulting.

Sales process

The sales process can be distinguished by 5 phases [8]:

1. Explore: on the lookout for sales leads
2. Winning trust of customers
3. Sales closure
4. After-sales activities
5. Relation management

Explore: on the lookout for sales leads

To explore potential customers sales leads are used. Sales leads are companies or persons with demonstrable interest in a product. Sales leads are explored in different ways, for example by using published buying plans or relations of sales people. Information and communication technologies could facilitate sales people in the exploration for these sales leads. If a relationship already exists, the nature of exploration will be less complex. On the other hand setting up a new relation with a new customer will be a very intensive task.

Winning trust of customers

Trust of customers can be won by using convincing information. If sales people have to deal the *Decision Making Unit* (DMU) of a company, the members of the DMU have all sorts of different uncertainties. Pushing correct and convincing information can clear up these uncertainties. Unpredictable need of information has to be accessible during these meeting to gain task closure. By anticipating to company issues by problem solving and consulting customers sales people can win their trust. Also sales people have to convince that their product can contribute to the interests of customers. The knowledge a sales person has is therefore representative for the company they represent.

In general there are three kinds of uncertainties for customers [8]:

1. Product uncertainty; uncertainty of a solution not to be an adequate solution for the customer's problem.
2. Transaction uncertainty; uncertainty about the reliability of delivery. Does the supplier keep its promises and will it deliver on time.
3. Market uncertainty; uncertainty about if customers made the right choice to choose this products and not its competitor.

To win the trust of customers, sales people have to push information to reduce these uncertainties. These uncertainties cannot be reduced totally even when the trust is won and will not reduced totally in the next phases. Sales people have to be on top of things to keep the uncertainties reduced to a minimum all through the relationship with customers.

Aids to reduce uncertainties can be:

- References, testimonies of other customers of suppliers
- Evaluations of other projects
- Quality certificates
- Warranties
- Product comparison with offers of competitors
- Being on alert for feedback from customers

Sales Closure

During complex sales closures different functions within the sales organisation, for example production, marketing, R&D, has to work together in order to close the sale. The salesman will have to coordinate and be the interface between these functions of the company, which is a very important and difficult issue. The responsibility of sales closure can shift during complex orders from salesman to project or sales manager. In these cases salesman has to work together with the project or sales manager.

After-sales activities

After sales closure it is very important to maintain the relationship with customers. In business-to-business situations salesmen has to keep on touch regularly to:

- Check if the sold product functions correctly
- If service is delivered correctly
- To keep in the picture by their clients

Relation management

Relation management could be defined as developing, building up and maintaining long-term relationships between suppliers and customers. This relationship is distinguished by:

- Collaborative problem solving
- Striving for a win-win situation for both parties
- Striving for continuous improvement of the relationship
- Sharing relevant information between parties

Miscellaneous

Sales meetings

Sales meetings are obtrusive in the whole sales process. It is the most flexible, direct and obtrusive form of marketing communications.

Before a sales meeting salesmen could structure the meeting as a way of preparation. The actual meeting will come down to the salesmanship of a salesman. Besides skills, knowledge about products and customers and utilising psychology in meetings are important.

Account management

Account management is the part of the sales organization, which focuses on key accounts. Key accounts are individual customers of a sales organization, who are responsible for a substantial part of the sales. Next

to key accounts other customers are responsible for a relatively smaller part of the sales. In this situation it is meaningful to give more attention to key accounts by account management. An account manager will have a coordinative nature of management by monitoring, coordinating and adjusting activities of the sales organization towards the key customers. The account manager is also called a sales quota manager.

Conclusions

The sales process is about having the right information and being able to use this information at all times. This means communicating and interacting to and with customers, colleagues and others. Salespeople have to use communications in order to build & maintain relationships, collect & distribute information and explore for sales leads.

4.3 Sales organization

A sales organization is part of an organization. The general organizational structure of a sales department can be represented by figure 1:

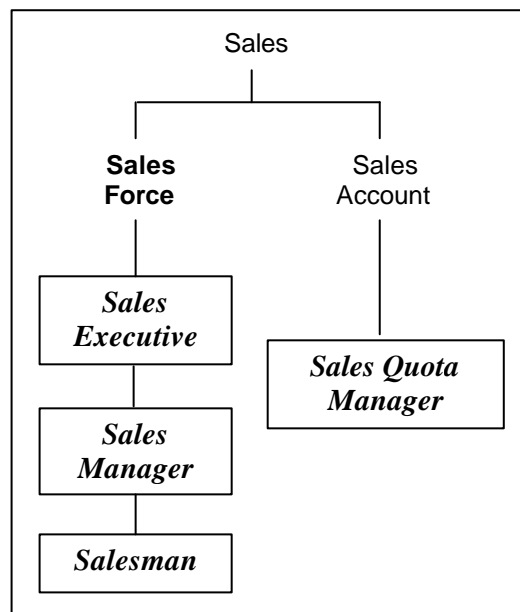


Figure 4.1 Organizational structure of a sales department

The sales force consists generally out of sales executives, sales managers and salesmen. The H.R. Chally Group indicates in *"How to identify the type of management needed for a specific position"* [9] that sales force managers are more responsible for building quality and productivity of their salesmen than for any one customer. The sales manager has to report back to their sales executive. Also according to the H.R. Chally Group the most effective sales managers will have a span of 4 to 5 salespeople who they work with, coach and develop one-on-one on a regular (often weekly) basis. The least effective have a large span of control and focus most of their time on traditional administrative tasks including sales projections, facilitating problem resolution for salespeople, and other administrative tasks.

Sales managers have a need of sufficient information to coordinate salesman adequately.

Sales account is focussed on account management of key accounts. H.R. Chally Group indicates in "*How to identify the type of management needed for a specific position*" [9] that a Sales Quota Manager is primarily a strategic or national account manager that focuses on coordinating the entire relationship as well as the key service skills of sales team members towards customers.

4.4 Sales Executive profile

As indicated by Grinwis and Partner the term salesman is not used anymore. To increase image of salesman these days they are called Sales Executives and within the Sales Account Area, Sales Account Manager. They have to report to a Sales Unit Manager or at smaller companies a Sales Manager/ Sales Director (in contradiction to the organizational structure indicated above).

Sales Executives are responsible for direct and personal sale. They have to build up and maintain long-term relationships with customers. They have to generate continuously incoming sales flows by maintenance and support contracts.

Salesmen have to be able to think at the technical level of the customer-organisation. They need to identify and solve customer's problems and create long-term solutions. Therefore they need to have industry and market knowledge.

Salesman are able to work independent and internationally. Professionalism in scheduling, relation management, etc. is required. A salesman needs to be a systematic worker and a communicator with high abstraction level and vision for a customer.

The H.R. Chally Group indicates in "*The World Class Sales Excellence Benchmark Research Report – Study 2, Executive summary*" [10] seven critical salesperson skills, of which customers believe can best fulfil their basic business needs. These are:

1. Personally manages customer satisfaction
2. Understands customer's business
3. Acts as a customer advocate
4. Is knowledgeable of applications as well as products/services
5. Is locally or, at least, easily accessible
6. Solves problems
7. Is innovative in responding to customers needs

Also it indicated that the basic priority is to add value to the customers' business. To do this three critical elements are required [10]:

1. Measure (identify) the business needs of customers
2. Develop the added services to wrap around our products which will guarantee the customers' business improvement; and
3. Measure again both continuous improvement refinements as well as proof for customers that their business was improved.

4.5 Where is a salesman?

Introduction

According to the Yankee Group indicated in “*Mobile technologies and the Consumer 2000*” [7] a salesman spends on average 37 hours per week of its time at the primary workplace and extends their day for 15 hours a week at the secondary workplace.

Primary workplace

Their primary workplace is at the office, while being in mobile situations and at customers’ offices.

At the office

According to the Yankee Group [7] salesmen are spending their time at the office:

- 71% in their office/ cubicle
- 21% in communal spaces
- 6% in co-workers’ spaces
- 2% in meeting or conference rooms

While mobile

According to the Yankee group [12] most business travel of mobile users is done within 100 miles of the home office, which is indicated in Table 1 *Frequency of Business Travel of Mobile Users* [12].

Autotravel	Frequently	Infrequently	Never
Short (Less than 10 Miles)	50.0%	23.1%	17.7%
Medium (10-100 Miles)	42.3%	32.3%	16.9%
Long (Greater than 100 Miles)	12.3%	40.0%	33.1%
Walking	Frequently	Infrequently	Never
Short (Less than 0.5 Mile)	20.0%	12.3%	52.3%
Medium (0.5-2.0 Miles)	5.4%	11.5%	66.2%
Long (Greater than 2.0 Miles)	3.1%	8.5%	70.0%
Air Travel	Frequently	Infrequently	Never
Long (Greater than 100 Miles)	3.1%	45.4%	41.5%

Table 1.5.1. Frequency of Business Travel of Mobile Users

The International Data Corporation indicate in “Customer Directions and Buying Behaviour: the 1996 Smart Handheld Devices Survey” [13] that business-related travel is about even divided between those who remain in a city or urban area and those who travel throughout a small geographic area, state or region. Those groups are relatively much bigger than nationwide and international travellers.

The Yankee group also indicates in “Mobile technologies and the Consumer 2000” [7] that most wireless voice usage and paging is done within the user’s metro area. 85% of cellular calls are made or received inside the local metro area. Also they indicate that most meetings are held in the metro area and that mobile calls are placed from the car or outside.

This means that the car is a possible platform where mobile devices will be used. As indicated by the Yankee Group it is possible to conclude that products and services can be designed for more localised use.

Secondary workplace

It also indicated that salesman spend time at a secondary workplace environment:

- 5% in an office
- 15% in a non-office
- 15% mobile
- 30% in a home office
- 20% other

Conclusions

While at the office a salesman is 30% of his time away from their desk. Every call and message during that time will have to be received or monitored by the salesman, because he has to be available to key customers. He needs therefore tools to be kept in touch and that can be used unobtrusively in certain situations (e.g. meetings).

While being mobile from the office it is on average inside the local area and most likely in a car.

The time spend at a secondary workplace is divided over all kinds of possibilities so that mobile tools are needed and can be beneficial to a salesman.

4.6 Sales executive function profile, Grinwis & Partners, 1998

De onderneming

The new planet® (voorheen Planet Internet Holding) is een dochteronderneming van Unisource NV. Het bedrijf heeft als belang-rijk-ste doelstelling services en soft-ware te ontwikkelen voor de zeer snel groeiende Internet Markt. Door een gefaseerde strategie te voeren van Research, Develop-ment, Implementatie en Produkt-introducties, heeft het be-drijf een repu-tatie neergezet als leider in de Advanced Software van Internet toe-pas-singen.

The new planet® heeft internationale installaties gereali-seerd. In een aantal Europese landen (zoals in België, Slovenië en Engeland) brengen zij hun WorldEye Internet Subscribers Manage-ment System (ISMS) op de markt. ISMS is het kernprodukt (service desk software, authentication en identification pakketten en een vol-ledig relationele database), dat wordt gecombineerd met ope-ratio-neel aanvullende oplossingen (o.a. Accounting / Billing, On-line registration, Closed user groups, Classified Advertising etc.).

De organisatie

The new planet® is als Planet Internet Holding in het najaar van 1995 gestart als onder-deel van KPN MultiMedia. Momenteel is Unisource eigenaar. Het bedrijf is gevestigd in Diemen, waar nu ongeveer 35 mensen werken verdeeld over de afdelingen Development, Implementatie/ Support en Sales. The new planet® is een jonge, dynamische en professionele organisatie. Na een periode van investeren wordt nu een omzet van ruim 7 miljoen behaald. De groeiplannen voor de komende jaren zijn ambitieus en vooral internationaal gericht.

De functie

De Sales Executive is verantwoordelijk voor het verkopen van het WorldEye Internet Subscriber Management System en de daaraan gerelateerde oplossingen aan één van de volgende internationale marktsegmenten: Internet Service Providers (ISP), Telecom Operators en internationale uitgeverij. De nadruk voor de eerste jaren ligt op de internationale Telecom Operators en de regionale ISP's. Verkopen gebeurt zowel via Value Added Reseller kanalen (VARs) als direct. Voor de Sales Executive ligt de nadruk op direct¹.

De Sales Executive moet lange termijn relaties opbouwen en onderhouden en genereert continue inkomende omzetstromen door middel van onderhouds- en supportcontracten. De zakelijke contacten liggen overwegend op directieniveau .

Daarnaast is hij/zij in staat af te dalen tot op technisch niveau van de klantorganisatie. Is in staat de voorgestelde softwareoplossingen te plaatsen binnen de klantproblematiek (als kostenbesparing, marketing, proces re-engineering en efficiëntie). Het werkgebied van de Sales Executive is in principe wereldwijd, maar in 1998 wordt vooral op Europe en het Midden Oosten geconcentreerd. Succesvolle kandidaten kunnen dus zeer zelfstandig opereren en zijn gewend internationaal te werken en onregelmatig te reizen. Hij/zij opereert in een 'tandem' met de huidige Sales Executive en rapporteert aan de Director Sales.

Profielkenmerken

- HBO- of Academisch niveau (bedrijfskundig / technisch).
- Minimaal 1 jaar aantoonbaar succesvol in de direct sales van software en/of systemen. Bij voorkeur ten behoeve van bedrijfskritische processen, óf Database-, Customer Care - en Helpdesk oplossingen en Billing software.
- Vanuit een leveranciers-oogpunt bekend met de markt van Telecom Operators, Service Providers, grote customer care centra en/of internationale uitgeverij.
- Grote mate van zelfstandigheid en zeer professioneel in werkplanning, relatiebeheer, opvolging etc.
- **Persoon:**
 - o flexibel, enthousiast en initiërend, nuchter, tactisch en operationeel sterk, eerlijk en integer, brede interesse
 - o Planmatig werker die ook de ogenschijnlijk simpele zaken aanpakt.
 - o Communicator met hoog abstractieniveau en visie op de klant achter de klant¹.
- Hoog energieniveau.
- Internationaal kunnen/willen werken en onregelmatig reizen.
- Vloeiend spreken/schrijven van de Engelse taal.
- Bij voorkeur een goede kennis van de Oost Europese markt, Duitsland, Oostenrijk en Zwitserland.

- Leeftijd vanaf 25 jaar.

De arbeidsvoorwaarden

- All-in brutojaarsalaris afhankelijk van senioriteit. Er is een vast en een variabel (doelstelling afhankelijk) deel.
- Leaseauto in de goede middencategorie .
- GSM en ISDN privé.
- Onkostenvergoedingen op declaratiebasis.
- Verzekeringen en voorwaarden zijn concurrerend.

Het perspectief

Voor een succesvolle, nuchtere verkoper pur sang met affiniteit tot software- en systeemoplossingen ligt hier een geweldige uitdaging bij een groeiende en succesvolle onderneming.

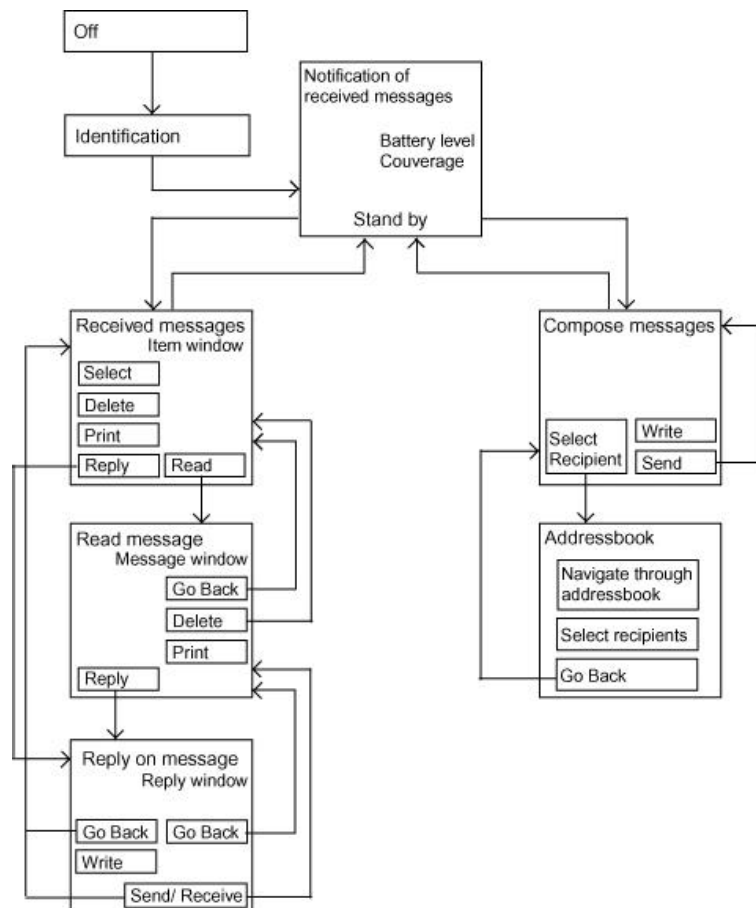
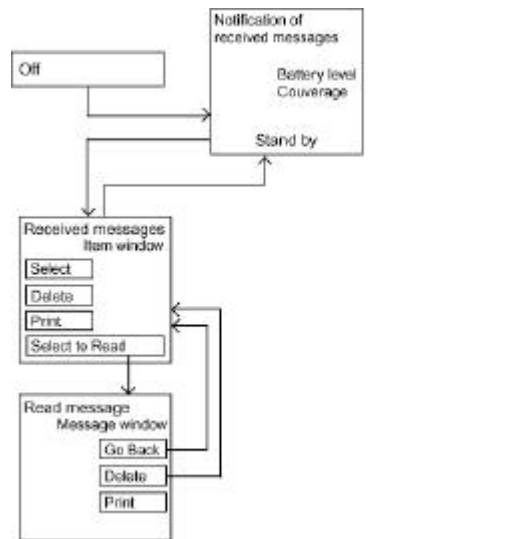
Aanvullende informatie

Grinwis & Partners, ingeschakeld bij de vervulling van deze vacature, kan aanvullende inlichtingen verschaffen. Bereikbaar op telefoon-nummer 030 - 691 20 88 (fax 030 - 691 38 66) of op internet URL: www.grinwis.nl, email adres: <grinwis@euronet.nl>.

A5 e.messaging idea generation

5.1 Introduction

This chapter will present the idea generation process from the first ideas until the e.messaging concepts. Below the e.me read-only and e.me read-and-write functionality structure is shown



5.2 e.me read only

On the following pages ideas for read only devices are presented.

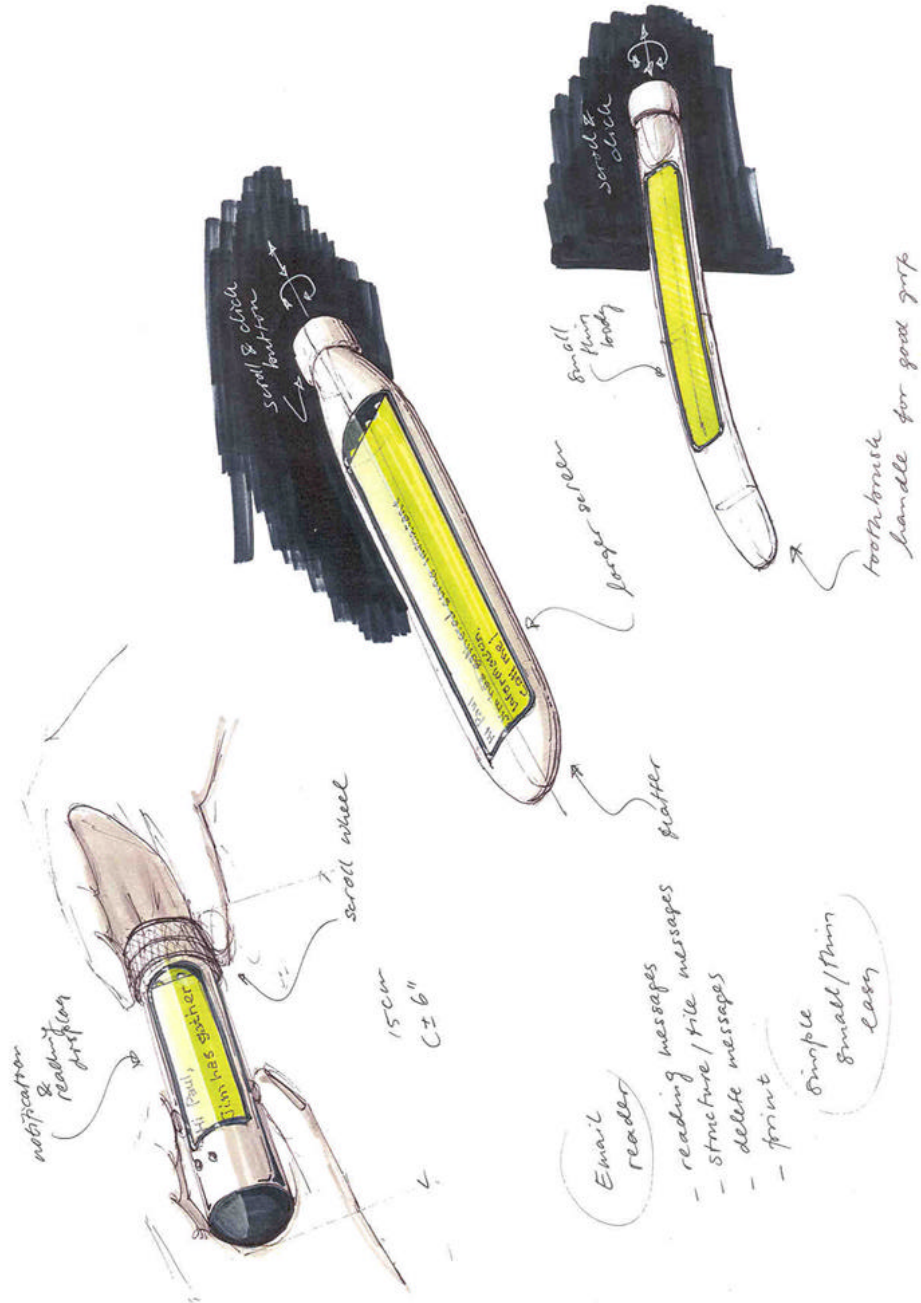


Figure 5.1 Small and easy to use read only ideas

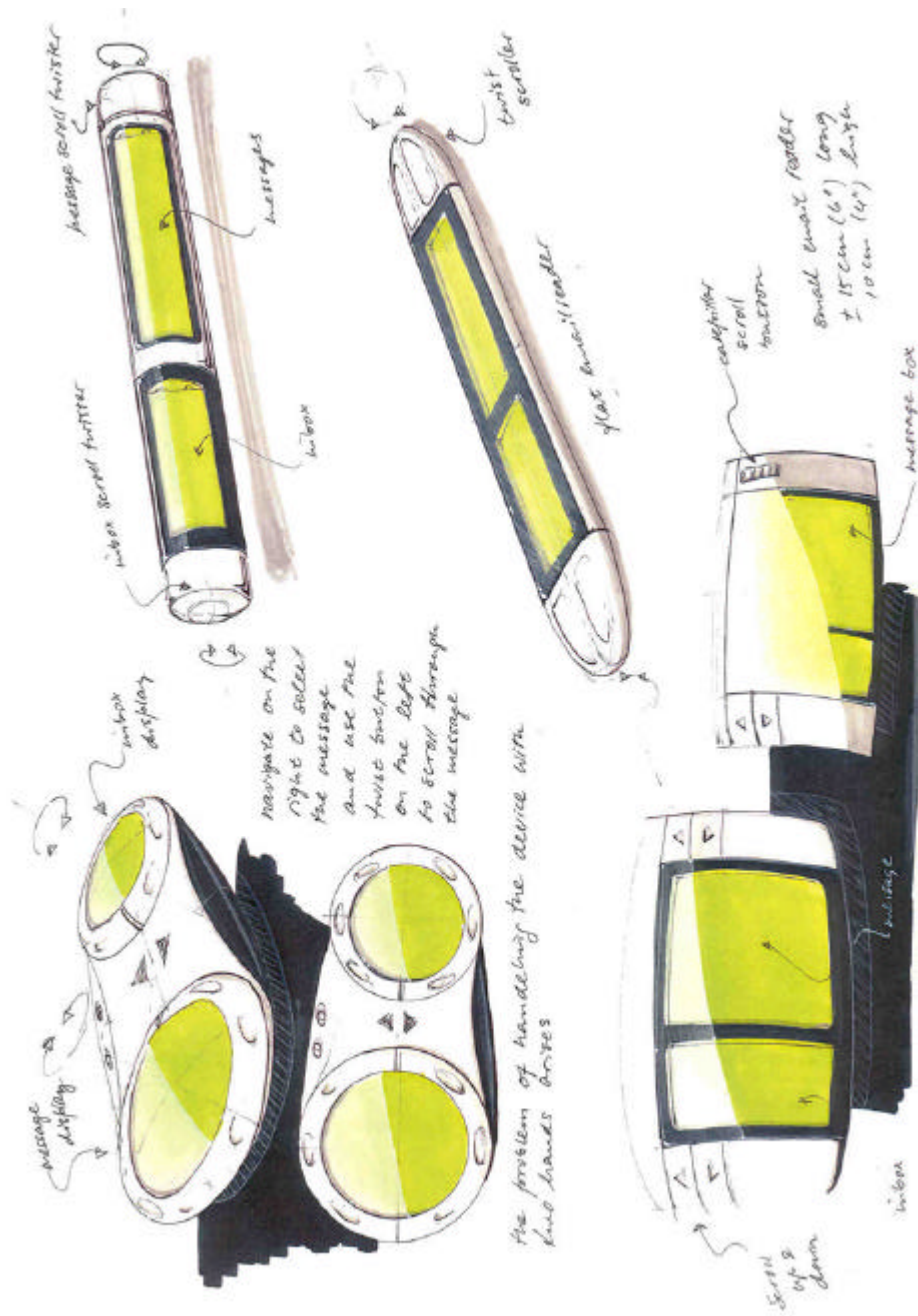


Figure 5.2 Double hand operation ideas

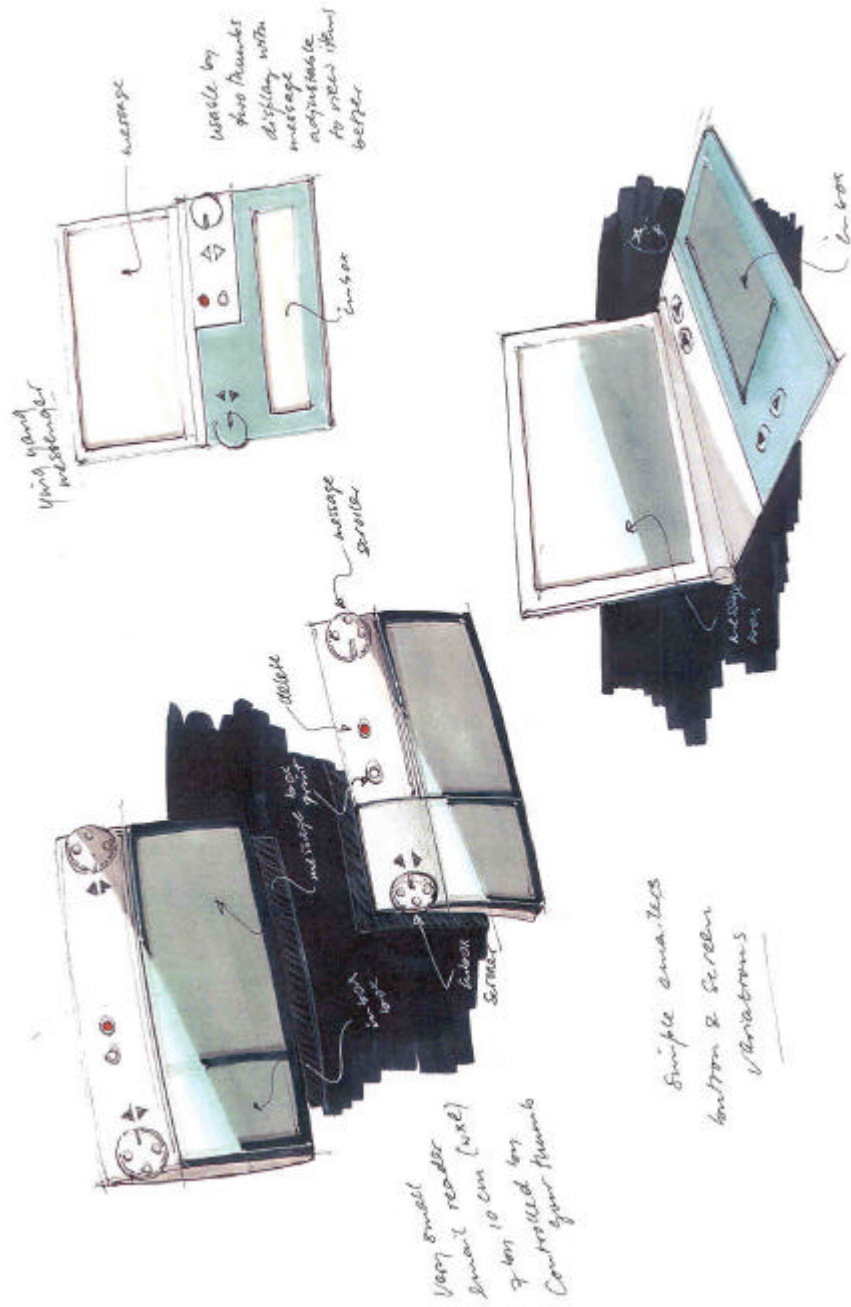
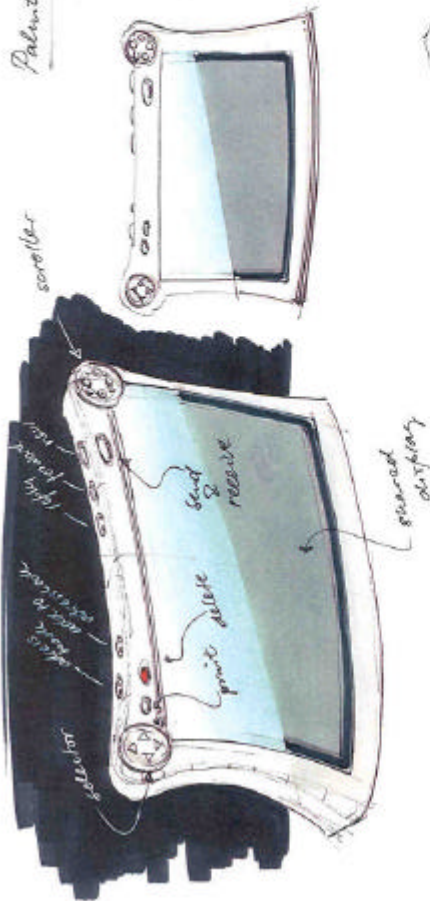


Figure 5.3 Other double hand operation ideas

Palmtop concept

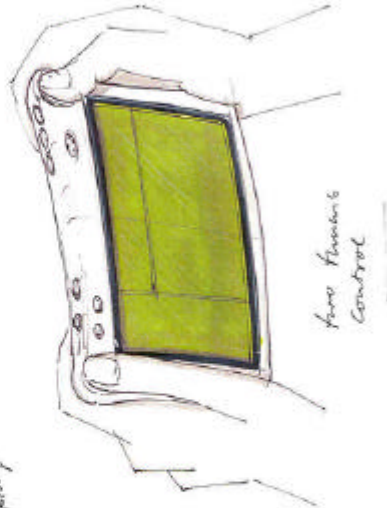


on the display
the menu bar,
headers & message
is visible

using your thumbs
& forefingers all
of the functions
are available

Writing Emails:

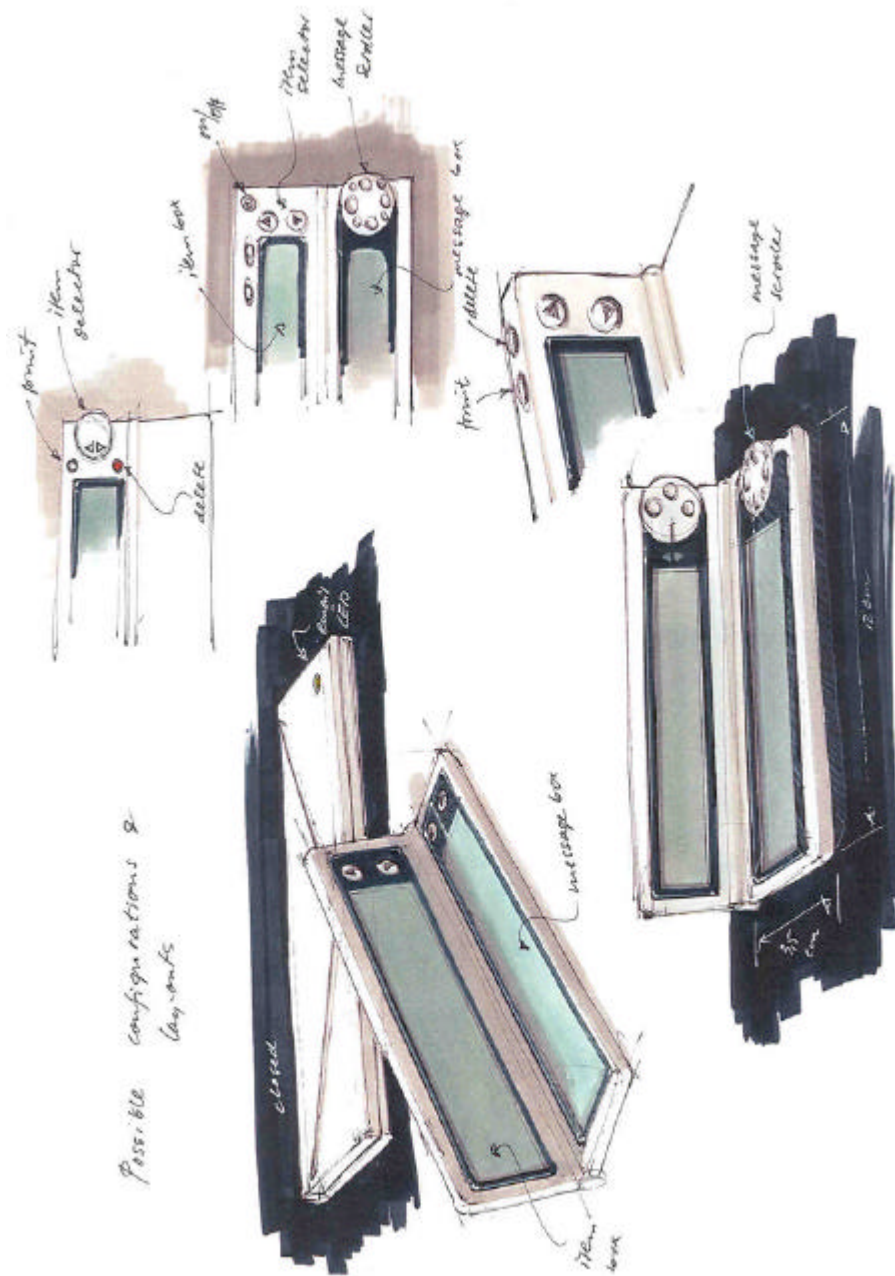
- Pen-input & touch screen is more emails
- Or only speech-to-text interpretation still for needed for some applications
- Color display is possible but needs a lot of power. Is color display required



The device has to be used on a desk as well.
Viewing angles can be a problem
size 11 x 8 cm
(4.3 x 3.1")

Or it has to be able to be handled as a palmtop device so that your hand adapts the viewing angle and the other operate is

Figure 5.4 Game boy like read only device



Possible configurations & layouts

Figure 5.5 Origami ideas: more space to use when open and small size to take with you

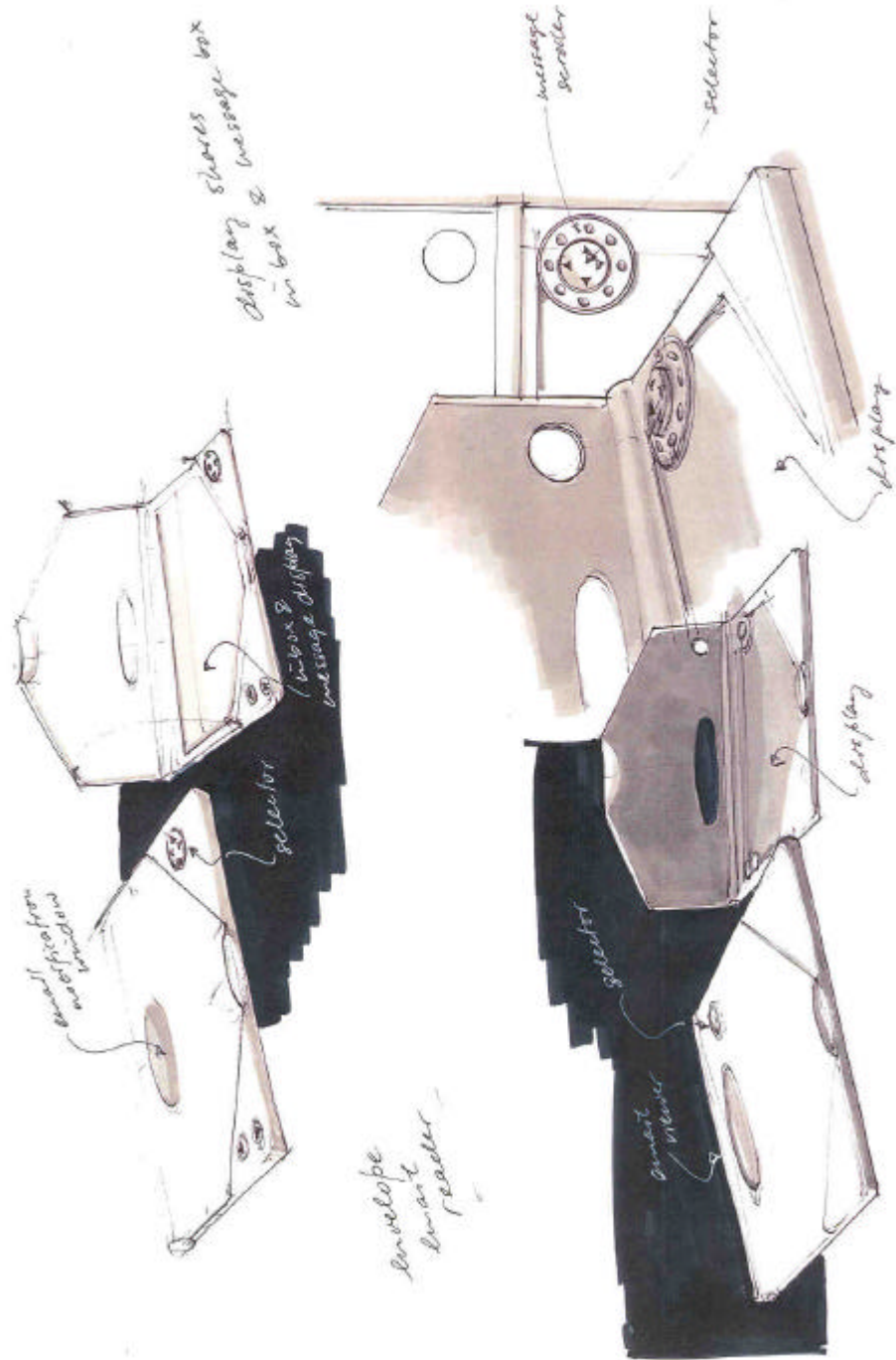


Figure 5.6 Envelop metaphors

5.4 e.Me read-and-write

On the following pages ideas for read only devices are presented.

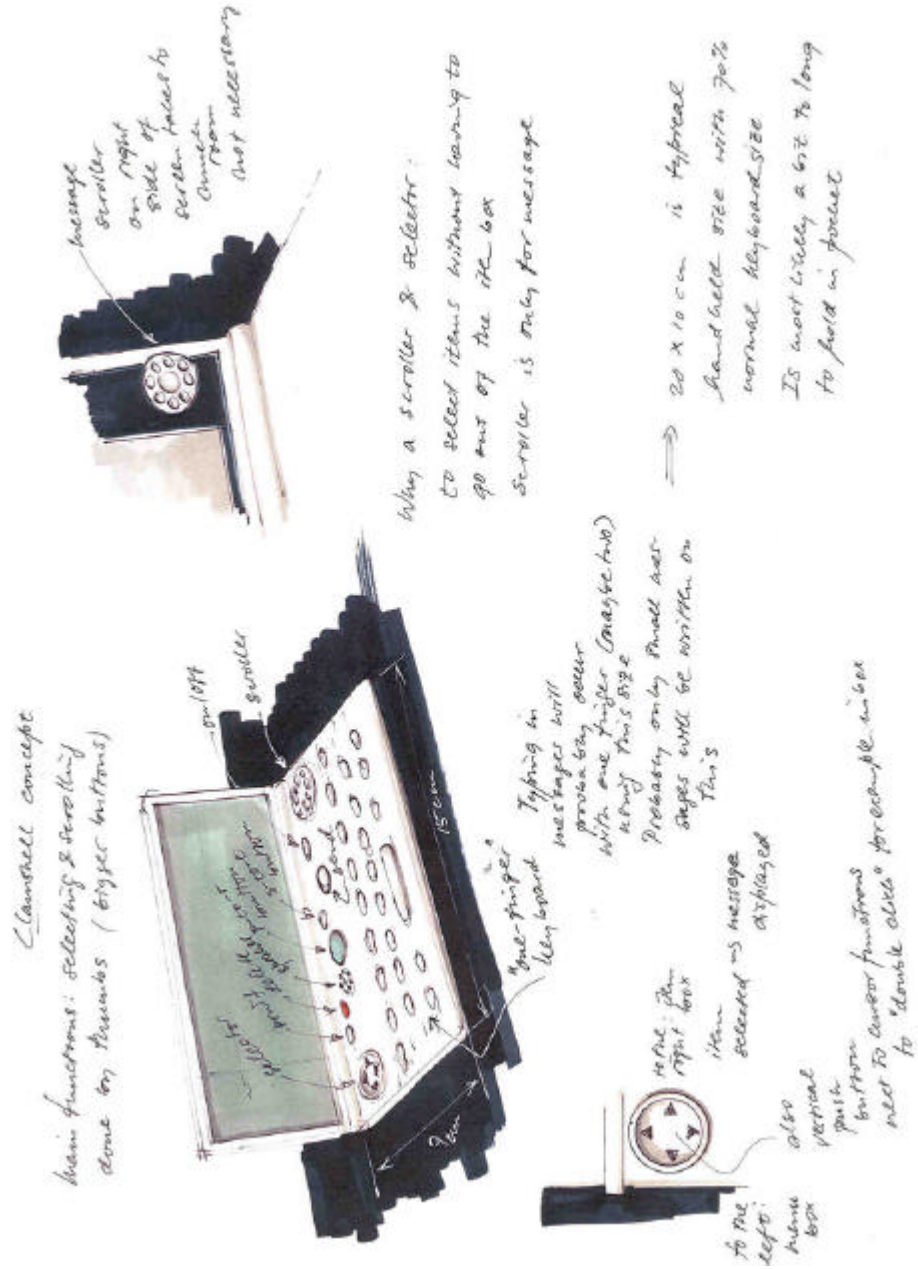


Figure 5.7 Handheld like ideas

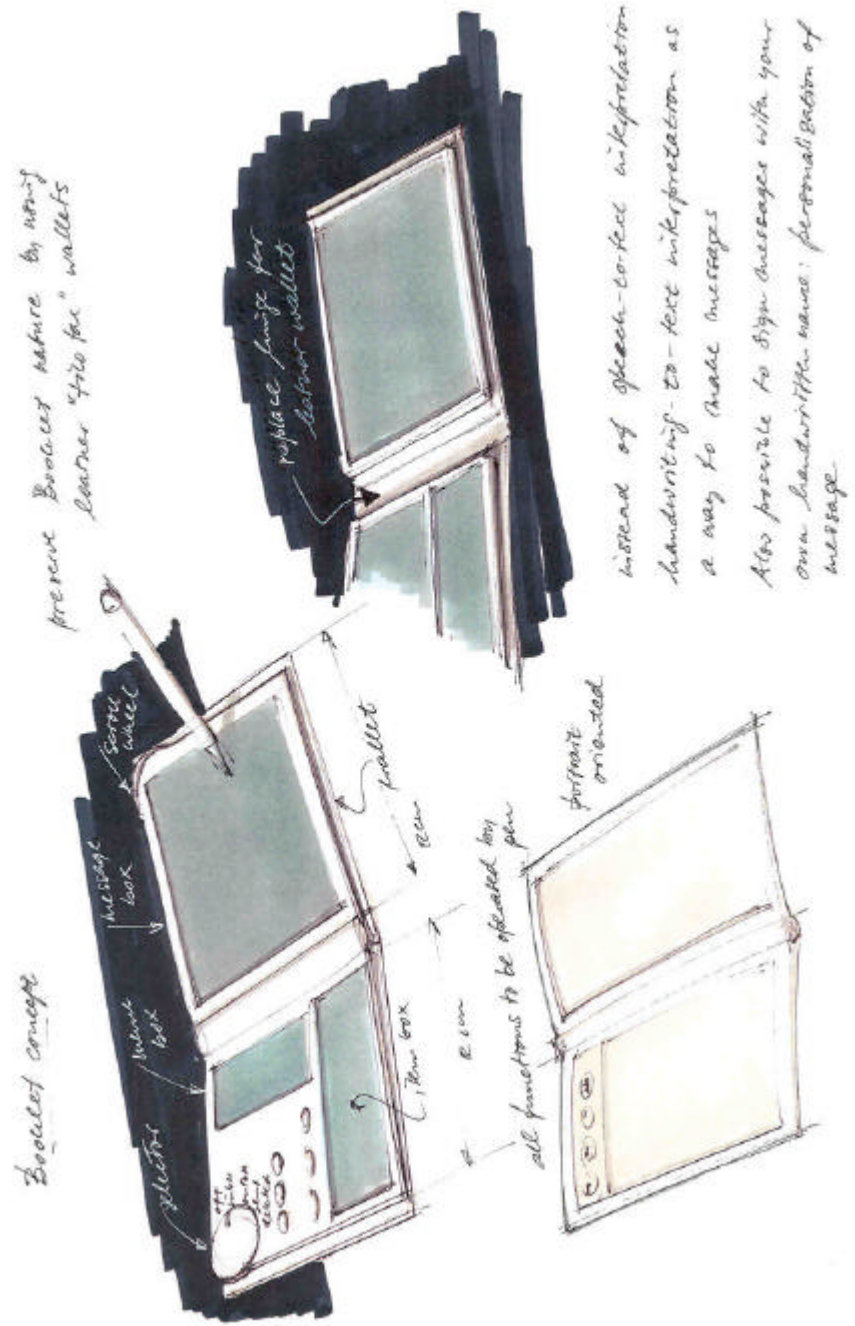


Figure 5.8 Booklet like ideas

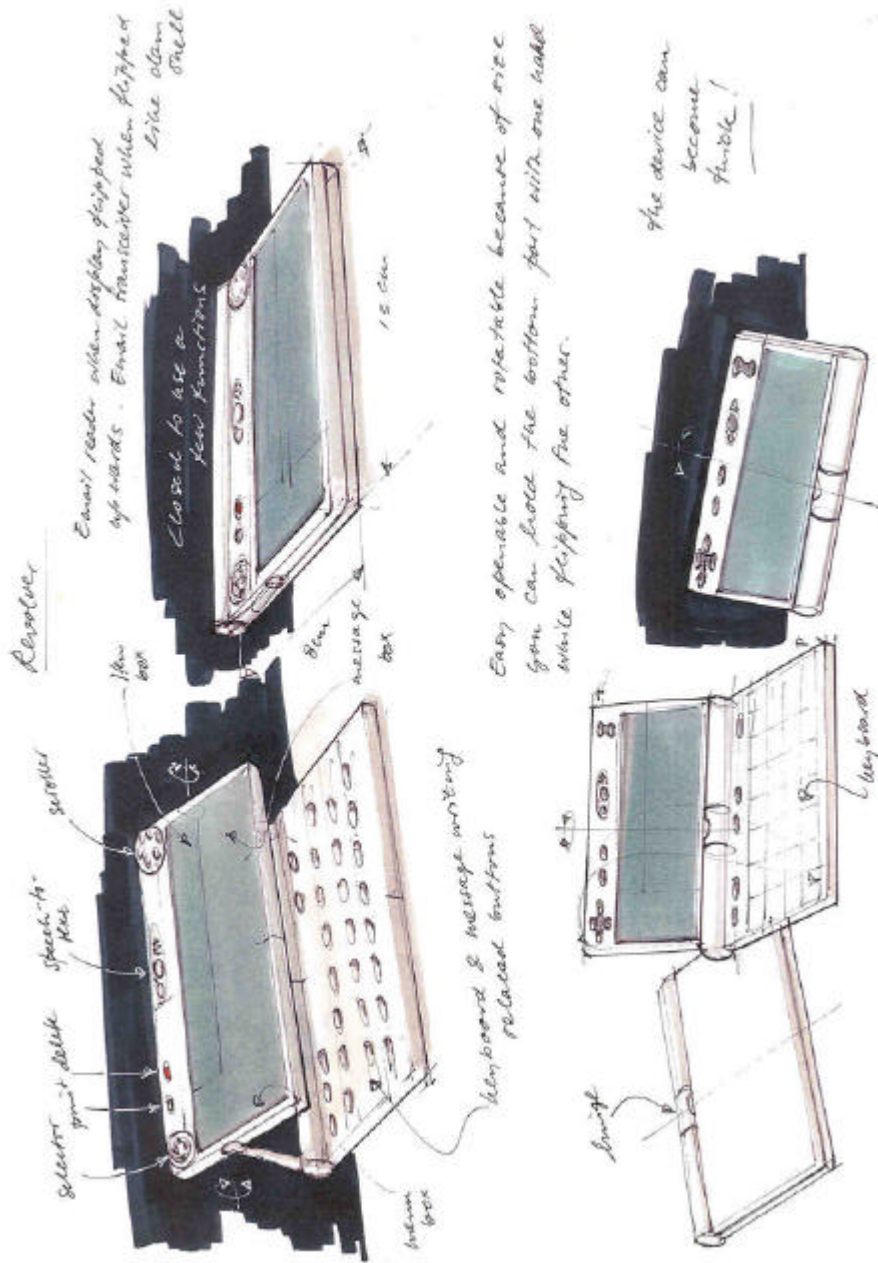


Figure 5.9 Hide and seek product ideas

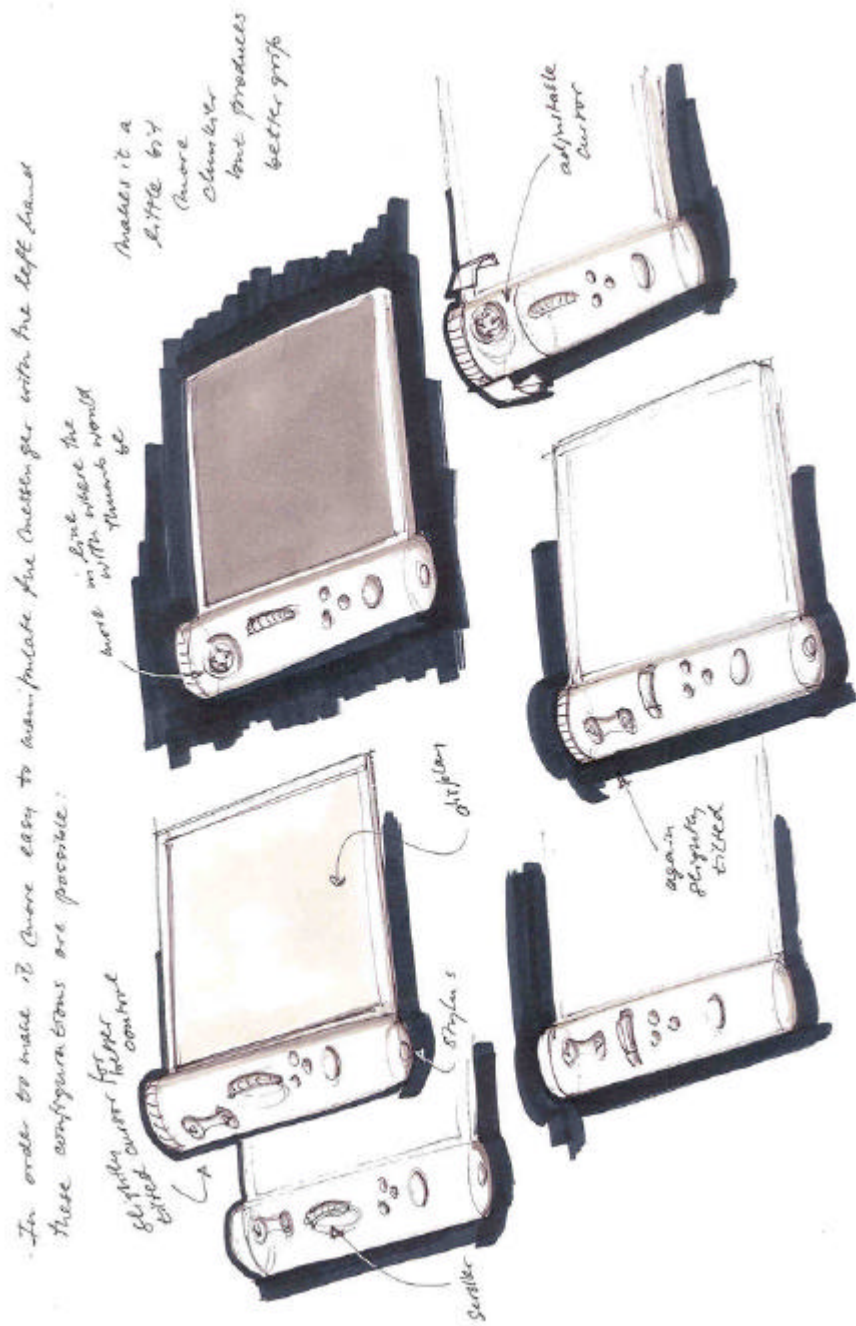


Figure 5.11 Buttons on the side to be controlled by left hand

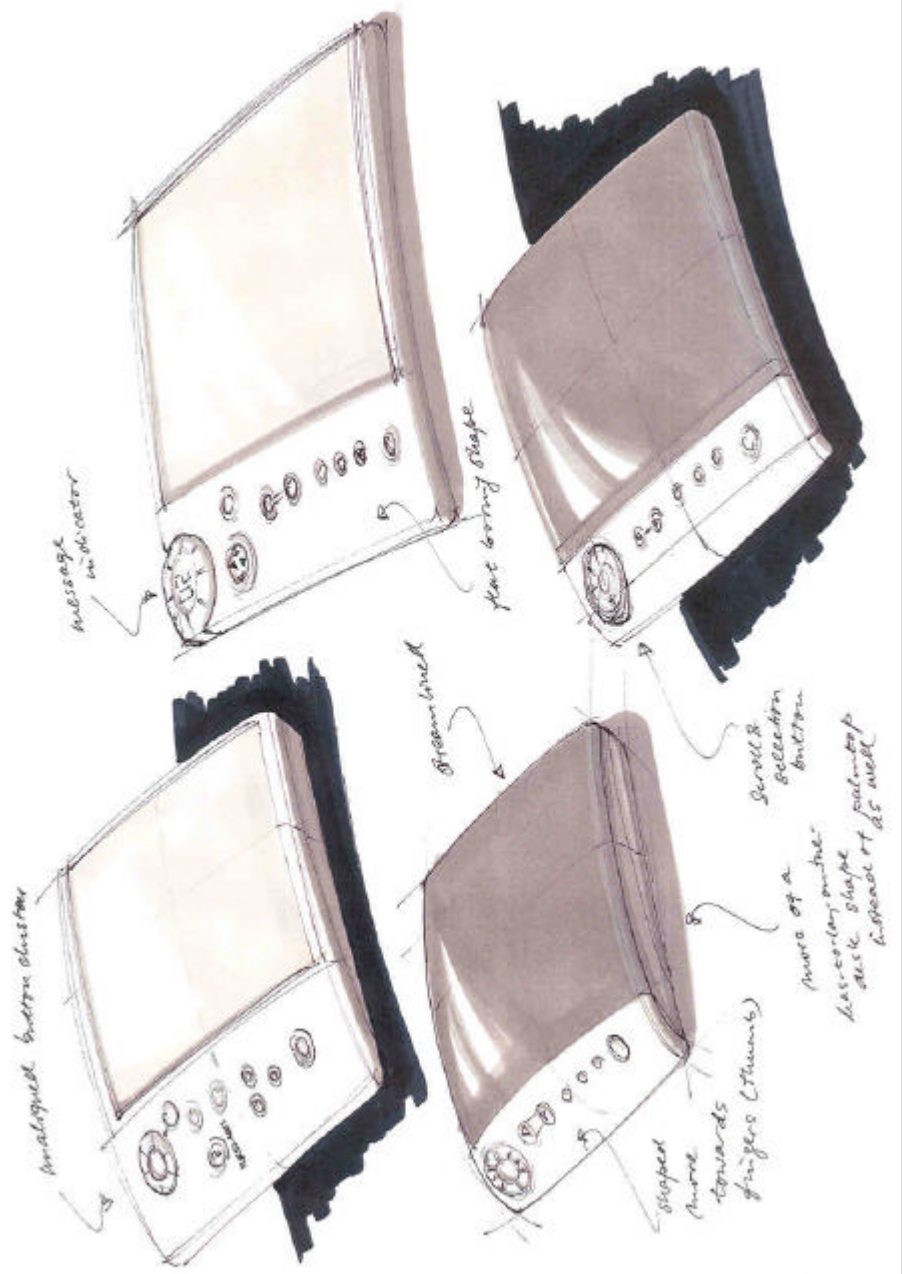


Figure 5.13 Form developments

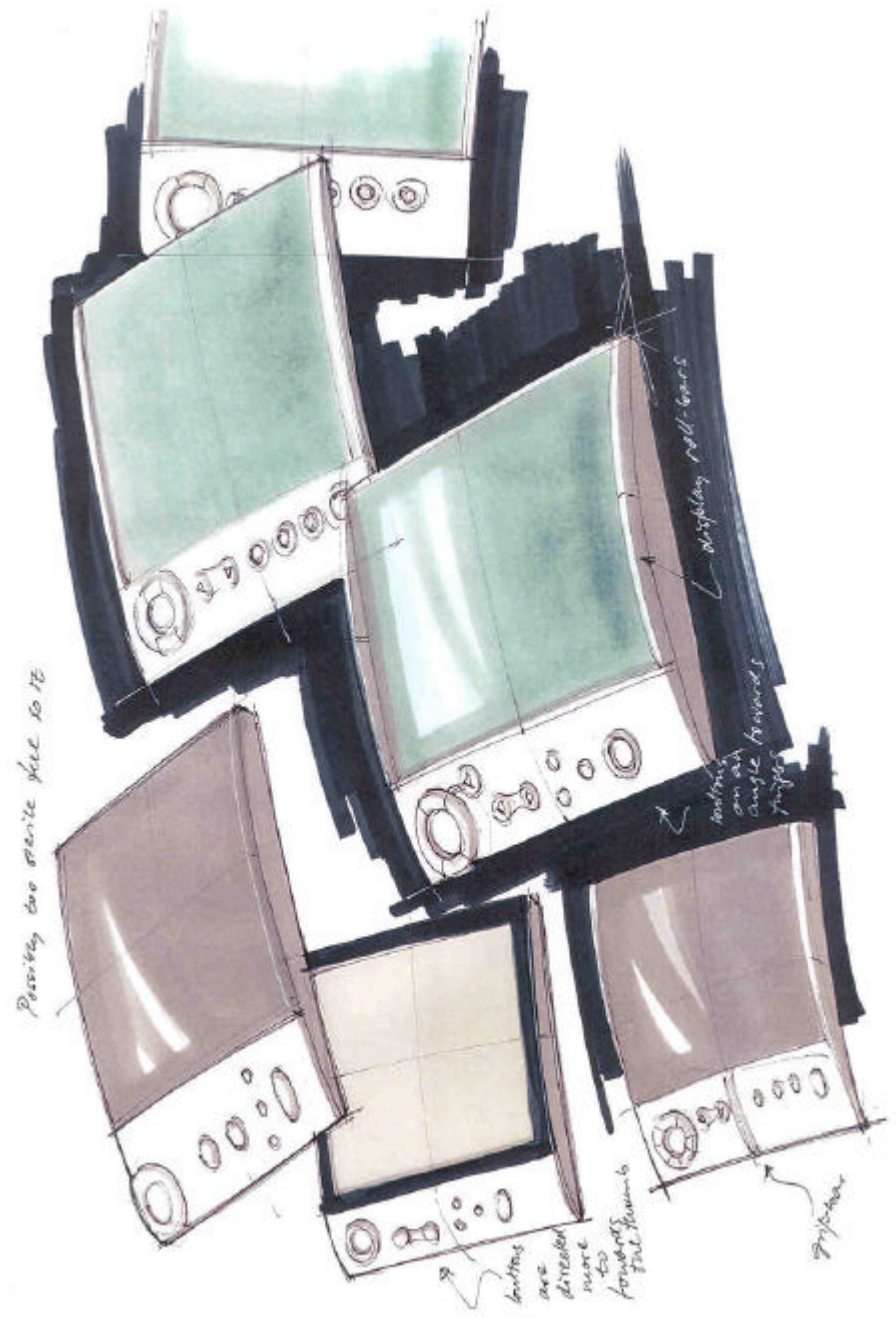


Figure 5.14 Form developments



Figure 5.15 B&O like form, but possibly too sterile for its use

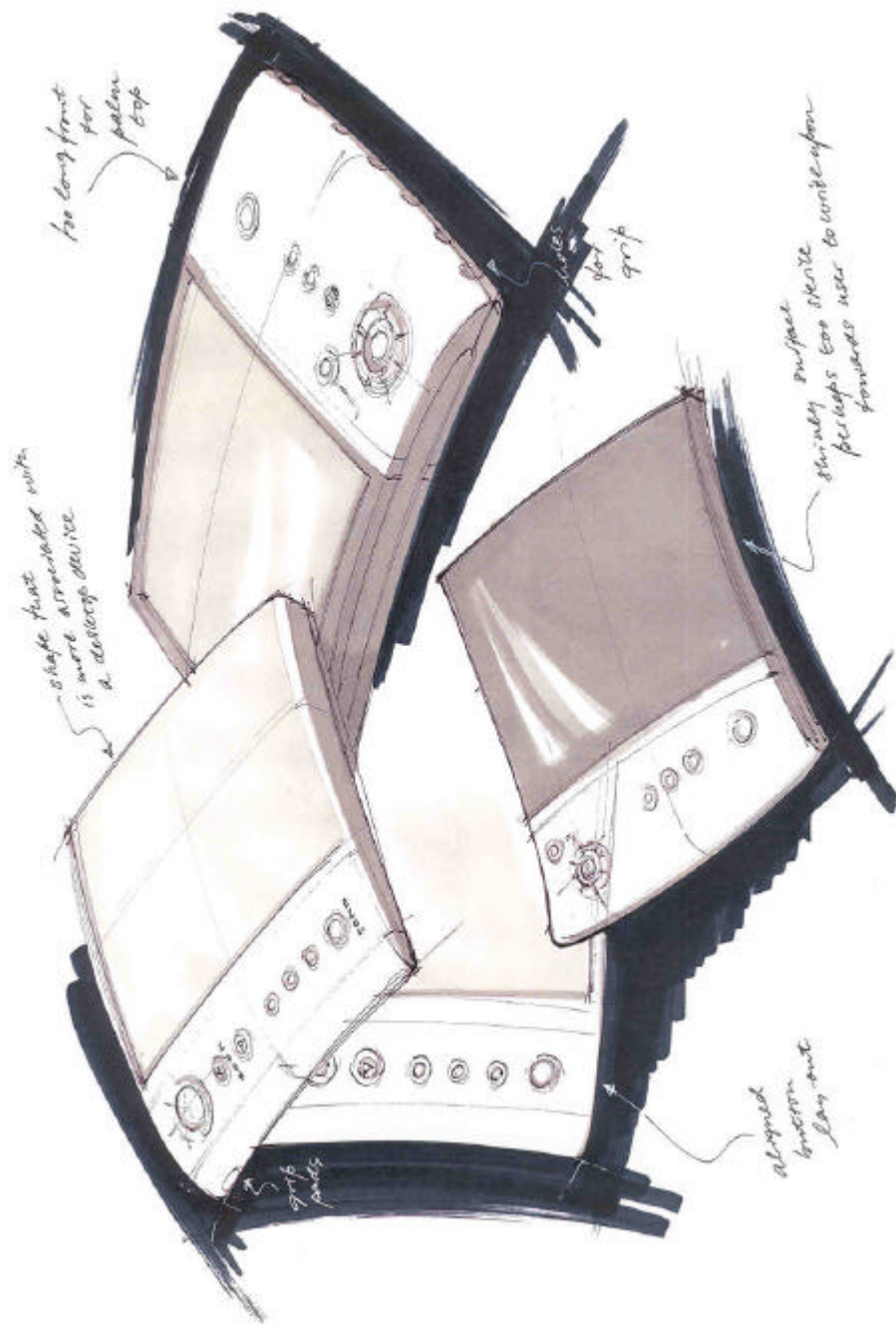


Figure 5.16 Form developments

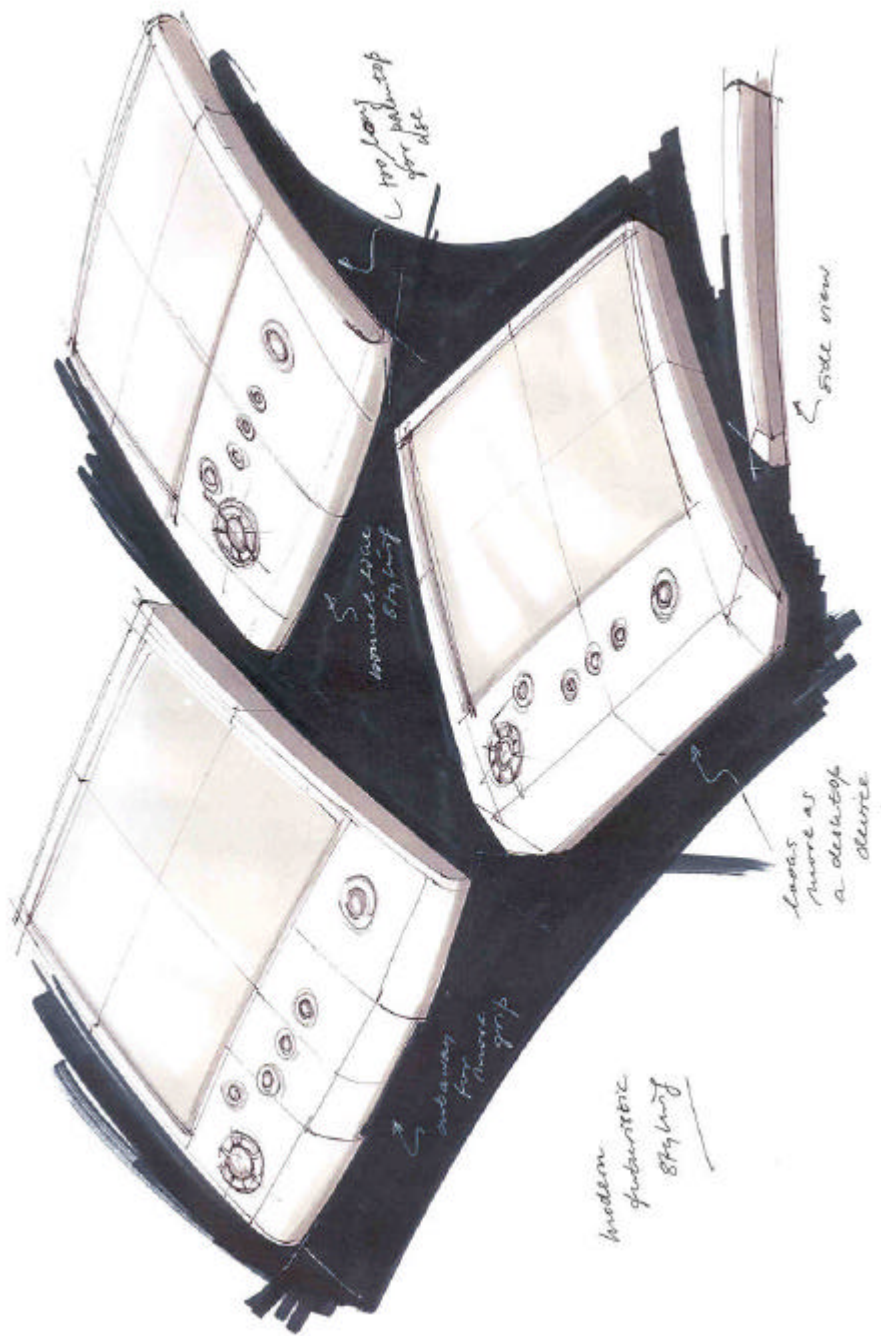


Figure 5.17 Form developments

5.5 e.me pager concept

From the read-only ideas the “tube” like idea is selected for further development. This read only product idea represents an easy to use, very tactile device, which could be appealing to a lot of users. The concept, shown below, will be developed as a computer and 3D model.

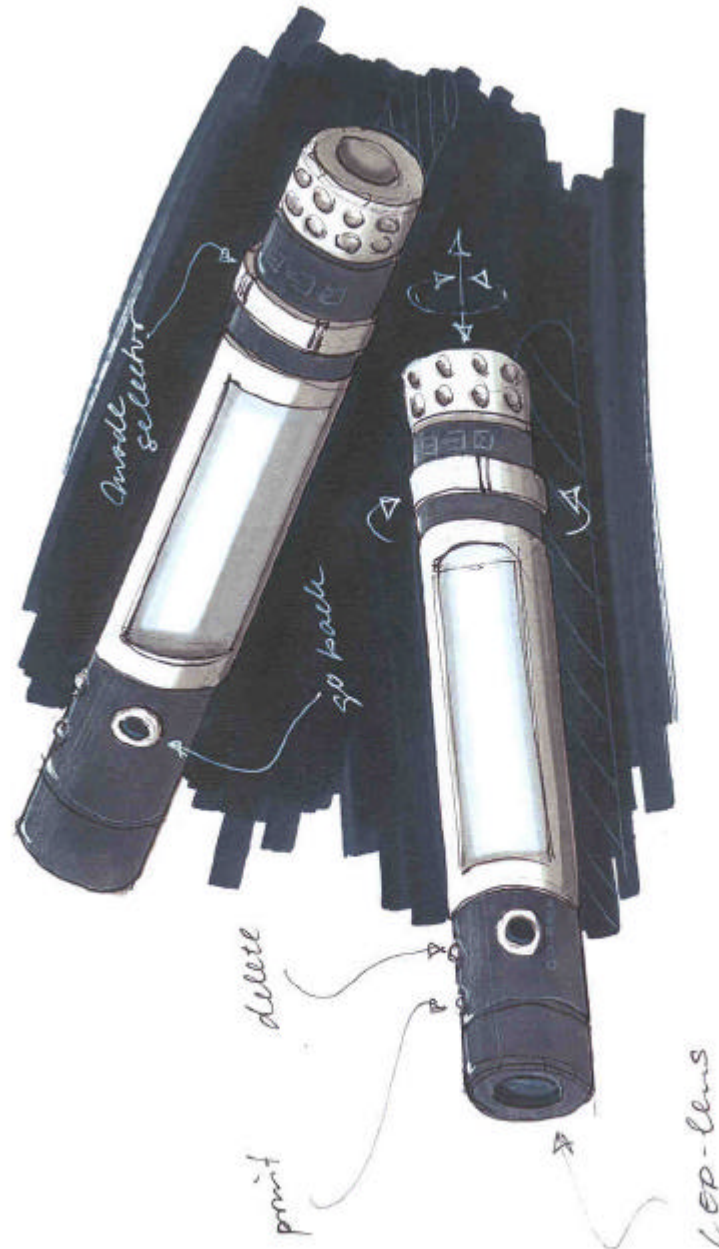


Figure 5.19 HP e.me pager

5.6 e.me tablet concept

The concept beneath is the end result of the search for a suitable read and write concept. This concept is only suitable for right handed people.

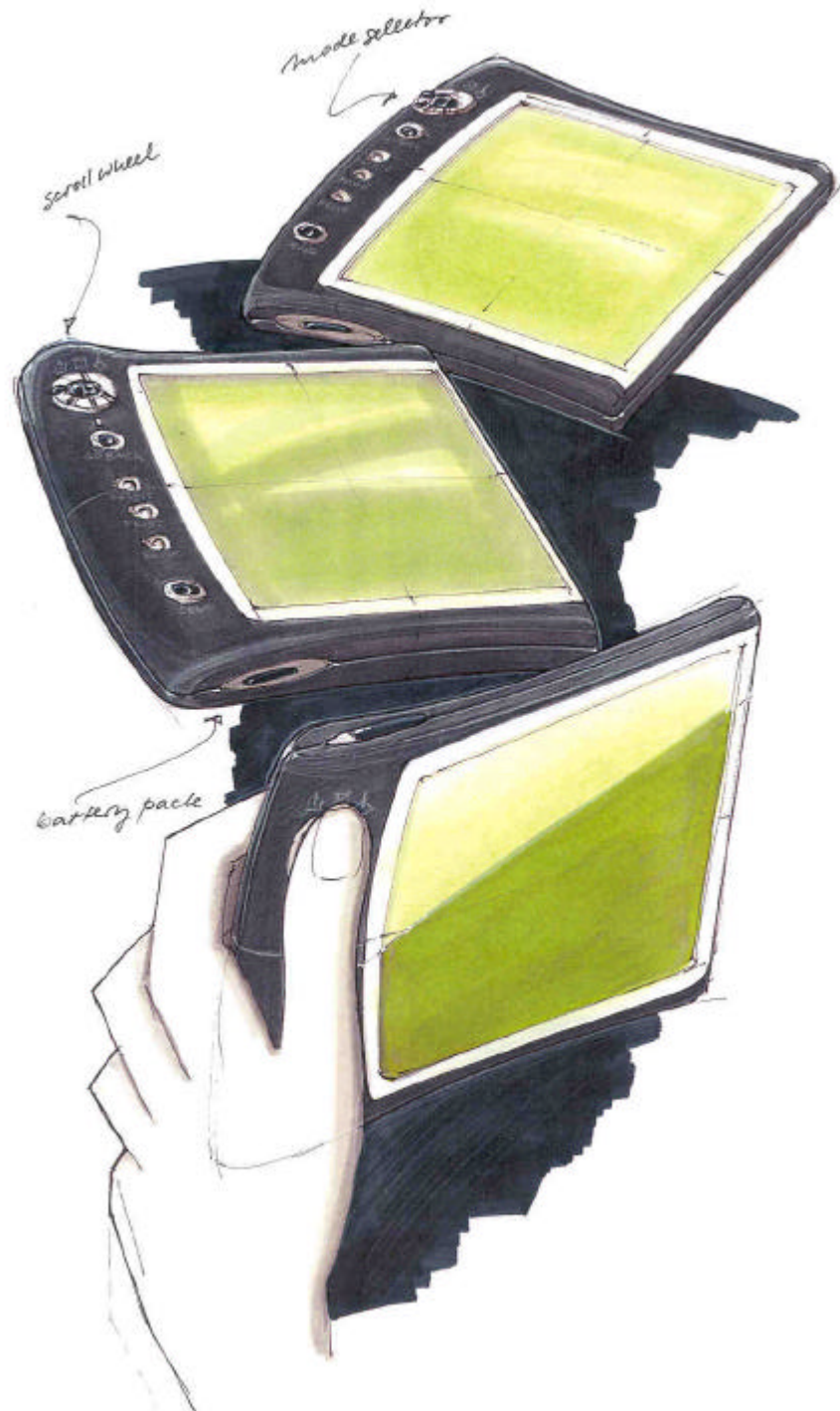


Figure 5.20 HP e.me tablet concept

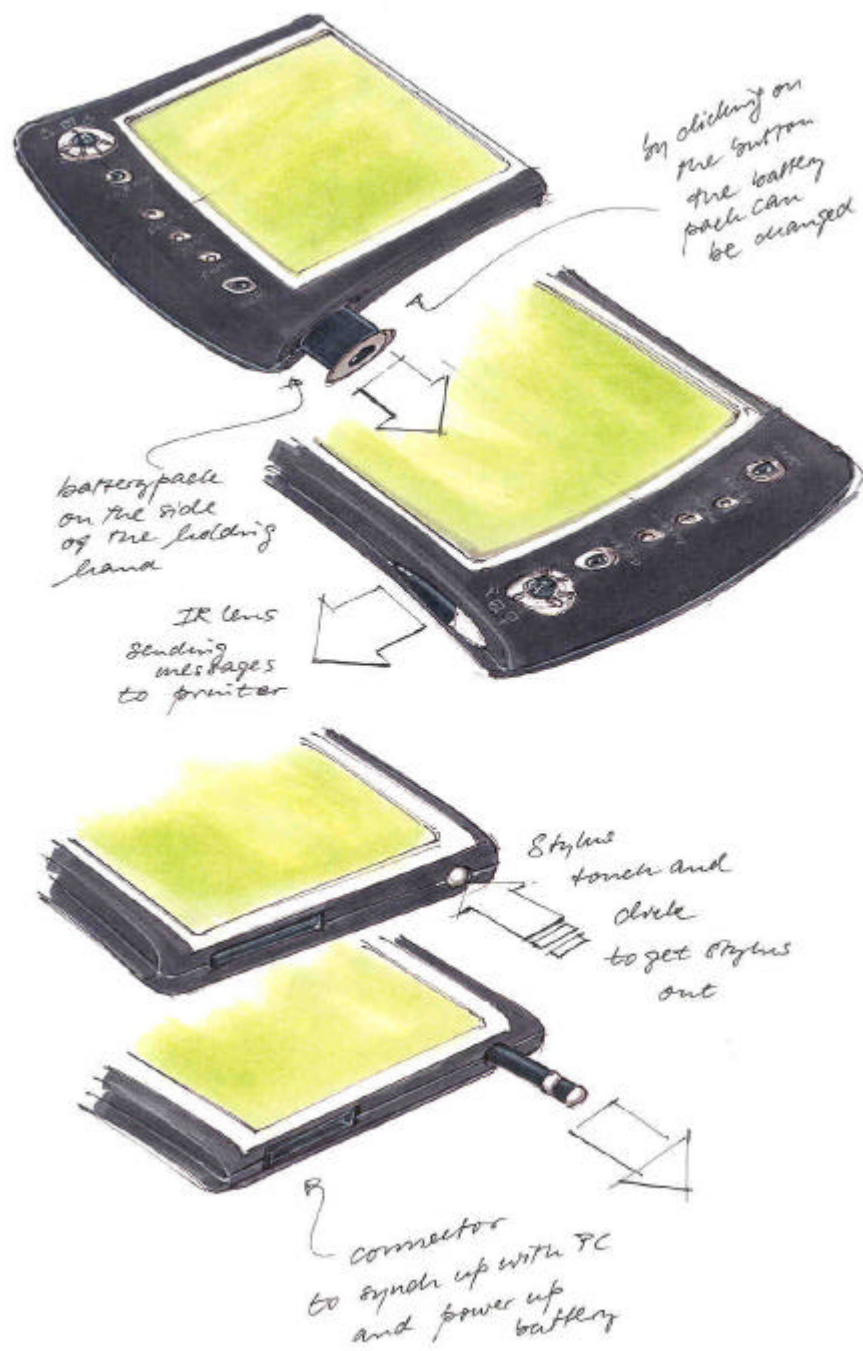


Figure 5.21 From top to bottom: Battery Pack, IR lens, "Touch and click" system for stylus, power recharge connector

5.7 Rapid prototyping

Below pictures of rapid prototyping and the end result are shown.



A6 concept testing of e.me concepts

6.0 Introduction

This chapter will describe procedures and results of the concept testing of the e.me concepts. Concept testing will take place by testing pre-assumptions and research questions. Most of research questions will be made operational so that these can be measured during concept testing. Other research questions are difficult to measure because of their qualitative nature.

After concept testing the results will be analysed and will be implemented in the requirements of the product. As an end result possible changes will be indicated and a proposal will be made for possible e.me products.

6.1 Research aim

The e.me concepts have been developed on the basis of design based pre-assumptions. These design-based pre-assumptions can be proven right or wrong during concept testing. Right or wrong, all feedback made by subjects are a positive contribution to the design development of the e.me concepts.

The concept testing is about getting valuable information how people perceive these concepts. The subjects' perception will therefore be used as input to adapt the concepts for the benefit of usage and appeal.

6.2 Assumptions

Use Cues

The e.me tablet has the following use cues:

- Stylus
- Fixed buttons
- Screen and button layout
- Screen size
- Text on screen
- Text near buttons (only readable on renderings)

The e.me pager has the following use cues:

- Scroll button on the right
- Fixed buttons
- Screen and button layout
- Text on screen
- Text near buttons (only readable on renderings)

Pre-assumptions

Pre-assumptions in respect to e.me tablet

- Users want to pick up the device take and take out the stylus to operate the device
- Users will use left hand to grasp the device and operate the fixed buttons. Their right hand will be used for stylus functions (for right handed people only)
- Users will expect palmsize PC functionality because the e.me tablet is perceived as having the same form factor as a palmsize PC
- Scribble input will appealed to users because they can just write their messages
- The device will be valued around £100
- Users will be doubtful to buy one because they strive to carry only one device. This device will mean they have to take another device, unless they see the benefit of the focused functionality

Pre-assumptions in respect to e.me pager

- Users want to scroll by turning button on the right
- Users will expect less functionality because of form factor and use cues
- User will not see the benefit over a message read only device next to a mobile phone
- Users will perceive it as a gadget, an accessory
- Users will only buy the device if it is sensibly priced because of their judgement of value of the device. Possibly £50 or less.
- Users will strive for using only one device

6.3 Research Questions

The research aim is translated into research questions in order to be able to observe and question subjects about their actions and opinions.

The main research questions are the following:

- How do subjects react to the concepts without any explanation? What are their first associations with these concepts?
- How do the subjects hold the models and what do they think of the size and shape?
- What is their view on functionality and usability after the concepts have been explained?
- Where do the subjects expect to buy such a device and what would they pay?

Elaborate research questions on the e.me tablet:

- What do subjects think of the scribble-input method and do they perceive the size of the screen adequate
- What do subjects want if they have to make a trade off between grasping the device better and having a slimmer but longer screen than the original screen on the concept

6.4 Method of concept testing and how it was made operational

Circumstances during concept testing

The subjects have to give their view on the concepts. The circumstances has to be in a fashion that subjects are willing to give their opinion on the concepts and are encouraged to do so. The concept testing may not turn out into a discussion about who is right or wrong, but needs to be an interview about how they perceive the concepts.

To capture the subjects' handling with the concepts the interview will be recorded on tape also to analyse items, for example handling patterns, after the interview.

Population during concept testing

To be able to get as best response as possible I need to interview subjects who can imagine how the concepts would operate during actual use. This requires subjects that use electronic ways of messaging and can understand mobile messaging concepts. Because the concepts are non-functional models subjects need to be able to image how the concepts would work if they were operational. In terms of scribble, people need to have got acquaintance with some form of electronic scribble or scribble methods like Palm Graffiti. Subjects also need to have some level of technical knowledge of how messaging would work in order to give their opinion of it would be possible or trustworthy to their opinion.

Subjects also needs to have knowledge about what is possible with other devices in order to be able to compare functionality from other products with the concepts. Comparable products are for example: palmsize PCs, handheld PCs, certain PDAs or smart phones. This would require that subjects need to have knowledge of what is happening in terms of messaging and communication possibilities today. Then subjects are able to give their best opinion of functionality and the connected issues like appeal and price.

These requirements for subjects raise practical difficulties. If I want to interview representatives of my target group I need to find sales executives in the first place and then select between them to meet my criteria. I believe that the concepts are very appealing to more user groups than sales executives and to get the proper response on the concepts from several user groups it is not required to have representatives of my target group.

I have selected 11 subjects from HP Labs and HP Computer and Network Support, 1 HP IT project manager, and 1 student who were not connected with my project, were not known to my concepts and met the most criteria above.

I have done this out of practical and time-concerning reasons and because I believe I could get the best feedback on the concepts.

Making the research questions operational

The research questions are made operational according to their nature. Qualitative questions were transformed into open questions, which has to be answered during the interview. Questions that are possible to measure are made operational by using a Graphic Rating Scale method. Additional reactions from subjects were notated.

The interview was divided into a part per concept. The order of parts during the interview was changed to prevent effects of being influenced by the results of the first part.

Research questions related to scribble input have been made operational by setting up a test of writing a message on two sizes of Post-Its: 76x76mm and 96x56mm. The message was the same for every subject. The aim was to give subjects a feel about writing a message on a surface with the size of the screen. Subjects have to write the same message on two sizes to compare the two sizes and get feedback about a possible trade off between screen size and a better grasping configuration.

6.5 Organization of concept testing

Instruction

The interview starts with an instruction to make it clear that the opinion and view on the concepts of the subjects is the most important output for this test, “There are no right or wrong answers”.

Per part of the interview subjects will be encouraged to take a look at the concepts and explain their first view on and associations with the concept.

Questions and assignment

The interview is divided in open questions and questions where subjects need to fill in questions with the Graphic Rating Scale. Subjects have to make a mark or a tick along a line to give a gestured-based answer on a question. Additionally subjects are encouraged to explain their motives and opinion to place their mark or tick on that spot.

At the end of the part concerning the e.me tablet concept subjects are given an assignment to copy a message on two sizes of Post-Its to give them a feel about scribbling on certain sizes. Again subjects are encouraged to stress their view on scribble input and screen size.

6.6 Analysis of concept testing

Introduction

The acquired data will be presented below and is divided per concept.

The measurable questions for the tablet and stick are compared and an analysis of variance (ANOVA) is carried out, initially taking order into account (between subjects) but there were no order effects. Therefore the data is collapsed and a one-way (within subjects) ANOVA is performed.

The conclusions of the research questions will be discussed in the following paragraph.

Acquired data e.me tablet

First associations

What do you think this is?

- S1: Windows CE device or a Palm Pilot, one of the two
- S2: Reminds me of a Palm Pilot, feels like a Palm Pilot
- S3: Wireless email reading
- S4: Palmtop, like a Cassiopeia
- S5: Portable email reader
- S6: Write emails on it? To compose Messages
- S7: Like Palm Pilot
- S8: Email assistant
- S9: Email browser
- S10: Email browser
- S11: Organiser with possibly email functionality
- S12: Send & receive messages

What do you think you can do (what functions does it have)?

- S1: Schedule, organiser, contacts, inbox, reminders, web browser
- S2: Email reading and more
- S3: Standard PDA functionality, Email, handwriting recognition, Compose emails
- S4: Palmtop functionality, but you can put more information on it because of screen size
- S5: Read email, maybe write email on it, possibly notes
- S6: Reading and Composing messages
- S7: Functionality of a Palm Pilot, address book, perhaps games and let you read messages as well
- S8: Palmtop functionality for example: telephone numbers, notepad
- S9: Because of the size & shape it could have organiser functionality, perhaps web browsing. I think it is for message reading tasks and possibly has message management tasks. Tapping with stylus on keyboard to input text and handwriting recognition on the fly.
- S10: Palm Pilot functionality: address book, notebook, and email

S11: Expect calendaring functionality, maybe extras. Can possibly deliver access to the Internet

S12: Calendar, diary functions, similar to Palm organiser functionality

Form evaluation

Do you like the shape?

S1: Organisers are too big, I would like to see them smaller

S2: subject does not like the design. He wants is narrower and wants better grip.

S3:

S4: The design is different and the shape is odd to hold. It is not too bad. Still not sure about the shape, it is too big to hold it.

S5: I think it is beautiful and stylish. For the empowered business executive

S6: I like the colours, shape is good, I like the feel of the weight

S7: Is okay

S8: I do not like it. Too big for my hands, too wide, it's orientated is the wrong way. I feel I cannot hold it in my hand

S9: It is not a left hand machine (S9 is right-handed)

S10: Shape is okay you can hold it good

S11: Shape is different, does not make the feel better than standards. I need more grip

S12: Smaller would be better, from the point of carrying it. Curved edge is okay, my hand fits in the edge.

How easily do you think you could carry such a device with you?

Out of 100 points the average score was 74 points.

How well does it fit in your hands?

Out of 100 points the average score was 65 points. This score confirms the opinions stressed in the question above: Do you like the shape? I believe that the too big width and a less tactile design are the result of this.

Would it fit in your hand better if it was much smaller or just right?

Out of 50 points the average score was 39 points. The extremes are: much smaller: 0 points and just right: 50 points.

The relative higher score than the previous question is a result of the fact that subjects like the screen size.

Scribble input

In order to get the subject's opinion on how they imagine scribble messaging works, they had to copy a message on a Post-It 76x76mm. The message is the following:

Hi Paul,
Jim has found a strategic gap at Smith Inc.



Opportunity!! Call me.
Chris

After writing this message of a 76x76mm size Post-It they had to repeat the task on a 96x56mm size Post-It (portrait orientation) to compare both sizes.

The intention was to get their opinion on what subjects think if the screen size would smaller, but higher, in order to give users better grip because of reduced width.

S1: Subject indicates that there is more space than you think. He would not mind having a smaller screen

S2: Subject likes big screen, but prefers the smaller width and taller length. It depends on the accuracy of the pen input. "With the smaller screen...everything else would fit so much better...somewhere in between would be good...the size like a police notepad."

S3: The screen is a bit too wide.

S4: According to subject it does not seem to make any difference. He likes a size that is in between both sizes.

S5: Subject does not like scribble input. He would prefer to give speech input, make a graph insert another speech to text part and sign it with scribble.

S6: Subject indicates that screen reduction might solve the grip problem, but still prefers the bigger screen. For little messages doesn't have to be as big as current screen. Subject really likes scribble input.

S7: It is okay for small messages. Smaller size is too small.

S8: Subject indicates that length is irrelevant. The benefit for grasping is better and recognizes the trade off with smaller width.

S9: Subject finds just scribble messages just fine. If it would be interpreted at the server he would want to know how it recognises the text. Subject would like to keep the width, but it would depend on the grip.

S10: Subject would not like to send handwriting to anybody and indicates that he finds handwriting recognition like Palm Graffiti language more suitable.

S11: Subject would not use it. He is used to sending voice messages, but maybe would use it for very short messages.

S12: Subject might like the wider screen better for reading as for writing. She indicates that reducing the width is not necessary for her.

Do you think the screen should be smaller or is it just right?

Out of 50 points the average score was 44 points. The extremes are: much smaller: 0 points and just right: 50 points. I believe that is the screen was slightly smaller to give users more grip the trade off with screen size is suitable.

Opinion towards concept

How clear was the concept to you?

Out of 100 points the average score was 62 points. This is the result of user expectation expecting organiser functionality in the device.

How easily do you think it would be to operate?

Out of 100 points the average score was 79 points.

In what sort of shops do you expect you could buy such a device?

- S1: Dixons, Comet, Argos, John Lewis (consumer electronic shops)
- S2: More towards shops that sell office devices because the nature of the device is more serious
- S3: Dixons, Computing shops
- S4: Depends on the price, Dixons, Tandy (consumer electronic shops)
- S5: Airport shops
- S6: Electronic shops
- S7: Curris, PC World, Computer stores
- S8: Wherever you can buy a Palmtop
- S9: Phone shops,, it is a communication device
- S10: Electronic, PC, or telephone shops
- S11: Dixons, electronic shops
- S12: Electronic shops, business catalogue stuff

What do you expect such a device to cost?

- S1: Same price as a phone? £100 + service free
- S2: £120 and upwards
- S3:
- S4: £100 end price
- S5: £110 (\$200)
- S6: £100 on trial basis
- S7: £200
- S8: £60 - £70
- S9:
- S10: £100 - £200
- S11: £100
- S12: £100 - £150 subject would like it much better if she only had to pay for the service

Do you think this concept is appropriate to you?

S1: Subject wants more functionality in one. Is interested if it could be a phone as well, possibly with an earpiece

S2: I could appreciate that it would be maybe not as much as much as a Palm Pilot. I don't like the way it feels

S3: Needs more features

S4: Subject thinks it is very appropriate, It is the way forward but refers to electronic organisers. I am not sure if he refers to the eMe concept.

S5: I would buy one if it replaced my phone. "At the moment I am using my phone and my palm to do the same thing and I want speech."

S6: Subject finds it very appropriate especially for messaging tasks in for example trains. "I actually like this one and I am not a gadget person."

S7: It is okay but wouldn't buy it.

S8: Subject indicates it needs to be more tactile, needs better grip, but indicates that the concept is appropriate to her.

S9: People want to carry one device and different solutions would be more appropriate for different people. A range of products could be an interesting solution.

S10: If the concept had been multifunctional it would have been appropriate

S11: No, the subject uses voice messaging for this kind of activity. He thinks that it is more natural and easy to use for the purpose of messaging.

S12: Very appropriate. Subject thinks it might put her off that calendar functionality is not possible. Likes the fact that she could send reminders to herself.

Out of 100 points the average score was 69 points. Two subjects gave a very low score which influenced the average score.

Acquired data e.me pager

First associations

What do you think this is?

- S1: For reading email
- S2: Mailer
- S3: Looks like Sony MP3 player. Email version of pager
- S4: Email reader
- S5: Reading email
- S6: Reading email
- S7: Reading messages
- S8: Device for email messaging. Store names and addresses
- S9: Email reading device
- S10: Email device
- S11: Messaging device
- S12: Reading messages, short email/text messages

What do you think you can do (what functions does it have)?

- S1: Reminder of schedule. Possibly function to compose messages via voice activation
- S2: Obviously web browsing. Scrolling button on the right
- S3: Receiving email
- S4: Only reading email. Can't imagine no way to enter data
- S5: Only reading
- S6: Have to assume it has more functionality, perhaps audio
- S7: Read and compose messages
- S8: Like Palm Pilot, store address book. Receive only
- S9: How to answer? Microphone? Speech input device?
- S10: Mailbox, scroller on the right side. Camera/ video capabilities
- S11: Only reading messages
- S12: Maybe sound in relation to indication

Form evaluation

Do you like the shape?

S1: -

S2: It is very tactile, but slightly too big. Still it is a nice size to hold. You would want people to see that you are reading messages

S3: -

S4: It is a novel shape, but subject is not sure it is practical. "It can be handy, but it is not the shape I go for."

S5: Science Fiction Gadget. Subject is not sure it is the right shape or design

S6: Should be flatter. It is weird shape for in pocket

S7: Shape is okay. Looks like a spacey toy

S8: Not as losable as a pen. Can't see it in the pocket probably too bulky. Put it probably in my handbag

S9: Subject would like it if it was more pocket shaped. And possibly flatter, if it is more thinner it would be in the pager area. The scroller is very natural

S10: It is okay, overview is okay, screen is still too small

S11: Strange shape

S12: Not particularly interested. Has to be extremely portable and is too small to read messages. It should be flatter.

How easily do you think you could carry such a device with you?

Out of 100 points the average score was 65 points.

How well does it fit in your hand?

Out of 100 points the average score was 85 points.

Do you think it should be smaller or is it just right?

Out of 100 points the average score was 84 points.

Many people think it is very tactile and because of that interesting. "I want to turn that little bit at the end, I want to turn that and I want to see this scroll round."

Opinion towards concept

How clear was the concept to you?

Out of 100 points the average score was 72.5 points.

How easy do you think it would be to operate?

Out of 100 points the average score was 85 points.

In what sort of shops do you expect you could buy such a device?

- S1: Electronic shops
- S2: Could be sold as a Fashion accessory
- S3: Any place that stocks electronic devices
- S4: Dixons, Tandy, electronic shops
- S5: Airport, gadget store
- S6: Electronic shops
- S7: Computer shops
- S8: Computer, electronic and phone shops
- S9: Phone shop, a computer shop is not about communication
- S10: Phone shops
- S11: Electronic shops
- S12: Young person's fashion shops

What do you expect such a device to cost?

- S1: Has to be really cheap because you can do it on the mobile phone
- S2: £49,95 would be brilliant
- S3: £50
- S4: £50
- S5: £65 (\$100)
- S6: £50 is reasonable. Subject wouldn't buy it for her self
- S7: £60, wouldn't pay more than £60
- S8: £30 - £50
- S9: £50
- S10: £10 because it is a gadget
- S11: £20, has to be significantly cheaper
- S12: £20

Do you think this concept is appropriate to you?

- S1: No, because it can be done on a mobile phone and I don't want both products. In the end of the day people only want to carry one thing. Also If you can't act on it, you will be annoyed. "Can it be a phone as well?"
- S2: Nice to have as an accessory. Interested in the possibilities of colour and matching different user groups.
- S3: Only interested if it could work stand alone. Subject is interested because he does not want to have a mobile phone.
- S4: If the phone has the functionality subject would use the phone. Subject thinks that two-way communication is the way to go.
- S5: Size of the display is still too small. Cannot wear it

S6: Subject is not into gadgets. Not necessary to have, it is a gimmick, a gadget. If you would need a email pager, okay then subject could be interested

S7: Does not appeal to subject. Does not know if you would pick it up to read messages

S8: If it was a little bit more thinner. I would be nice to use it as a microphone to input text & scan & send: a multifunctional tool.

S9: Subject sees it as a fashion or phone accessory, a gadget and cannot imagine that people are going to look for their phone to react after a message. Reaction has to be in the concept and subject does not believe that the interface of this communication process has to need two devices.

S10: No because the phone can do it and is therefore redundant

S11: It would be ideal for one-way information distribution, for example stock share information, but needs more functionality

S12: No, subject is not interested. Subject could do this on her palm if she wanted. "I wouldn't buy gadgets personally, but if it could work stand alone it would be handy during work as an email pager."

Out of 100 points the average score was 25 points.

6.7 Instruction and questionnaire

Name :
.....
Age :
.....
Gender :
.....
Occupation :
.....

Introduction

Thank you for helping us with this evaluation. We are interested in your opinions on two concepts. So there are nor right or wrong answers.

Concept : eMe tablet

This is the first/second concept. It is a mock-up, so it does not really work.

Please feel free to pick it up and hold it.

The first thing I would like to know is : What do you think this is?

What do you think you can do (what functions does it have)?

I will now explain what we intended with this design. -----

This device will allow you to receive, read and write electronic messages when you are mobile. It will connect itself to the GSM mobile telephone network to send and receive messages. While writing a message it will not be converted in plain text so that you can compose messages easily and quickly.

Could you please make a tick mark on the line indicating how clear the concept was to you.

How clear was the concept to you?

Not at all

Very clear

|_____| q101=

(Follow up on why)

How easily do you think you could carry such a device with you?

Not at all

Very easy

|_____| q102=

How easy do you think it would be to operate?

Not at all

Very easy

|_____| q103=

How well does it fit in your hand?

Not at all

Very well

|_____| q104=

Would it fit in your hand better if it was ----?

Much smaller

Just right

Much bigger

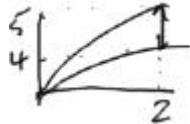
|_____||_____| q105=

Scribble input

“How do you imagine scibble-messaging works?”

“Try to put these following messages to write on a post-it?”

Hi Paul,
Jim has found a strategic gap at Smith Inc.



Opportunity!! Call me.
Chris

Do you think the screen should be bigger or smaller?

Much smaller

Just right

Much bigger

|_____||_____|| q106=

In what sort of shops do you expect you could buy such a device?

What do you expect such a device to cost?

Concept : eMe tube

This is the first/second concept. It is a mock-up, so it does not really work.

Please feel free to pick it up and hold it.

The first thing I would like to know is : What do you think this is?

What do you think you can do (what functions does it have)?

I will now explain what we intended with this design. -----

This concept will allow you to be notified of incoming messages all the time. It enables you to receive and read messages when you are away from your desktop PC. You can browse through the message and possibly print it out by beaming it to a printer. It will be wirelessly connected to your mobile telephone to receive your messages.

Could you please make a tick mark on the line indicating how clear the concept was to you.

How clear was the concept to you?

Not at all

Very clear

|_____| q201=

(Follow up on why)

How easily do you think you could carry such a device with you?

Not at all

Very easy

|_____| q202=

How easy do you think it would be to operate?

Not at all

Very easy

|_____| q203=

How well does it fit in your hand?

Not at all

Very well

|_____| q204=

Do you think it should be bigger or smaller?

Much smaller

Just right

Much bigger

|_____||_____| q205=

In what sort of shops do you expect you could buy such a device?

What do you expect such a device to cost?