AssistancePlus - 3D-mediated Advice-giving on Pharmaceutical Products

by

Martin Östlund

Submitted to Linköping Institute of Technology at Linköping University in partial fulfilment of the requirements for the degree of Licentiate of Philosophy

Department of Computer and Information Science
Linköpings universitet
SE-581 83 Linköping, Sweden

Linköping 2008
In the use of medication and pharmaceutical products, non-compliance is a major problem. One thing we can do something about is making sure consumers have the information they need. This thesis investigates how remote communication technology can be used to improve the availability for expressive advice-giving services. Special attention is given to the balancing of expressiveness and availability. A solution is presented that uses 3D visualisation in combination with audio and video communication to convey advice on complex pharmaceutical products. The solution is tested and evaluated in two user studies. The first study is broad and explorative, the second more focused and evaluative. The solution was well received by participating subjects. They welcomed the sense of personal contact that seeing the communicating party over video link produced and appreciated the expressive power and pedagogical value of the 3D materials. Herbert Clark’s theory of use of language is suggested as a framework for the analysis of the dynamics of the relationship between consumer and advisor.

This work has been supported by Kalmar R&D Foundation, eHälsoinstitutet, University of Kalmar and The National Cooperation of Swedish Pharmacies - Apoteket AB.
Kisses to Louise, my darling

Hugs to Mum, Dad and Peter, the best family anybody could hope to have

High five to John and Johan in team purple, my dev-buddies and also to 3D-Peter

Thanks to Nils, Sture and Göran for support, encouragement and guidance

My gratitude to Lars Malmborg and the Kalmar R&D foundation, eHälsoinstitutet, Apoteket AB and University of Kalmar for giving me the opportunity to research this most interesting topic.
# Table of Contents

1 **INTRODUCTION**

1.1 **BACKGROUND**

1.1.1 Pharmaceutical instruction in Sweden

1.1.2 Room for improvement

1.2 The contribution

1.3 Outline

2 **REMOTE COMMUNICATION TECHNOLOGY**

2.1 Video conferencing

2.2 Groupware and Web conferencing

2.3 Desktop sharing

2.4 Co-browsing

2.5 3D-mediated communication

2.5.1 The 3D medium

2.5.2 Communicating with 3D

2.5.3 3D collaboration

2.5.4 Web3D

3 **REMOTE COMMUNICATION TECHNOLOGY IN HEALTHCARE**

4 **PRE-STUDY**

4.1 Idea seminar participants

4.2 The seminar activities

4.2.1 The information phase

4.2.2 The creation phase

4.2.3 The discussion phase

4.3 Results from the discussion phase

4.3.1 Services/Functions

4.3.2 Range

4.3.3 Benefits

4.3.4 Users

4.3.5 User experience

4.4 Summary

4.5 Choosing what to focus on

4.6 Implementation/evaluation plan
5 ASSISTANCEPLUS – THE FIRST IMPLEMENTATION 43

5.1.1 AVAILABILITY CONSIDERATIONS 46
5.1.2 WHY TO ADJUST TO TECHNICAL LIMITATIONS THAT WILL SOON BECOME OUTDATED 48

6 USER STUDY I 49

6.1 OBJECTIVES 49
6.2 EXPERIMENTAL DESIGN 49
6.3 RESULTS 50
   6.3.1 TECHNICAL THRESHOLD 50
   6.3.2 USABILITY THRESHOLD 51
   6.3.3 LOCUS OF CONTROL 51
   6.3.4 REMOTE INDICATION 52
   6.3.5 AUDIO 52
   6.3.6 VIDEO 52
   6.3.7 3D FUNCTIONALITY 53
   6.3.8 COMPARISON WITH THE PHONE 54
   6.3.9 COMPARISON WITH FACE-TO-FACE SETTING 54
6.4 IMPLICATIONS FOR THE APPLICATION DESIGN 55
6.5 CONCLUSIONS 56

7 ASSISTANCEPLUS – THE SECOND IMPLEMENTATION 57

7.1 THE TECHNICAL SOLUTION – REDESIGNED 57

8 USER STUDY II 63

8.1 OBJECTIVES 63
8.2 EXPERIMENTAL DESIGN 63
   8.2.1 THE PARTICIPANT GROUP’S COMPOSITION 66
8.3 RESULTS FROM THE QUESTIONNAIRE 67
   8.3.1 COMPARISONS BETWEEN ASSISTANCEPLUS AND THE TELEPHONE 67
   8.3.2 RATINGS FOR ASSISTANCEPLUS 68
   8.3.3 RATINGS FOR CO-BROWSING FEATURES 69
   8.3.4 3D CONTENT 70
   8.3.5 ACTIVITY LEVEL AND SENSE OF CONTROL 71
   8.3.6 PREFERRED INFORMATION CHANNELS 73
8.4 RESULTS FROM THE INTERVIEWS 75
   8.4.1 GENERAL IMPRESSION 75
   8.4.2 THE 3D MODEL – QUALITY AND LEVEL OF REALISM 76
   8.4.3 CONTROLLING THE 3D MODEL 78
   8.4.4 SHARED MATERIAL AND THE ROLE OF THE REMOTE CURSOR 78
   8.4.5 ACTIVITY LEVEL, LEVEL OF CONTROL 80
   8.4.6 PERSONAL CONTACT 81
   8.4.7 TRUST, RELIANCE, CONFIDENCE 81
   8.4.8 EXPRESSIVENESS 82
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.4.9</td>
<td>UNDERSTANDING</td>
<td>83</td>
</tr>
<tr>
<td>8.4.10</td>
<td>INTERACTIVITY</td>
<td>83</td>
</tr>
<tr>
<td>8.4.11</td>
<td>FIELD OF APPLICATION</td>
<td>83</td>
</tr>
<tr>
<td>8.4.12</td>
<td>VIDEO</td>
<td>84</td>
</tr>
<tr>
<td>8.4.13</td>
<td>AUDIO</td>
<td>84</td>
</tr>
<tr>
<td>8.4.14</td>
<td>COMPARISON BETWEEN THE TELEPHONE AND ASSISTANCEPLUS SESSIONS</td>
<td>85</td>
</tr>
<tr>
<td>8.5</td>
<td>DISCUSSION</td>
<td>85</td>
</tr>
<tr>
<td>8.5.1</td>
<td>GENERAL IMPRESSION</td>
<td>85</td>
</tr>
<tr>
<td>8.5.2</td>
<td>LEVEL OF ACTIVITY AND CONTROL</td>
<td>86</td>
</tr>
<tr>
<td>8.5.3</td>
<td>SIGNALLING UNDERSTANDING</td>
<td>86</td>
</tr>
<tr>
<td>8.5.4</td>
<td>THE ROLE OF VIDEO</td>
<td>86</td>
</tr>
<tr>
<td>8.5.5</td>
<td>THE UNIMPORTANCE OF AUDIO</td>
<td>87</td>
</tr>
<tr>
<td>8.5.6</td>
<td>SENSE OF PERSONAL CONTACT</td>
<td>87</td>
</tr>
<tr>
<td>8.5.7</td>
<td>SENSE OF PRESENCE</td>
<td>88</td>
</tr>
<tr>
<td>8.5.8</td>
<td>CHOICE OF 3D REPRESENTATION</td>
<td>88</td>
</tr>
<tr>
<td>8.5.9</td>
<td>A MORE FORGIVING MEDIUM</td>
<td>89</td>
</tr>
<tr>
<td>8.5.10</td>
<td>FIELD OF APPLICATION</td>
<td>89</td>
</tr>
<tr>
<td>8.6</td>
<td>IMPLICATIONS FOR DESIGN</td>
<td>90</td>
</tr>
<tr>
<td>8.7</td>
<td>CONCLUSIONS</td>
<td>93</td>
</tr>
<tr>
<td>9</td>
<td>THE ROAD AHEAD</td>
<td>97</td>
</tr>
<tr>
<td>9.1</td>
<td>THEORY OF LANGUAGE USE</td>
<td>97</td>
</tr>
<tr>
<td>9.1.1</td>
<td>JOINT ACTIONS</td>
<td>99</td>
</tr>
<tr>
<td>9.2</td>
<td>THEORY OF LANGUAGE USE APPLIED TO THE ADVICE-GIVING SITUATION</td>
<td>100</td>
</tr>
<tr>
<td>9.3</td>
<td>THE ROLE OF THE TECHNICAL SUPPORT SYSTEM</td>
<td>102</td>
</tr>
<tr>
<td>9.4</td>
<td>CONCLUSIONS</td>
<td>105</td>
</tr>
<tr>
<td>10</td>
<td>REFERENCES</td>
<td>107</td>
</tr>
<tr>
<td>11</td>
<td>APPENDIX 1. MATERIALS USED IN THE PRE-STUDY</td>
<td>115</td>
</tr>
<tr>
<td>12</td>
<td>APPENDIX 2. MATERIALS USED IN THE FIRST USER STUDY</td>
<td>121</td>
</tr>
<tr>
<td>13</td>
<td>APPENDIX 3. MATERIALS USED IN THE SECOND USER STUDY</td>
<td>127</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Background

Give medicine a chance! Studies have shown that patients are not very good at taking their medicines. Level of compliance\(^1\), i.e. following the doctor’s instructions, varies depending on the type of medication, the personal characteristics of the patient and various situational factors. The average compliance, however, is believed to be as low as 50% (ABLA, 2001; Läkemedelsindustriförbundet, 2006; Sackett & Snow, 1979).

Medicine is serious stuff! The low levels of compliance are surprising and worrying. Non-compliance can have very serious consequences. A Swedish study showed that nearly half of all medication-related admittances to hospital were directly related to the patients not following their prescription properly (Bergman & Wiholm, 1981). Similarly, an American study reported that 8-10% of the total number of hospital admittances could be directly related to incorrect use of medication (Manasse, 1995).

It is a big problem! Sweden has 9 million inhabitants. In one year, 6 out of every 10 people in Sweden will have been issued a prescription drug. Used correctly medicine cures people and makes people feel better. But medicine can also hurt people or make them feel bad. In fact, 30% of all regular users of prescription drugs experience negative effects related to their use of the drug (Nilsson, Strandqvist, & Svensson, 1998). There are many reasons medicine gives negative effects. Some effects can be avoided, others cannot. Non-compliance is one that we can do something about.

It is an expensive problem! Every day 12 million doses are dispensed in Sweden. The yearly cost is close to 3 billion euro (Socialstyrelsen, 2004). That is a lot of medicine! It is estimated that in the US, for every dollar spent on medication, 1 to 1.5 dollars is spent on managing effects related to inappropriate drug use (Ernst & Grizzle, 2001; Johnson & Bootman, 1995). No comparable study has been performed in Sweden, but estimates place the cost at 8 Swedish crowns for every 10 crowns spent on drugs (ABLA, 2001). The proper use of drugs is an issue that concerns society as a whole.

\(^1\) Also called adherence or concordance.
**Introduction**

*Why don’t patients comply?* Several studies have been conducted to investigate reasons for non-compliance. Common excuses given are: experienced adverse effects; instructions found to be inadequate or difficult to understand; relationship with healthcare provider is poor; not believing medication will help; and prohibitive cost (Haynes et al., 2005; Jaret, 2001; SOU, 1998:28). Many different strategies have been attempted to improve compliance. In a comprehensive review of compliance intervention studies\(^1\), Haynes et al. (2005) list no less than 17 different ways that have been tried out to improve compliance\(^2\). The following list of intervention tactics were those found to give the best results: providing more and better instructions, fostering a good relationship between the healthcare professional and the patient, scheduling regular follow-up meetings and supplying the patient with appropriate reminders. These interventions were shown to give positive effects that were replicated in more than one study.

Trying to induce compliance is a complex issue and there is no single, one-size-fits-all, solution. There are many problems and many solutions. This thesis investigates one solution for one problem – one piece of the puzzle. The chosen problem is how to increase the availability of rich expression advice-giving for pharmaceutical products; the goal being to improve compliance for these products by fulfilling the informational and motivational needs of the consumer/patient. The proposed solution uses web-based remote communication and 3D visualisation technology to convey rich and expressive advice from professional advisors to consumers. This is summarised below:

The problem: *How to increase the availability of rich expression advice-giving for pharmaceutical products*

The solution: *A web-based advice-giving service that uses 3D visualisation techniques as a pedagogical aid in the relaying of advice from professional advisor to consumer user*

\(^1\) Only studies that were properly randomised were included in this review.

\(^2\) Haynes et al prefer the term adherence instead of compliance.
How this specific problem was singled out will unfold in the following sections of this chapter; and how the specific solution was shaped will be described in chapters 4, 5 and 7 and how it was tested and evaluated in chapters 6 and 8.

1.1.1 Pharmaceutical instruction in Sweden

The main distributors of information on pharmaceutical products in Sweden are the pharmaceutical companies, the hospitals and other care facilities, the National Cooperation of Swedish Pharmacies (Apoteket AB\(^1\)) and government agencies such as The Medical Products Agency\(^2\) (Läkemedelsverket) and The Swedish Council on Technology Assessment in Health Care (Statens beredning för medicinsk utvärdering, SBU) (Läkemedelsverket, 2008; SBU, 2008). The basic information about pharmaceutical products is provided by the companies that produce or distribute the products. The information is compiled in a standardised document called the *Summary of Product Characteristics*. These documents are collected and published by the pharmaceutical companies’ trade association: The Swedish Association of the Pharmaceutical Industry – Läkemedelsindustriföreningen, LIF (LIF, 2008).

Other organisations provide additional information. Government agencies and research organisations issue reports and various information materials. Apoteket AB publish information leaflets and product sheets, and run topical information/advertising campaigns. Apoteket AB also manage a relatively new but well-established call centre service which offers 24-hour telephone, e-mail and fax access to qualified pharmacists. Another helpful source of information is the *sjukvardsradgivningen.se* website (the title roughly translates to: The medical advice service). The site is jointly run by the county councils, regional councils and the Ministry of Health and Social Affairs (Socialdepartementet) and publishes articles on health and medicine-related topics. The articles are written in layman’s language with the texts carefully scrutinised by an editorial board to make sure they are easy to understand. The same organisation has recently

---

\(^1\) Apoteket AB is a limited company wholly owned by the Swedish state. They hold the exclusive rights to sell and distribute pharmaceutical products to the general public in Sweden. They are also responsible for providing information about said products to assure their safe and reliable use. They have a nation-wide chain of 900+ pharmacy stores and a well-developed call centre with telephone, e-mail and fax services (Apoteket, 2007).

\(^2\) The Medical Products Agency (Läkemedelsverket) is the main regulatory body in the Pharmaceutical market.
launched a telephone service – Sjukvårdsrådgivningen 1177. The service is open to members of the general public\(^1\) and offers 24h access to qualified nurses and specialists (Sjukvårdsrådgivningen, 2008). There are also a number of privately or commercially run web sites that provide information services on health issues (Findahl, 2007b; KOM, 2007).

The various information providers and distributors make information available through many different channels. In addition to the traditional person-to-person exchange of information at the pharmacy or the hospital, there are: telephone, fax and e-mail services; web pages; discussion boards and other types of Internet-based communication; demonstration videos; and written materials (books, brochures, leaflets). Out of these, the Internet based channels are growing the fastest. The 2007 report on the Internet habits of the Swedish population revealed that seeking health information is the single fastest growing activity on the net. More than 50% of the participants reported that they had sought health information on the net in the last year (Findahl, 2007a). This is a trend that is mirrored in many other countries as well, for example Canada, USA, Japan and Spain (Dutton, di Gennaro, & Millwood Hargrave, 2005; Findahl, 2007a; Fox, 2006; Zamaria, Caron, & Fletcher).

1.1.2 Room for improvement

Correct information and instructions for pharmaceutical products is important in fostering compliance. It is not the only factor, but it is an important one. The problem is not that there is a shortage of information. There is a lot of information available and it can be accessed through many different channels. However, the characteristics of the channel’s medium determine what information needs can be handled. It also determines when, and from where, the information can be accessed. The channel must be expressive enough to fulfil information needs, but must also be available from the right place at the right time. The goal is not to provide information as rich in content and expression as possible for any and all situations. Indeed, too much information is counter-productive (Daft & Lengel, 1984, 1986; Grice, 1975). The trick is to match the channel to what the situation requires.

---

\(^1\) The telephone service was originally launched in the Stockholm area. At the time of printing the service is available to 2.5 million people in the counties of Stockholm, Skåne, Kronoberg, Uppsala, Jämtland, Gävleborg and Östergötland. Several other counties are in the process of joining.
Information is not enough – making information available is fundamental, but in striving to induce compliance, the satisfaction of information needs is only the first step. The information then needs to be turned into knowledge. The term knowledge has been assigned many meanings, but in the present context, it is defined as information that has been understood and internalised to a degree that it is usable in practice (Devlin, 1999). This means that the pharmaceutical information needs to be transformed (in the mind of the patient) into a practically usable form. It is not necessary for the patient to know every detail of their medication. Indeed, instructions can be followed even if they are not fully understood. However, compliance has been shown to improve with understanding (Haynes et al., 2005; SOU, 1998:41). Hence, the chosen channel should be expressive enough to support the transformation of information into knowledge. What level of expressiveness is required varies with the complexity of the product and which prior knowledge the patient has of the product.

Knowledge is not enough either – once knowledge is achieved, it still remains to make sure that the patient is properly motivated to act in accordance with the gained knowledge. This is also dependent on the expressiveness of the chosen channel; although not necessarily the same type of expressiveness as that used to convey factual information. The type of expressiveness that supports the instilling of motivation depends more on the ability to create a sense of personal contact and in the building of trust.

There is no single preferred channel in pharmaceutical advice-giving. The choice of channel depends on many interacting contextual factors such as what kind of medication it is, how complex the question is, in what situation the information is sought/provided, personal characteristics and preferences of the patient and many others. There are many different channels available catering for different needs. For questions/issues that require high expressiveness, a highly expressive channel such as the face-to-face meeting is used. For questions/issues where availability is important, a highly available channel such as the telephone is used. Ultimately, the usefulness of any channel in a given situation is decided by whether or not it can deliver the right mix of expressiveness and availability. Availability and richness of expression are defined here as follows:
**Richness of expression:** The expressive power available to either or both of the communicating parties in the advice-giving setting

**Availability:** The ease with which the information seeker can access and use an advice service.

As was argued above, there is no reason to waste *expressive bandwidth*. Enough is adequate; and most questions/issues require no more than can be provided over the telephone, through the web or with written materials; whichever is the most suitable for the given situation. However, there are questions/issues that do require a higher level of expressiveness than that which the telephone can offer; and that occur in situations where physically going to the pharmacy or the hospital is not a practical option. Out of the range of channels available for pharmaceutical information, there is no channel that fulfils the need for both high expressiveness and high availability. Here is the room for improvement.

1.2 The contribution

The contribution of this thesis is to show how the reach of pharmaceutical information can be extended by complementing existing information channels with expressive advice-giving services that can be reached over distance. This increases the total availability for pharmaceutical information and can contribute to improved patient compliance by making sure the patient has the right *information*, the right *knowledge* and the right *motivation* – at the right *time*.

1.3 Outline

First, the various technologies that are used to support communication and collaboration over distance are described, the tools in the toolbox, so to speak. Special attention is given to the use of 3D visualisation as a communicative device. Next, the results are presented of a pre-study exercise that was conducted to gather creative input on how these technologies can be put to use in the field of pharmaceutical information. Based on the results from the pre-study, a conceptual design was drafted. The general principles outlined in the conceptual design were used to guide the design of a first web-based prototype. It had the following
features: duplex audio/video communication, co-browsing and basic co-manipulation of a 3D product. The prototype was tested and evaluated in an exploratory user study. The prototype was then re-designed in a second prototype. The main new feature was a 3D video hybrid player, which added support for playback of interactive animation sequences. After this, the findings from both user studies are analysed from a psycho-linguistic perspective using Herbert Clark’s theory of use of language and common ground. Special attention is given to the communicative potential of the 3D medium. Finally, the theoretical and practical consequences of what has been learned are discussed and the most important findings are summarised. Also, some future directions for research in the field are suggested.
2 Remote communication technology

The purpose of this chapter is to provide a snapshot of the current status of remote communication technology; and thereby provide an overview of which tools that are available to the developer aiming to create a rich information remote communications service.

2.1 Video conferencing

Video conferencing is used to link two or more people together with bi-directional simultaneous audio and video transmissions. It is usually used to allow people to converse over distance, but can also be used to convey instructions or demonstrate something (Gergle, Kraut, & Fussel, 2004). Video conferencing has been used in business and professional settings for some time now, but up until recently prohibitive costs have limited its use. Today the required technology is (relatively) cheap. Low cost web cameras and convenient and affordable broadband access has made video conferencing a viable alternative for many different communication needs. High-end implementations are still the province of big business, but good quality solutions are available also for less affluent organisations such as schools, for small-scale businesses and also for private use.

High-end packages are marketed by vendors such as Polycom, VCON, Cisco and Tandberg (Cisco, 2008; Polycom, 2008; Tandberg, 2008; VCON, 2008) who offer wholly or partially proprietary solutions. Standards are winning ground in this area, but many of the high-end solutions still require special equipment that is incompatible with that of others. The advantage with the high-end systems is that they provide high quality video and audio and they are reliable.

Desktop video conferencing technology has been available since the early nineties, but it is only since broadband access has become commonly available that it has become useful in a wider context. While the high-end packages typically focus on offering high quality audio and video, most desktop packages bundle audio/video communication with other features, such as Instant Messaging, whiteboard features and application sharing (these other features are covered in the following sections). There are many free-to-use applications that support one-to-one video conferencing with acceptable audio and video quality (for most purposes). Some
examples are: Microsoft NetMeeting\textsuperscript{1}, MSN messenger/Live Messenger, Yahoo Messenger, ooVoo\textsuperscript{2}, Skype\textsuperscript{3} (Microsoft, 2008c; ooVoo, 2008; Skype, 2008; Yahoo, 2008). There are also many moderately priced packages offering multi-party video conferencing (with more than 2 participants). Examples are: Microsoft Live Meeting, Adobe Connect Pros, Webex (Adobe, 2008a; Microsoft, 2008b; Webex, 2008). It seems fair to say that in the industrialised part of the world, basic video conferencing is within the reach of most companies, organisations and even individuals.

2.2 Groupware and web conferencing

Groupware\textsuperscript{4} is used by businesses and organisations to co-ordinate, collaborate and communicate within a group of people. There are many tools that offer groupware services. Examples are: Microsoft Sharepoint and Microsoft Groove, Lotus Notes/ Domino and Lotus Quickr, Google Apps and Huddle (Google, 2008; Huddle, 2008; IBM, 2008a, 2008b; Microsoft, 2008a, 2008d). The typical features in groupware systems are audio/video-communication, text chat, whiteboarding (a shared drawing area) and application/desktop sharing (allowing participants to see and/or remotely control a remote computer).

Groupware and web conferencing services are similar in many ways. They share the same feature list and the terms groupware and web

\textsuperscript{1} Netmeeting is a popular multi-point video conferencing and collaboration client with a long history. It has been bundled with the Windows operating system since the mid-nineties up until (not including) the Vista version; and also with the Internet Explorer browser for a period. Microsoft stopped development on Netmeeting in the late nineties as not to compete with their own other commercial products. (Summers, 1998; Wikipedia, 2008)

\textsuperscript{2} Supports up to 6 simultaneous users in newer versions.

\textsuperscript{3} Video conferencing capabilities are integrated in Skype since version 2.0.

\textsuperscript{4} Also sometimes called collaborative software
conferencing are even used interchangeably sometimes. This is not quite correct. There are many similarities, but there are also differences. The main difference is a difference in focus. Groupware services focus on collaborative and administrative tools such as document management systems, shared calendars and planning tools. Web conferencing services focus on tools for communication such as on-line meeting rooms, video conferencing and webcasting. Examples are: Adobe Connect Pro, WebEx, Microsoft Live Meeting; and Vyew, dimdim and Yugma. The first 3 come with quite hefty price tags, while the latter three are free1.

Groupware has been extensively researched within the scientific discipline of Computer Supported Co-operative Work – CSCW2. The object of study in CSCW is how people work together with the aid of computing and networking technology (Bannon & Schmidt, 1989; Borghoff & Schlichter, 2000). CSCW is an eclectic field whose members take a broad view on the multi-layered challenge of getting people to work together with the aid of computers (Baecker, 1993; Beaudouin-Lafon, 1999). The social dynamics, socio-economic impact and technological challenges of computer supported co-operative work have all been investigated in the field; with the investigators coming from such diverse domains as psychology, sociology, economy, technology and many other (Grudin, 1994; Shneiderman & Plaisant, 2005; Wilson, 1991).

2.3 Desktop sharing

Shared desktop techniques are used to allow one or more persons to view or control another person’s computer remotely. It is similar to the application sharing feature found in many groupware and web conferencing solutions. The difference is that with application sharing the remote access is limited to a selected application or even a single document, while with desktop sharing the remote party can control the computer as if sitting in front of it. There are also similarities with remote desktop programs such as the popular VNC3 freeware. Here, the difference is that there is only a single user in remote desktop programs, while in desktop sharing there are two (or more) users, one local and one (or more) remote; and they share control or take turns.

1 With fees charged for additional features.
2 There is some debate of whether the second ‘C’ in CSCW should stand for co-operative, collaborative and even competitive. Here the term co-operative is intended.
3 Virtual Network Computer
Remote communication technology

Desktop sharing can be used for many different purposes, since any program that is installed on a local computer can be used. A common area of use is for remote support and helpdesk services. There are several companies that provide this type of service. Examples are: NTRSupport (NTRSupport, 2008), Netviewer one2one (Netviewer, 2008), Bomgar (Bomgar, 2008) and GotoAssist (GotoAssist, 2008). Desktop sharing sessions are typically initiated by running a small executable that is downloaded by clicking a link in an email or on a web page. This allows the remote operator to begin sharing control over the user’s local computer. When the session ends, the executable is either removed or inactivated.

Another area of use for remote desktop services is for presentations and demonstrations. The operator, or presenter, “beams” his/her screen to one or more remote viewers. There are several products that offer wholly web-based clients that do not require any additional download or installation on the viewers’ side. Examples are: BeamYourScreen (BeamYourScreen, 2008), Glance (Glance, 2008), Netviewer one2meet (Netviewer, 2008), NCH Screen Stream (NCH, 2008)

The drawback of desktop sharing (and the same applies to application sharing) is that it requires a high bandwidth connection. The reason is that the screen image needs to be continually broadcast as a sequence of images and, while there are many ways in which the image data can be compressed, it typically requires high bandwidth to run smoothly. One commonly used method to reduce the data load is to only send updates for those areas of the screen that have changed since the last transmission. This works fine when only smaller portions of the screen are updated between frames, such as is the case when the only changes are cursor position updates. However, for full-screen video and for direct manipulation actions such as scrolling or rotation of a 3D-model, requirements on bandwidth and network latency (high bandwidth, low latency) quickly become prohibitive.

---

1 Many products are capable of broadcasting the presenter’s screen to many simultaneous viewers.

2 Latency measures the time it takes for a data packet to traverse the network. Latency is partly dependent on bandwidth (more bandwidth, less congestion), but also the distance travelled and the physical medium. In desktop sharing and application sharing the key measure is the roundtrip time – from action to result, i.e. from remote command (mouse or keyboard event) to screen update. High latency times make direct manipulation tasks difficult to perform.
2.4 Co-browsing

Co-browsing or collaborative browsing (sometimes also called escorted browsing) is a technique where the viewing, and in some cases the editing, of a shared document is co-ordinated between two or more parties. Each participant has his/her own copy of the document and changes made to the document content or view (such as scrolling, highlighting or indication) is transmitted to the other participants, updating their local copy. The resulting experience is similar to that in desktop sharing and application sharing. The difference is that the footprint of the data sent between the participants is much smaller, since only small amounts of data need to be sent to describe the actions performed by the participants. Network latency is also less of a problem since every participant has his/her local copy of the document.

The drawback with co-browsing techniques is that the program used to display the document must have built-in collaboration features for it to work. Moreover, each participant must have the same program (and possibly the same version of the program) installed. For this reason, co-browsing is primarily associated with web-based implementations, and even here, the few available products have not been very successful. Probably a major contributing factor for this is that co-browsing features are typically implemented with browser plug-ins or add-ons, see for example nloose, Mozilla Coop, iosurf, chatsum, me.dium, weblin and Flock\(^1\). Even though the required plug-ins and add-ons are typically small in size and easy to install, when users are required to install something anyway, they opt for more full-featured packages; or just use the collaboration features of programs that they already have installed (such as NetMeeting, Windows Meeting Space, MSN Messenger/Live Messenger, Yahoo Messenger).

There are different levels of co-browsing. Simpler systems offer page push functionality. Page push allows an operator to force a certain web page to be shown for a remote viewer. Synchronised surfing is a more sophisticated type of co-browsing. Here, any participant can initiate a page change and the page change is then propagated to all viewers. For this type of co-browsing it is important that concurrent actions are properly synchronised and that there are mechanisms for conflict control. Other features that are used to complement synchronised surfing are synchronised scrolling (keeping the viewers on the same part of the page),

---

\(^1\) Flock is actually not a plug-in or add-on, but a stand-alone browser.
synchronised form fill-ins (making assisted form fill-in possible), and telepointers (broadcasting the position of the participants’ cursors for indication or highlighting purposes).

Very recently, a few web co-browsing services have appeared that offer installation free co-browsing, for example: weblin lite, Xpanity, Browzmi, ginzawalk and itzle – all are currently in alpha or beta testing stages. There are also a couple of older, now defunct, demo systems developed for research purposes that offered installation-free co-browsing (Esenther, 2002; Han, Perret, & Naghshineh, 2000; Hoyos Rivera, 2005). The good thing about installation-free co-browsing is that it makes it possible for users to instantly and with minimal pre-planning initiate a co-browsing session. The single requirement is that each user has access to a standard web browser. It remains to be seen if these services will fare better than their plug-in/add-on predecessors.

2.5 3D-mediated communication

2.5.1 The 3D medium

3D, or 3-dimensional space, as a medium is something that is very familiar to all of us. At least if it is described as a spatial quantification of the piece of reality that surrounds us at any given moment. Any point in space can be unequivocally and absolutely specified by using a set of 3 values (if we momentarily, for practical purposes, disregard the curved nature of Einsteinian space-time and its absence of a preferred reference point). Typically a fixed co-ordinate system is used with a pre-determined centre point from which three orthogonal axes protrude, often labelled x, y and z. With a set of xyz-values, the position of any point in space can be unequivocally defined relative to the centre point; or in relation to any other point in this space.

The 3D space itself can be of any size and any scale (or infinite as the universe – probably – is). It need not even be real, in the physical sense. The 3D space and its contents can exist solely in the form of a numerical model. This, in fact, is what 3D computer graphics is – a numerical model describing a virtual 3D space and its contents. The space is given physical representation by projecting an image of its contents onto a 2-dimensional plane, typically a computer screen. This means that at the point in time when the view of the contents is actually displayed, its 3 dimensions are reduced to 2. This is not the place for a deeper analysis of the nature of the difference between a projection of a 3-dimensional entity onto a 2-dimensional plane and the display of natively 2D images on the same
plane. For present purposes, it will suffice to define the difference between the two in terms of the way each is represented in computer memory. The positions of true 3D content is represented by sets of 3 values \((x, y \text{ and } z)\) while 2D images content is represented by sets of 2 values \((x \text{ and } y)\). The term \(3D\) is from here on used exclusively to refer to content that contains \(z\)-value depth data. The term is used both for real (physical) 3D-dimensional space and for any numerical virtual equivalents (such as those found in 3D computer graphics). It is also used to denote the surface representation of numerical 3D computer graphics models when they are projected onto the computer screen. The use of the term is summarised below:

**3D:** The term “3D” is used to denote any representation of a 3-dimensional real (physical) or numerical space and the spatial distribution of its contents; and also to refer to the real-time projection of such content onto a 2-dimensional plane.

The computer 3D graphics numerical space can be used to represent simulations of physical objects as well as made-up or purely abstract objects. A distinction can be made on whether that which is visualised actually exists or could exist in the physical world. A concrete example of the visualisation of something that does exist is the use of a 3D model to demonstrate servicing instructions for a copying machine. The copying machine obviously exists. The 3D model is used to convey servicing instructions instead of the real machine simply because it is more convenient (using a 3D model allows instructions to be related over distance, instructions can be made clearer by showing hidden parts and so on). An example of the visualisation of something that could exist is the creation of an architectural 3D mock-up showing what a planned building will, or could, look like before it has been built. The building obviously

---

1 Of course, both 3D and 2D content have additional data bound to them, such as color information or displacement mappings. The \(xy\) and \(xyz\) value sets mentioned here refer only to position.

2 According to this definition, a snapshot or animation sequence that has been pre-rendered from 3D data would not be considered 3D. The reason is that the depth-values have been stripped away in the rendering process. If the same 3D data is rendered in real-time directly from the 3-dimensional data it is, however, considered to be 3D.
could exist in the real world; and, if one decides to go ahead with the building plans, it will. It does not yet, though.

Visualisation of abstract or imaginary objects concern things that have no physical form, nor are they intended to have, or be given, physical form. An example is the use of 3D-visualisation in the analysis of multidimensional statistics. Here, data series are plotted in 3D space in accordance with some schema. This representation can then be visually scanned to try and make sense of the data and to try to identify relationships and trends. Although the data may very well represent quantifications of real world activities, the representation itself is arbitrary and abstract and there would be no reason, or point, to bring the representation itself into the physical space.

There is no hard boundary between simulation of physical objects, on the one hand, and virtual and purely abstract content, on the other. For example, the content of a first-person shooter (FPS) computer game, such as Counter Strike or Unreal, simulates action in a physical space, complete with artificial gravity and Newtonian motion. However, it does not, nor is it intended to, represent a true physical space. For present purposes, it is not of importance to pin down the exact defining characteristics of what would be considered simulation of real objects and virtual/abstract content. The point being made is that the 3D medium can be used to represent a wide range of both physical, virtual and abstract spaces.

2.5.2 Communicating with 3D

Now with the 3D medium itself defined and described, it is time to turn to how 3D can be used as a communication device and to the definition of 3D-mediated communication. 3D-mediated communication occurs whenever 3D resources are used for communicative purposes – to get a message across, to make a point, to present, demonstrate, instruct or collaborate. The 3D medium can be used by itself or in combination with other communication mediums and it can be used at a single physical location or be used to communicate remotely between geographically dispersed locations. For obvious reasons, the 3D medium is well-suited for representing content containing 3-dimensional spatial data of some form, but it can also be used to represent other types of data; for example data that have some inherent complexity that is difficult to communicate with other mediums. Some examples might be helpful to illustrate how the 3D medium has been used as a communicative aid:
Remote communication technology

- For real-time collaboration in drawing-board stages of construction/design projects;
- for presenting non-visitable places such as reconstructed historical sites or planned future sites;
- for presentation of multi-dimensional complex data sets;
- for presentation, demonstration and instruction on physical tasks over distance;

There must always be a human sender (one or more) and a human receiver (one or more) in 3D-mediated communication. The exchange between sender and receiver does not have to be synchronous — that the sender and receiver are communicating live at the same moment in time. The exchange can just as well be asynchronous, where the sender prepares a message in advance for the intended receiver/receivers to access at his/her/their convenience. This is summarised in the following definition:

3D-mediated communication: any communication that occurs between a human sender and a human receiver with the aid of 3D resources, used in isolation or together with other types of resources, for the purpose of communicating something to someone.

2.5.3 3D Collaboration

3D collaboration is a good example of 3D-mediated communication. 3D collaboration was first adopted by the technologically intensive CAD/CAE/CAM industry (Computer Aided Design, Computer Aided Engineering and Computer Aided Manufacturing). This is an industry that is heavily dependent on co-operation to achieve the necessary co-ordination between the many actors, often geographically dispersed, that are involved at different stages of design, production and deployment of a product – designers, engineers, production units, logistics planners, sales departments, business developers and so on (Törlind, Larsson, Löfstrand, & Karlsson, 2005). The need for communication has driven the

---

1 More examples of the use of 3D-mediated communication for collaboration are described in the section on 3D collaboration.
development of a wide array of both simple and advanced communication tools\textsuperscript{1} - see Li et al (2006) for a comprehensive overview.

3D has been used as a communication tool for many different purposes in the CAD industry. It has been used to create interactive instruction and service manuals (Adobe, 2007), to circulate annotatable models as part of the design review process (Chu, Cheng, & Wu, 2006; Santos et al., 2007), for replacing physical mock-ups with digital equivalents (Ghodous, Dieng-Kuntz, & Loureiro, 2006), for production planning and for real-time collaborative work (Fuh & Li, 2005; Rosenman, Smith, Ding, Marchant, & Maher, 2005; Wang, Shen, Xie, Neelamkavil, & Pardasani, 2002). The typical application is desktop-based, but experiments have been using immersive virtual environments (simulating first-person presence in a 3D world, as opposed to viewing 3D content from an outside perspective) (Min, Shang-Ching, & Jin-Xiang, 2004; Pekkola, 2002). No commercial application of this kind has been successful, though; the reason probably being that immersion has not been seen as an essential feature for CAD work.

Many current CAD programs have built-in functions to support collaborative work over distance, for example: CATIA (Dassault, 2008), Solidworks (Dassault, 2008) and Unigraphics (Unigraphics, 2008). There are also add-ons or stand-alone programs that add collaborative and communicative features. The stand-alone programs typically offer a reduced set of functions and make use of simplified and/or compressed content to reduce bandwidth demands and processor and memory load. The type of viewers that are used can often be downloaded on-demand or are entirely web based\textsuperscript{2} (Zhang, Shen, & Ghenniwa, 2004). They are also considerably easier to use than CAD programs, which makes it possible to invite a much broader range of participants than would be possible using a full scale CAD program.

Although 3D communication tools for CAD have been around for a while and the technologies are mature, the CAD community has yet to fully embrace 3D communication tools as a natural part of the daily work process. Differences in educational and cultural backgrounds of CAD engineers and in their design and work habits have been suggested as

\textsuperscript{1} Note that the acts of creating, modifying or manipulating 3D models with a CAD programme are not considered 3D-mediated communication according to the current definition of the term. It is only when the purpose is to communicate, or collaborate – which is a type of communication, that it is considered 3D-mediated communication.

\textsuperscript{2} Typically web-based solutions require a custom browser plug-in.
reasons why (Fuh & Li, 2005). Probably the main reason, though, is that the mechanisms used for real-time distribution of 3D models, co-
ordination and co-operation are simply not considered good enough (yet) for many of the extremely data intensive and complex operations performed in CAD work (Fuh & Li, 2005; Li, Lu, Fuh, & Wong, 2005). The continual improvements in computer and communications technology, particularly in the areas of graphics processing, broadband technologies and distributed memory management, will alleviate some problems. But other application-specific issues such as usability factors, collaboration techniques, conflict resolution, data compression, 3D streaming, data distribution and consistency management need to be addressed further. Nonetheless, the work performed in this field has contributed greatly to the understanding of the dynamics of 3D-mediated communication, and in filling the 3D communications toolbox with useful tools and ideas.

2.5.4 Web3D

The Internet has always been about communication; and The Web is one of its most successful incarnations. The Web, or the World Wide Web, acts as host for many different media formats: text, images, video, sound, animations and even interactive embedded applications, both simple and advanced. There have been several attempts to introduce 3D media onto the web. First was VRML in 1995. VRML stands for Virtual Reality Modelling Language¹, and is an open standard for 3D interactive graphics. VRML is a text-based format that is used to describe the various 3D assets, textures, animations and event triggers that can be found in a 3D scene. The 3D content is rendered in the browser using a custom plug-in or in a separate stand-alone browser.

The hyped-up VRML format failed to transform the Web into a 3D Web; which it was, somewhat optimistically or even naively, hoped to do. This was followed by a near 10-year backlash for 3D on the web. The simple fact is that neither the web nor its users were ready for it. Internet bandwidth and processor power at the time were insufficient to display more complex models; and users and content producers alike simply failed to figure out what to use it for. VRML instead found a place as a general purpose 3D file exchange format and it has also been used extensively in various research settings (Fairbairn & Parsley, 1997; Nadeau, 1999; Wray & Hawkes, 1998).

¹ Originally VRML stood for Virtual Reality Markup Language, but this was changed to the current interpretation, Virtual Reality Modeling Language, in 1995.
After it became evident in the late nineties that VRML had flopped as a general purpose web 3D format, there was a new race to corner the market. Out of the many proprietary formats that emerged during this period, the W3D format – developed by Macromedia and supported by a consortium of major players in the industry – seemed to be coming out on top. It had the competitive edge since it was supported by Macromedia’s popular Shockwave player. However, although the W3D format has had some success in the 3D web gaming domain, it has not lived up to the high set ambitions and expectations of its supporters. There are several other examples of failed ventures in the domain, or more correctly: ventures that did not live up to the, often unrealistic, expectations placed upon them. The list includes Adobe’s Atmosphere and Microsoft’s ChromEffects, which were reportedly both cancelled due to a lack of interest.

VRML has recently been revamped in the form of X3D. X3D, like VRML, is a text-based format; but unlike VRML, it is also fully XML-compliant (accepted as an international ISO standard in 2004). X3D-encoded content can be viewed in a compatible browser, i.e. a standard web browser using a plug-in; or with a stand-alone browser. There are several standardised extensions to X3D format for use in specialist areas such as for CAD data exchange, geospatial information, medical CAD and immersive VR. None of the available viewers, and hence no application using X3D, have gained any wide-spread use outside specialist fields – at least not yet.

Other formats that have enjoyed more success, are those designed for special-purpose applications and for specific domains. The formats and the players that support them typically offer limited functionality, but they are easy to use and the players are light-weight (small downloads and processor and memory friendly). Some applications use generic plug-ins such as Java, Acrobat Viewer (PDF) or Shockwave; others use custom plug-ins designed specifically for the application. There are several companies that have cut out niches for themselves in the specialist market. Some examples are:

- Hypercosm, who focus on training applications (medical training, aerospace training, industrial equipment training and so on).
- Anark and SolidEdge, who concentrate on visualisation of complex CAD models.
- Stonetrip and Shockwave3D (W3D), who cater for the web-based 3D gaming market.
- Quest and EON Reality, who produce immersive design visualisation and simulation experiences.
Remote communication technology

- Acrobat 3D, that has become the branch standard for technical documentation (viewable with Adobe’s Acrobat stand-alone viewer for PDF documents or embedded on web pages with the Acrobat plug-in).
- I-maginer, Mediamachines and Tixeo, who provide 3D meeting spaces.
- Kaon, Blaze3D, Aarkid, Demicron, Cult3D, Swift3D, Viewpoint and many others, that are used for showcasing products.

The choice of plug-in that is used to render the 3D content affects the reach of the application, i.e. the size of the potential audience. If a generic plug-in that is already installed in the user’s web browser can be used, the content can be run without any additional download or installation. This is a huge advantage; especially for on demand viewing, in which case it can be difficult to justify the overhead of having to download a plug-in before any content can be viewed. Also, security concerns have many users rejecting sites that require additional installations of this kind. The most common plug-ins that support 3D content are Java, Acrobat 3D and Shockwave. Many product showcasing applications are java-based and since most browsers support Java (approx. 85%) they can be run without delay or hassle. The same applies for Acrobat 3D content which is shown in the PDF viewer plug-in (available in over 90% of browsers); and, to a slightly lesser degree, W3D content which uses the Shockwave plug-in (available in slightly more than half of all web browsers). An exciting recent development in this area is an open-source 3D rendering engine for Adobe Flash called Papervision. Papervision shows great promise and its

1 Many companies set restrictions in their computer security policies that disallow users without administrator clearance from performing any kind of programme or plug-in installation.

2 The reader may wonder why QuickTime is not included in this list. QuickTime has a current market penetration of close to 70% and supports 360° QTVR panoramas and also object-based QTVR visualisation. QTVR panoramas give a sense of standing inside a 3D scene, while object-based visualisations allow the user to view an object from any angle. However, neither techniques is based on true 3D (no depth data), but is instead accomplished by stitching together photographs.

3 Current penetration for Java on the web, calculated as the percentage of java-enabled browsers, is 84.0% - march 2008 (Adobe, 2008c).

4 Penetration for the Acrobat Reader is close to 100%, although the figure is probably slightly lower for versions that support 3D (3D support was introduced in version 7, released January, 2005).

5 Penetration for the Shockwave plug-in is 55.6% - march 2008 (Adobe, 2008c).

6 This is actually not the only 3D rendering engine available for Adobe Flash. Others are SWFZ, Sandy 3D Engine, 3DFS and 9elements. Electric rain’s popular Swift3D for Flash is not included
open source status has attracted a large number of developers. Since the penetration of the Flash player is even higher\(^1\) than that of Java and Acrobat PDF Viewer, this means that flash-based 3D content can reach practically all web users. Progress with Papervision is fast, but it remains to be seen if it will become the catalyst that finally brings 3D to the web in force.

The great attraction with web-based 3D is that it can be used as a communication device with the potential to reach a massive audience. The drawback is that functionality and performance is somewhat limited. The extra layer of the web browser slows things down and sets limits to what can and cannot be done with web 3D; and, consequently, what web 3D can (or rather should) be used for. Web 3D is suitable for applications that are limited in size, limited in functionality and where demands on graphics quality are moderate. There are no set rules for how to strike the perfect balance between quality and reach, but specialised applications typically opt for quality+functionality, while applications of the product showcase type prioritise reach. Furthermore, with technology changing (improving), the premises on which this decision is made are constantly shifting. Moore’s law states that the performance of processors will double every two years\(^2\). Since computer graphics depend on both the speed of the main (CPU) processor and the speed of the processors found on the graphics card, this further boosts the potential performance increase. The projected increase in hardware performance does not necessarily translate into a same magnitude performance boost for web 3D graphics, but it is clear that the performance will continue to improve, and this pushes the boundaries for what can (should) be done with web 3D.

---

1 The version 8 (or higher) required to run Papervision 3D content has 98.5% penetration in mature markets – march 2008 (Adobe, 2008c).

2 It is predicted that Moore’s law will cease to be valid when processor component density reaches molecular scale, but by that time it is probable that other processor technology will have emerged with potential to speed up rather than slow the performance increase, for example biological, light-based and quantum technology based processors.
3 Remote communication technology in healthcare

Any use of remote communications technology in the healthcare sector usually falls under the term of *telemedicine*, which is a term that encompasses all medical activity that is performed over physical distance. Synonyms such as “telehealth”, “online health” and “e-health” are used with similar intended meaning. A wide variety of applications have been tested and evaluated in research settings and in practice. The application domains have varied, as have the purposes, approaches and the type of technologies used. The most common technical mediator used in telemedicine is (of course) the telephone. However, focus in the field is on more recently introduced technologies such as the remote communication technologies covered above: video communication, e-mail, web conferencing, instant messaging, 3D imaging and also remote monitoring (for example of blood pressure, heart rate, glucose levels) and PDA and mobile phone services. (Smith, 2007; Wootton, Craig, & Patterson, 2006).

Telemedicine solutions do not have to be technologically complex. Many of the best results have been achieved with quite simple measures. Umefjord et al. (2007) have examined a large corpus of doctor-patient communication data collected from the *Ask the Doctor* service (Fråga doktorn), which is a medical Q&A service sponsored by Swedish health authorities. Umefjord et al. (2006) write that patients felt satisfied with the answers they received on their questions. The participating doctors were also pleased and reported feeling stimulated and challenged by the experience (Umefjord, Malker, Olofsson, Hensjö, & Petersson, 2004). Many other studies have investigated the value of e-mail type messaging between physician and patient. Results have been mixed, but mostly positive (Couchman et al., 2005; Leong, Gingrich, Lewis, Mauger, & George, 2005; Liederman & Morefield, 2003).

Video communication has also been used for doctor-patient communication. There are several projects where patients have been provided with video communications equipment so that they can communicate with their physician over distance. For example, in the ACTION project, the patients, who are stroke victims and patients suffering from dementia, were provided with a computer and video conferencing equipment through which they could communicate with

---

1 ACTION stands for *Assisting Carers using Telematics Interventions to meet Older Persons’ Needs.*
healthcare personnel and with fellow patients. The usefulness of video-based telecare systems of this kind has been tested for a variety of patient groups and results have in general been very positive. (Chang, Lee, & Wu, 2004; Clemensen & Larsen, 2007; Koch, 2005). There are also many commercial services available offering home video communications and monitoring services, for example: Zydacron (Zydacron, 2008), Acadian Telehealth monitoring (Acadian, 2008), American Telecare (Telecare, 2008) and Telemedical.com (Telemedical, 2008).

Many clinics make use of store-and-forward network image banks, which allows physicians to remotely access medical images such as x-rays, eye-scans and dermatology photographs (Chan, Callahan, Sheets, Moreno, & Malone, 2003; High, Houston, Calobrisi, Drage, & McEvoy, 2000). The images can then be used to discuss a given case with a colleague or a specialist over the phone. This is a simple but effective form of remote communication. More advanced forms of communication use groupware solutions with multi-part video and whiteboard capabilities. In Tromsø special-purpose groupware has been used to collaborate on medical data such as MRI and CT scanning data over distance. Tromsø is located in a remote region on the northern coast of Norway and the communications system gives its inhabitants convenient access to medical expertise not available locally (Hartvigsen et al., 2007). A similar project has been launched in Ethiopia, where the problem is not the remote location, but scarcity of medical expertise. Using video and shared image-viewing systems, physicians in Ethiopia can get consult experts at a leading cardiac institute in Hyderabad, India (Reuters, 2008). In other cases video communication and collaborative tools are used just because it is convenient and effective (LeRouge, Garfield, & Hevner, 2002; Wootton et al., 2006). Little use has – so far – been found in this area, though, for the type of web-based techniques (such as desktop sharing1, co-browsing and web3D) that could make these kinds of services available for a broader audience.

“Telemedicine” is spreading, the technology is maturing and acceptance is being gained both on the provider side and the recipient side. However, when it comes to providing information and assistance over distance, the demand is much greater than the supply. This is causing people to turn to other sources. In the last couple of years, a large number of health-related services have turned up on the web. Q&A (Questions and

1 Desktop sharing of the service provider’s screen can be accomplished with only a standard web browser on the user side.
Remote communications technologies offer great potential benefits in telemedicine, but unless the official healthcare providers embrace these opportunities and open up for new types of information and communication exchanges with patients, quality of care is in jeopardy when people instead turn to un-controlled sources. The proper use of remote communications technology in the healthcare domain is to use it to make information and assistance more available, more efficient and more effective.
4 Pre-study

A pre-study was conducted in the form of an idea seminar with the purpose of gathering creative input on how remote communications technology and 3D technology could be put to use in the field of pharmaceutical information.\(^1\)

4.1 Idea seminar participants

The selection of seminar participants was important. The goal was that the group should represent a broad range of relevant professional roles and knowledge backgrounds. A list of profiles was put together to describe the sought after participant types:

- The visionary – providing creative insights/input into the development of new services
- The future planner – strategic planner for new services
- Having systems knowledge from the content domain – knowledge about which systems are in place in the target domain and how they are used
- Having knowledge about the content domain – knowledge about what problems there are, what needs there are, for whom are they problems etc.
- Public health representatives – having a public service perspective
- Research representatives – having a research perspective
- Technological expertise – having technological insights (in the target technology domain – 3D/VR)

The profiles were used to compile a list of 25 prospective participants. In the selection of participants, consideration was given both to formal position, personal characteristics and knowledge background. The target group size was 10-15 participants. Invitations were sent out to the 25 people on the list of which 15 were able to accept. The formal position and profile match for each of the participants are shown in Table 4-1. Apart from the 15 invited participants I myself participated as the seminar leader

\(^1\) Partly reported in Östlund & Révay (2004)
and I had an assistant to help me with the documentation of the seminar and other administrative tasks.

Table 4-1. The participants’ formal positions and role matches

<table>
<thead>
<tr>
<th>#</th>
<th>Position</th>
<th>Role match</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>1</td>
<td>Director of Apoteket AB’s web division</td>
<td>●</td>
</tr>
<tr>
<td>2</td>
<td>Marketing director of Apoteket AB’s web division</td>
<td>●</td>
</tr>
<tr>
<td>3</td>
<td>Director of customer relations, Apoteket AB</td>
<td>●</td>
</tr>
<tr>
<td>4</td>
<td>Director of development, Apoteket AB</td>
<td>●</td>
</tr>
<tr>
<td>5</td>
<td>Business developer, Apoteket AB</td>
<td>●</td>
</tr>
<tr>
<td>6</td>
<td>Project leader, Apoteket AB</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Public relations, County Council</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Public relations, County Council web initiative</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Professor, informatics and economics</td>
<td>●</td>
</tr>
<tr>
<td>10</td>
<td>Senior researcher, informatics and chemistry</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Senior researcher, informatics and pedagogics</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Phd student, informatics</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Project leader within e-health</td>
<td>●</td>
</tr>
<tr>
<td>14</td>
<td>Technical officer, Kalmar VR Institute</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Director of VR development company</td>
<td>●</td>
</tr>
</tbody>
</table>


4.2 The seminar activities

The idea seminar was conducted in a one full day sitting, which was divided into three phases: information, creation and discussion phases. The activities contained in each phase are summarised in Figure 4-1. As illustrated in the figure, the seminar design was intended to produce a gradual narrowing of the scope and finally lead to a number of research approach suggestions. The suggestions would then be used to make a decision on which direction to pursue in the Virtual Pharmacy project.
4.2.1 The information phase

The information phase activities consisted of a general introduction to Virtual Reality and 3D in the shape of a short lecture, followed by a demonstration of a few selected applications of 3D and VR (see Figure 4-2). The purpose of this phase was to provide basic knowledge about the technology and to inspire them going into the creation phase.

Figure 4-2. Photograph from the demonstration of selected VR applications
4.2.2 The creation phase

The purpose of the creation phase was to stimulate the participants’ imagination. Two separate exercises were conducted. The first exercise focused on the user perspective – the way the user, whoever this may be, experiences a service. The second exercise focused on structural issues – the way different topics, services, needs and user groups relate to each other. The goal of the exercises was to produce a selection of creative ideas which would be used as a basis for discussion in the final discussion phase.

In the first creative exercise, the participants were divided into four groups (3 groups with 4 members and one group with 3 members). Each group was assigned the task of performing a semi-structured brainstorming session on the topic of how 3D/VR technology can bring end user benefits in the field of pharmaceutical information. Their task was to construct, discuss and describe scenarios on this subject. The groups were provided with the following material to guide their efforts (the material can be viewed in Appendix 1 in their original form):

- Target illustration – an illustration representing the target area providing a starting point for the creative dialogue and a gravitational centre for the discussion (see Figure 4-3 a).
- Actor cards – short descriptions of possible users, used to stimulate thinking on who the user might be. Blank cards were provided to add own user profiles (see Figure 4-3 b).
- Kick-starter cards – examples of possible content, services/functions, processes and user experiences – used to stimulate thinking on what 3D/VR technology could be used for in the chosen domain.
- A structured form used to document the discussed scenarios. The form consisted of the following sections: general description of the scenario, service description, user profiling, benefits, and do-ability (can it be done/what obstacles need to be overcome).
The participants were actively encouraged not to limit their discussions only to the topics suggested in the supplied materials and were repeatedly reminded during the exercises that they should feel free to pursue any and all lines of thought that might pop up. Figure 4-4 shows the participants in two of the groups working on the first creative task.

In the second exercise, the participants were divided into two groups (one group with 7 members and one with 8 members). The task for this exercise was to explore relationships between the services/functions, users/actors and areas of use identified in the previous exercise. The participants were instructed to use affinity diagrams to analyse the structural relationships between functions and actors (see Barnum [6] for information on affinity diagrams). Basically this meant writing down
words/phrases on post-it notes and pasting them on a large sheet of paper. Then by moving them around they would try to discover groupings, relationships, connections and dependencies among the items (see photograph in Figure 4-5). A set of question cards were used to stimulate the process and were handed out whenever there was a perceived lull in the dialogue. Examples of the phrases on the question cards are: “what would make a user use a system such as this?” “When would one use a system such as this/when would one not use it?” and “How can information about pharmaceutical products be communicated?” (see Appendix 1 for the full list of the question cards that were used).

Figure 4-5. Photographs from the second creative exercise.

At the end of the exercise, the two groups switched locations and then spent the last 10 minutes of the exercise discussing the other group’s affinity diagram and comparing it to their own.

4.2.3 The discussion phase
The final phase was conducted with all the participants in one group. The impressions from the day’s experiences were summarised and important points were highlighted. The following list of pre-defined points was used to structure the discussion and to document the conclusions of the discussion:
• Services/functions
• Content
• Benefits
• User experience
• Users

The session was documented on a whiteboard to make the content and progress of the discussion visible to all participants. The whiteboard contents represented a distillation of the insights gained during the day’s exercises. It was this final document that would be used to make a decision on the future direction of the research project (see Figure 4-6 and Appendix 1).

![Whiteboard with discussion points](image)

Figure 4-6. The resulting documentation from the discussion phase.

4.3 Results from the discussion phase

The results from the discussion phase are presented below using the same structuring points that were used in the discussion.
4.3.1 Services/functions

The participants nominated the following services/functions as being those most worthy of further attention:

- **Product information** – The use of 3D interactive models to provide information about specific medications.
- **Product demonstration** – The use of 3D interactive models to demonstrate how to use pharmaceutical products of varying complexity.
- **Pharmaceutical effects** – It was also suggested that such models could be used to visualise the way pharmaceuticals function and also to visualise their effect on the body in the long term.
- **Interaction effects** – The use of 3D visualisation to educate users on potential interaction effects that can occur when certain medications are used together.
- **Live advice** – Real-time communication between real persons set in a virtual environment where information and demonstration resources are used to inform, educate and motivate end consumers.
- **Medical profile access** – providing convenient access to medical histories with the option of being able to consult with a pharmaceutical expert to help understand the contents.
- **Efficient navigation** – The use of 3D/VR to provide tools for intuitive and efficient navigation.

The usefulness of a common virtual environment was a topic that reappeared on several occasions during the discussion. The virtual environment was seen as a container that could be filled with a wide array of interesting and useful services. It was suggested that the virtual environment could be modelled as a visual information landscape with fly-over navigation features. Any given information resource would be surrounded by similar items in the visual landscape, thus providing the user with intuitive visual cues and making it easier for him/her to discover related information. It was also suggested that personal medical history data could be integrated into the visual landscape and thereby personalise the user experience.
The function that was discussed the most in relation to the virtual environment was how an advisor in this setting could make use of information resources to demonstrate the practical handling of pharmaceutical products. Traditional media types such as text, images, video and animations were mentioned, but the discussion centred on how 3D representations could be used for this purpose. It was believed that 3D visualisation – if it could be made available to the end consumer in a practical way – had potential to bring remote medical instruction to a new level. Furthermore, if the advisor could be provided access to the consumer’s medical history in a convenient manner, this would allow for individually tailored assistance. The resulting rich media and personalised consultation setting was believed to hold the potential of improving pharmaceutical user habits and thereby be beneficial for both medical efficiency and medical safety.

The design and layout of the virtual environment was discussed at some length. One suggestion was that it might be modelled on the physical pharmacy store. It was decided, though, that it would be awkward to model it on a physical store since the typical pharmacy store in Sweden, and elsewhere, is divided into separate consumer and pharmacist areas. The two areas have completely different layouts, each suited to the respective role of their intended user. Another layout approach that was suggested was to make use of the ATC categorisation model in some way. The ATC model is an international standard that is used to describe drugs on three dimensions: anatomical, therapeutic, and chemical.

No consensus was reached on which design and layout was the most appropriate. It was concluded that it might not be possible to find the one best approach since requirements for separate user groups are quite different. For instance, the novice consumer user and the professional pharmacist user have very different needs and wants. The consumer version was discussed further. While no consensus was reached on which specific layout would be appropriate for the consumer user, it was concluded that the chosen layout must be one that is easy to use; and one that is considerate of the typical user’s limited domain knowledge.

4.3.2 Range

There was agreement on that the content should consist of in-depth product information, and specifically information about how pharmaceutical products are used and how they affect the body. There were two lines of reasoning on which products to include – full range or selective range. The full range alternative stated that information should
be provided for every available pharmaceutical product. This would create a convenient virtual repository for pharmaceutical product information. The repository could be put to use both at the physical pharmacy store – where it could replace physical sample products; and to be accessed remotely through a call centre service. Proponents for the selective range alternative, on the other hand, argued that resources would be put to best use by concentrating on a smaller number of difficult products; those that are difficult to describe, difficult to understand or difficult to use. Examples given were: eye drops, suppositories, inhalers, colostomy products and injection drugs.

The real difference between the two alternatives is who is seen as the primary user. For the full range solution it is the work process of the pharmacist that is in focus and how the virtual repository solution would benefit them. For the selective range alternative, the focus is on end consumer benefits and how 3D visualisations can be used as pedagogical aids.

4.3.3 Benefits

The following list summarises the possible benefits that were mentioned during the discussion exercise:

- Improve quality of information – improve information clarity and precision, information richness, perceived realism and flexibility and adaptability in the presentation of the information
- Improve quality of communication
- Active learning – activate the end user, encourage dialogue and interaction
- Improved use, which leads to better effect, which leads to better health – both on individual and societal levels
- Improve availability – Provide timely access to information – right time, right place
- Potential to go beyond the physical equivalent

The discussion on benefits centred on the potential of using 3D/VR-technology to emulate the rich experience of the person-to-person encounter. The goal was described as: to make rich information available through an expressive channel which is available to the end user when and from where it’s needed. This was believed would encourage the end consumer to be an active learner and would lead to better user habits.
The issue of going beyond physical limitation was touched upon. A virtual environment can be created to emulate a physical setting. The positive effect is that the natural understanding that we have of the physical space can be transferred to the virtual space. While this transfer is positive and should be encouraged, the limitless nature of the virtual space also provides an opportunity to go beyond physical reality. Examples that were mentioned in the discussion were: showing how medicines work inside the body (normally not viewable); instantaneously switching between a regular view and a microscopic view; give the user “super powers” such as being able to fly over an information landscape, instantly teleport between locations, or ability to see through normally solid objects.

4.3.4 Users

The following users were discussed:

- Consumers – members of the general public who use pharmaceutical products themselves or assist somebody else in using them
- Pharmacists – working at a pharmacy store, at a hospital or other care facility, or at a call centre facility
- Call centre personnel (other than pharmacists)
- Health Service professionals – doctors, nurses, counsellors
- Pharmacy students, practicing pharmacists doing extra training

There was no doubt that the consumer was considered the primary user; and the one whose needs the service should be designed to meet. The needs of remaining user groups were seen as secondary. It was suggested that one could target a specific consumer group, e.g. asthmatics, people suffering from allergies, colostomy patients and create a service tailor-made specifically for this group. This solution could then be adjusted for other uses or for general use.

4.3.5 User experience

The user experience was described as:

- Promoting better sense of understanding by offering a more concrete and hands-on approach; and activating multiple senses
- Promoting interest and motivation by being fun and exciting to use
- Transferability – better transfer of instructions to real life
• Preserving privacy – offering anonymity and confidentiality
• Relaxed setting – Less time pressure and less social pressure

Using 3D representations that are similar in look and feel to their physical equivalent was believed would improve transfer of knowledge into the real world. It was also believed that the person-to-person meeting in the virtual environment would yield both deeper understanding and greater motivation when compared to voice-only (telephone) or text-only (e-mail/fax) – which currently are the only other alternatives for person-to-person advice that can be accessed remotely. Finally, the novelty and engaging nature of the 3D medium was believed would make the experience fun and engaging for the users.

In the physical pharmacy store, there is always someone waiting next in line, someone in the next booth or somebody passing by. In the virtual setting, the consumer can be as anonymous as he/she wants to be and there are no eavesdroppers. This also contributes to creating a relaxed setting with less social pressure and time pressure.

4.4 Summary

The creative exercises produced a wide array of ideas on which services/functions and what content that should be included, as well as painting a picture of the target user, inventorising his/her needs and speculating on what the potential benefits are of using 3D technology in the pharmaceutical domain. The idea of a virtual space was a recurring topic. The virtual space was seen as a container that could be filled with whatever content was deemed appropriate to support the fulfilment of the information needs of the consumer. It could also be used to provide a meeting place where the consumer could receive guidance, advice and support from professional advisors. The content types that were suggested were: general product information, demonstration resources for explaining functionality and medical effects and relevant patient data. The range of products – full or selective range – was discussed. No consensus was achieved on this point, but to start with a small and focused range and then extend the range as needed seems to be a reasonable compromise. The initial focus could be on one of the patient groups that were discussed. The consumer was seen as the target user for whom the service should be designed. The potential benefits for the consumer that were suggested were: better understanding, better motivation and better transfer into real life.
4.5 Choosing what to focus on

The discussion phase produced a wide range of suggestions on how 3D could be put to use within the field of pharmaceutical information. Now it is time to make a choice of which path to pursue. The idea of a virtual meeting place was a recurring theme in the pre-study discussions and the choice is made to follow this path by focusing on the consumer-advisor relationship and how this may be supported using 3D resources.

The specific communication situation to support needs to be defined. There are many types of communication/interaction that can occur between consumer and advisor. Figure 4-7 lists 6 different purposes for which communication/interaction is performed: socialise, inform, instruct, advice-giving, steer and control. A specific communication situation can contain aspects of all these, but there is usually one primary purpose. For example: in using Live Messenger to chat to a friend, the interaction can contain acts of informing and instruction, but the primary purpose is socialising; in using the telephone to find out the opening hours for the local post office, there are social elements involved and possible acts of instruction, but the primary purpose is informing.

Here, the choice is made to focus on advice-giving (Bromme, Jucks, & Runde, 2005). Advice-giving is a complex type of communication, which contains aspects of all the other listed categories. Advice-giving has social elements and contains acts of informing, instructing, steering and control. But it is more than an amalgamation of these acts. Advice-giving requires a joint goal to be shared by the communicating individuals. The goal is that the recipient of the advice will act in accordance with the given advice. This is also partly true for instruction, but while instruction is essentially one-way, advice-giving is very much a give-and-take exchange.
The users involved in a pharmaceutical information advice-giving setting are the *consumer*, seeking advice, and the *advisor*, giving advice. The relationship between the consumer and advisor in the relaying of pharmaceutical advice is that of a non-expert novice and an expert professional. The two user types have an asymmetric relationship. The advisor is familiar both with the content domain and the communication setting, the consumer with neither. This affects the design of the user experience. Advisors are professional users and their user experience should be designed with focus on efficiency and flexibility. The consumer, on the other hand, is a novice user in unfamiliar territory for whom the user experience should be designed to be instantly usable with focus given to ease of access and ease of use. Technological requirements should be kept to a minimum (for easy access); and functions should be designed to be effortlessly usable (as far as possible). The first experience is especially important for the consumer user. If this is not favourable, the consumer will choose some other (less appropriate) information channel.

Figure 4-7 lists characteristics of a *rich* user experience. The chosen rich alternatives are: two-way, interactive, expressive and personal. To fulfil the requirement of ease of access and of use for the consumer user, care must be taken not to choose techniques that might restrict access or ease of use. Remember, that this only applies to the consumer, not to the advisor. This means that we can use communication techniques on the advisor side that we could not use on the consumer side. An example illustrates the point: consumer side video communication would require the consumer to set up and configure a video source. This would seriously limit the level of availability. However, receiving video is much easier and
may not require any action at all on the part of the consumer. Other communication techniques might be able to be controlled remotely by the advisor. As long as the consumer is not required to do something, the consumer’s ease of access and use need not be affected.

The communicative situation and the relationship between the consumer and advisor is summarised in the following points:

- The communicating parties are the novice consumer and the professional expert advisor.
- The primary purpose of the communication is advice-giving.
- The user experience should be rich (two-way, interactive, expressive and personal), but needs to be carefully tailored to suit the first-time consumer user and not limit availability.

4.6 Implementation/evaluation plan

With the problem defined, the toolbox inventory completed, and the choice made for which communication situation to support, it is time to turn to the shaping of the solution.

A plan was devised for a 2-phase implementation/evaluation cycle. In the initial phase, a first prototype was constructed and tested in a user study. The scope of the first user study was broad and inclusive and the approach was exploratory. The purpose was to explore a broad range of issues and to search for ways to improve the application. In the second phase, a new and improved version of the application was constructed. This was tested in a new user study. This time the scope was narrower and more focused. The purpose here was to evaluate the application and to explore the dynamics of the consumer-advisor interaction.

---

1 Ease of access may be affected if the communication being received places high demands on bandwidth and processor power or requires a special programme or plug-in. Ease of use may be affected if additional communication overloads the senses or increases the cognitive load for the user.
5 AssistancePlus – the first implementation

The technical implementation does not contain an actual virtual 3D space for the consumer and advisor to meet in (such as that envisioned in the pre-study discussions). An attempt was made to create such a virtual space using Shockwave to see how it would work in a run-time web 3D environment. It was concluded that it would indeed be technologically possible to implement the core features of the sketched out solution in Shockwave. However, it would not be practical to download the large amounts of content that this would require on an on-demand basis. The solution would be to use a stand-alone application, but this would severely limit the availability of the service. Therefore, the decision was taken to use 3D features only where most needed; and this was found to be in the demonstration of complex products. A web-based application framework was created to provide a delivery environment for the 3D content that would make it available to a broad audience. Thus, the virtual meeting between consumer and advisor takes place in a web-based environment with 3D resources available to be used as pedagogical aids. This is the proposed solution to the problem of how to create a both available and expressive service.

The solution: To support the virtual meeting between consumer and advisor using 3D resources as pedagogical aids.
The application consists of a synchronised web co-browsing system with functions for synchronised scrolling and remote cursors/telepointers (see section 2.4 on co-browsing). The co-browsing system allows the consumer and advisor to see the same web page, the same part of the web page thanks to the synchronised scrolling feature, and the same detail by using the remote cursor as an indication device. Any web page can be viewed with no modification of the web page code necessary. The consumer and advisor can communicate with audio, video and text. Which mode of communication that is used depends on the specific circumstances found in the communication situation. For example: if one party has a webcam with a built-in microphone, but the other party has neither webcam nor microphone, then audio+video can still be sent in one direction, while in the other direction text messages are used to communicate. Any combination can be used and the choice of combination is made dynamically at the time of contact. Furthermore, the advisor can remotely control audio and video settings for the consumer (see Figure 5-2 for a close-up of the Flash-based video feature).

Figure 5-1. The first implementation of the AssistancePlus: a web-based tool for 3D-mediated distance advice-giving with audio/video and co-browsing features.

The 3D content consists of a custom madeShockwave-based 3D player which can display a single static 3D model (no animation and no active components). The 3D model can be rotated, panned and zoomed (6
DOF\(^1\) using the buttons on the control panel. Each user has a local copy of the 3D player. The rotation, pan and zoom values are stored in a single location on a communications server. When either user performs a rotation, panning or zooming action, the corresponding value is updated on the server and propagated to the local copies. This synchronisation of the 3D views is the key feature of the 3D player: the consumer and advisor should not only see the same 3D model, but see it from the same angle, framed in the same way and at the same level of magnification. This is important for precision in both verbal and visual indication (using the remote cursor).

Synchronisation of 3D views:
- same angle, same framing, same magnification = same view.

The application was designed to be as easy as possible to start using for the first-time consumer user. All that the consumer needs to do is to go to a specific web page using a standard web browser (click a link or enter a web address). Then, when an advisor becomes available, the consumer’s and advisor’s web browsers are hooked up to each other. After this, everything else that might need to be done can be done remotely by the advisor. The consumer can be active if he/she so chooses: clicking links, scrolling, using the cursor to point to things, and rotate, pan and zoom the 3D model. But the user can also choose to just sit back and let the advisor control the action.

---

\(^1\) 6 DOF (Degrees of Freedom) – rotation round the x-, y- and z-axis; panning along x- and y-axes; and zoom in/out.
5.1.1 Availability considerations

The application is entirely web-based, but requires JavaScript\(^1\) to be enabled for the browser and two browser plug-ins: the Adobe Flash and Adobe Shockwave plug-ins. The Adobe Flash plug-in, which is used to run the co-browsing and audio/video features, has near total penetration\(^2\) and thus only marginally affects the level of availability. The Adobe Shockware plug-in, which is used to display the 3D content, does affect the level of availability with penetration figures slightly below 60%. At the time that the 3D player first was developed, it was the best available alternative available. Now, solutions like Papervision offer a better alternative.

File sizes have been minimised to lower bandwidth demands. The application itself has a file size of 100kb and only needs to be downloaded once per session. The file size for the 3D player is 30kb and the size of the

---

\(^1\) JavaScript is enabled in the great majority of browsers, and in the few cases it is not, it is easy to activate.

\(^2\) Flash player version 6 or higher is required. This version has a penetration of 99% in mature markets.
3D model is 76kb. Bandwidth requirements vary depending on which parts of the functionality are used. For co-browsing and co-manipulation of the 3D model requirements are very low, since in co-browsing only actions and events need to be sent, no content updates (except of course when a new web page is loaded). The audio/video functionality places the highest demands on bandwidth\(^1\). Audio/video also requires the user to manage extra equipment. As was argued previously, though, if only the advisor uses these features or if the advisor can configure the equipment remotely, the effect on availability is considerably less detrimental.

Usability design affects availability. Easier to use designs yield higher availability. Ease of use is not an end in itself. For many applications efficiency is a more important consideration (for example in a flight booking program managed by a clerk who processes hundreds of bookings each day). However, in the current advice-giving setting, ease of use is of crucial importance and care has been taken to make the entry-level threshold as low as possible for the first-time consumer user. The consumer does not need to do anything else than enter a web address into his/her browser. However, communication is more effective if both communicating parties can express themselves well. As noted above, the consumer can choose to be more active. The same communication tools are available to the consumer as are available to the advisor (although the advisor has more configuration options and can remotely control certain features for the consumer user). Here, it is important that the application is designed in such a way that having these options does not in itself raise

---

Technical requirements

- A JavaScript-enabled standard web browser with the Adobe Flash plug-in
- Adobe Shockwave plug-in for 3D-content
- A web camera if video is used
- A microphone and headset/loudspeakers if audio is used
- For duplex audio >= 56kps
- For duplex audio+video >= 200kbps

---

\(^1\) Full duplex audio can actually be managed quite comfortably with a basic 56kbps dial-up connection. For good quality full duplex audio/video, a higher bit rate is recommended, though, over 200kbps (Adobe, 2008b).
the *entry*-level threshold. The first step into the application should be as effortless and easy as possible. Once *in*, each choice to be more active represents another little step – like climbing the rungs of a ladder or the steps of a staircase. Also, being *in* means that the advisor is present to hold one’s hand along the way.

The height of the entry-level threshold depends not only on the design of the user experience, but also on how familiar the intended users are with the technology and interaction style that is employed. The assumption is made here that the target user has experience of the web and can draw on this experience in the use of the AssistancePlus application. Thus, the choice to use a web-based environment affects availability both on a technical level - being a technology with great potential reach, and on a usability level – by drawing on the familiarity of the web and with the web interaction style.

5.1.2 Why to adjust to technical limitations that will soon become outdated

Remote communication technologies are constantly changing and so are their penetration figures and familiarity ratings. This means that the *best* solution for implementing an available and expressive advice-giving service is also constantly changing. Consequently, it could be said that any given implementation is just waiting to become outdated. The purpose here, though, is to demonstrate what goes into the *process* of creating an expressive and available service with consideration given to technical and usability limitations. While technologies will advance and usability conditions will change, the issues of how to work with expressiveness *plus* availability are believed to be less variable. Moreover, the actual technical considerations that apply for today’s web, are very similar to those discussed for more *available* (or at least more mobile) devices such as smartphones, PDA:s, e-book readers etc.
6 User study I

A user study was set up to try out the AssistancePlus application. The purpose of the study was to see how the application would be received by users and to provide input on how the application could be changed and improved.

6.1 Objectives

- See how the type of application is received
- See how the specific application is received
- Examine how the audio/video features are used
- Examine how the co-browsing and remote cursor features are used
- Examine how the 3D feature is used
- Suggest improvements for the application design

6.2 Experimental design

The experimental design consisted of letting 10 participants try out the AssistancePlus application in a controlled, yet realistic setting. The participants assumed the role of a concerned caregiver to a twelve year old boy recently diagnosed with asthma. Their task was to try and find out as much as possible about a certain model of asthma inhaler by communicating with a pharmacist advisor through AssistancePlus.

The 10 participants were recruited from the local Pharmacy programme. The Pharmacy programme is a 3-year, university-level education that qualifies the student to work as a licensed pharmacist in Sweden. Pharmacy students, with obvious pre-knowledge of the subject area, were selected because their insight into the subject area was considered helpful at this early stage of development. On the advisor side were two licensed pharmacists working at the National Cooperation of Swedish Pharmacies’ national call centre. Both pharmacists had several years of experience of telephone-based client consultation. The asthma inhaler used in the study was the Ingelheim inhaler in combination with Atrovent inhalation powder.

The pharmacy students were scheduled at 30 minute intervals. When they arrived they were shown into a waiting room where they were given a one-page description to read that described their role – that of the concerned caregiver. They also signed a consent form that they agreed to
the trial being recorded on video. When they were done reading the role description, they were shown into the experiment room and placed in front of a standard PC computer. A video camera was discretely placed (although in full view) in the far end of the room to record the trial. The pharmacist advisor was placed in a separate room with a similar PC and video camera set up. The advice-giving session was initiated by the pharmacy student and lasted 15 minutes. Dual-direction audio and video communication was used so they could see and hear each other. Each advisor helped 5 participants in a row, with a 15 minute pause between subjects and a longer pause after 3 sessions. The case was the same for all the sessions. The web browser used in the trial was Internet Explorer version 6.0. Logitech Quickcam web cameras were used for audio and video transmission and were placed to the right of the screen.

At a later occasion about a week later, in-depth semi-structured interviews were conducted with all the participants; one hour interviews with the pharmacy students and two hour interviews with the pharmacist advisors. The interview questions are listed in Appendix 2 (in Swedish).

The participants, procedure and data collection methods are summarised below:

| Participants: | Two licensed pharmacists in the role of instructors (both women – age 40-50) and 10 pharmacy students in the role of consumers (9 women, 1 man – age range: 22-40). |
| Procedure:    | The clients used the AssistancePlus service to try and find out as much as possible about the Ingelheim/Atrovent asthma inhaler in 15 minutes. The two pharmacists assisted 5 clients each. |
| Data collection: | Video recordings Semi-structured, in-depth interviews with all participants; 1h interviews for the pharmacy students, and 2h interviews for the pharmacists. |

6.3 Results

The results from the interviews are presented below, supplemented with observations made from the video recordings.

6.3.1 Technical threshold

The members of the consumer group all agreed that attitudes towards computers in general would affect the willingness to use a service such as AssistancePlus. They also agreed that it was important to minimise requirements for all kinds of extra equipment, installation, configuration and such, to be able to reach a broad audience. They thought that people
used to using computers and the net would be quick to adopt a service like AssistancePlus, but that the elderly and people not used to computers would be difficult to reach.

6.3.2 Usability threshold

None of the participants experienced any difficulty in getting started and they reported being pleased with the simplicity of the user interface. They also stressed that they preferred simplicity over flexibility, at least when beginning to learn to use the service. One participant commented that complexity in the user interface might take focus away from the subject matter. The only usability related problem that was mentioned was that the link used to initiate the session could be made more visually distinctive.

6.3.3 Locus of control

It was clear that it was the pharmacist who was in control. Many of the participants communicated actively, but almost exclusively using verbal communication. The remote cursor was used by a few of the participants for referencing purposes, but only two initiated a page scroll or page change. No-one even attempted to manipulate the 3D model. In fact, the video records show that most participants removed their hand from the computer mouse a minute or two into the session. Several participants said that, thinking back to the trial, they were surprised at themselves not being more active. Reasons given were that they felt they might disrupt the pharmacist or that the content “belonged” to the pharmacist. Concerning the 3D model, many reported that they felt a bit intimidated by the look of the 3D control panel and that was the reason they did not try using it. A few also reported not really being aware of that they themselves could control the 3D model.

It might be only natural that the pharmacist advisor is the one who controls the action. After all, the pharmacist is familiar with the content domain as well as the service itself. The consumer is not. The roles of consumer and advisor also affect the communication dynamics. The consumer wants knowledge that the advisor has, so it is natural that most of the information should flow in the direction from advisor to consumer. Furthermore, the consumer’s request for information was typically expressed verbally or sometimes in combination with indication (with remote cursor). The advisor, whose task it is to explain, instruct and advise, used all the available modes of communication to get the message across. Even if the difference in control between the consumer and the advisor can be explained, and indeed justified, it is good if the consumer
can be encouraged to participate more actively. A consumer who uses the remote cursor to signal focus of attention and as a referencing device and uses the 3D resources to demonstrate understanding, makes it easier for the advisor to communicate efficiently.

6.3.4 Remote indication

Although most of the participants made little use of their own cursor for indication purposes, they reported appreciating being able to see the advisor’s remote cursor. It was found to be very helpful in directing attention and in the indication of details, in text and for the 3D content. It was also suggested that the remote cursor functionality could be extended to include other features such as highlighting of text and indication of movement or actions by dynamically changing the visual appearance of the cursor. These additional features were not for the consumer’s use, though. They were intended for the advisor to use and the consumer to view.

6.3.5 Audio

Sound quality was seen as important. Opinions varied, but most considered the sound quality comparable to that of the telephone. Problems mentioned were: low volume, telephone like quality of sound, occasional static, cutting out of sound (not common), slight time lag and echo. Only one participant was bothered by the sound quality after the first minute or so. The analysis of the video recording does, however, show that there seems to be a slightly impaired ability to project speaker change (when to take turns in the conversation). This was also confirmed in the interviews, but was not considered to be a major problem or inconvenience.

6.3.6 Video

Both the participants and pharmacist advisors agreed that being able to see their communication partner was positive. The participants were generally pleased with the quality of the video, but several mentioned that they thought the video image was a bit small and they would have liked to have been able to enlarge it. Still, somewhat surprisingly, many participants reported they felt they could establish eye-contact with the other party. Furthermore, they reported a strong feeling of personal contact with the pharmacist advisor. In fact, this strong feeling of personal contact was reported as the single most important impression of the trial for all of the participants, without exception.
6.3.7 3D functionality

Both participants and advisors had very positive impressions of the 3D model. The participants appreciated the directness and clarity of communication it contributed to; and the pharmacists said it made it much easier to explain properly and also to gage understanding. An obvious shortcoming that was mentioned by one participant is the absence of tactile sensation. The participant felt that this was a serious shortcoming when the demonstrated product is one that ultimately requires physical handling. Whether or not the knowledge gained does translate well into physical handling is an important issue that warrants further research.

The visual quality of the 3D model was discussed. The quality was considered sufficient for the current purpose by all the participants, although one commented that the quality was far from that found in his son’s video games and another said she thought it looked a bit “unreal”\(^1\). There was a difference in opinion regarding whether the 3D model should be realistic and detailed, or stylised and simple. The difference seemed to depend on what the perceived purpose for the model was believed to be. The supporters of realism focused on identification – that the consumer would feel confident that it is the right product. The supporters of stylisation focused on clarity – that the material is clear and easy to understand. For identification purposes, a photograph would probably be more appropriate, but for demonstration purposes, where the pedagogical value of the representation is central, a stylised version seems to be the better choice. Furthermore, the realism alternative would require larger file sizes and more processor power and this would limit availability. One aspect of realism which is equally relevant for a stylised representation is a frame of reference. Several participants asked what the actual size of the inhaler is. Since there is no reference object of known size in the 3D scene, there is nothing to compare it to. This could be solved by introducing a reference object such as a matchbox or a human hand.

The question was raised of whether video material or sequences of images might not be easier to use than 3D content. They felt that for a product like the inhaler which ultimately requires physical handling it would have been appropriate if actions such as the loading of the capsule and how to use the inhaler could have been demonstrated more realistically. The current version of the 3D player did not support this, but

\(^1\) No pun intended here. The second participant was not referring here to the computer game Unreal (developed by Epic Games and Digital Extremes), but intended it as a comment on the perceived visual quality of the 3D model.
this is a limitation of this implementation, not of the 3D medium. The 3D medium is a flexible medium that can be used for many different purposes. This flexibility is important in advice-giving because it allows the advisor to use the material in different ways depending on the situation.

6.3.8 Comparison with the phone

The pharmacist advisors were asked to compare AssistancePlus with the telephone, which is what they normally use to provide assistance in their regular job at the Apoteket call centre. The pharmacists reported appreciating being able to show what the product looks like and using the 3D model to demonstrate its use. They did not think that the same level of understanding could be achieved over the telephone for this type of product. Furthermore, the pharmacists thought that the increased personal contact that the video gives contributes to a greater sense of trust for the given advice. All of the participants also agreed that on questions requiring some kind of showing or demonstration AssistancePlus is clearly superior to the telephone.

6.3.9 Comparison with face-to-face setting

Many participants spontaneously described the meeting in AssistancePlus as feeling like a face-to-face interaction. While all the participants said that they still preferred the physical face-to-face meeting because it felt more natural, the feel of the communicative experience was seen as similar. The one major difference was not being able to manually handle the product. One participant even commented that she on several occasions caught herself using the type of visual cues that she would use in the physical setting (body language, nods and facial gestures). This is not appropriate, though, for the AssistancePlus setting. Subtle signals such as these do not transfer well over video (at least not video of the size and quality used here). There is a definite risk that consumers might misjudge what communicative methods that can be used in the specific communication situation. Furthermore, each possible combination of mediums represents a unique communication setting – if the advisor uses audio/video while the consumer uses text the setting is different than if both use audio/video. To reduce the risk of consumers misjudging the communication situation it is important that the advisors are aware of the risk so that they can help consumers avoid it. It may also be possible to help the consumer better judge the communicative situation with visual cues in the user interface.
6.4 Implications for the application design

The interviews and the observation data (the video recordings) provided many insights into how the AssistancePlus application may be improved. In the list below this has been translated into improvements for the application design:

• The start sequence should be looked over to see if it can be made even more simple and easy.
• Any parts of the consumer’s user interface that are not absolutely necessary should be removed or hidden. Functions should instead be remotely controlled by the advisor as far as possible.
• The design of the remote cursor could be improved to make consumers realise that the advisor can see their cursor and, consequently, that they can use it as an indication device.
• The remote cursor functionality could be re-designed to allow for highlighting of text and indicating movement.
• The option should be provided to be able to enlarge the video images. This function can be remotely controlled by the advisor to keep the consumers user experience as simple as possible.
• The sound and video quality settings should be examined to see which configuration is most appropriate with respect to the trade-off between quality and bandwidth.
• The appropriate level of visual quality – realism versus stylisation – for the 3D model needs to be investigated further.
• The way the 3D content is controlled should be simplified to encourage the consumer to be more active in controlling the 3D content themselves. The consumer and advisor could have different types of 3D controls – the consumer’s simple and easy to use, the advisor’s flexible and powerful.
• The 3D player should be developed to support animation sequences.
• Investigate what can be done to help the consumer better judge the communication setting.
• The advisor should be instructed to actively encourage the consumer to be active in situations where it is needed and to help consumers judge the communication setting appropriately.
6.5 Conclusions

The first implementation was received well by both consumers and advisors. There are many issues that can be explored further to better understand the dynamics of the consumer-advisor relationship and to support their interaction. The list of improvements should improve both the availability and expressiveness of the application.
7 AssistancePlus – the second implementation

A number of changes and modifications were made to the AssistancePlus application on the basis of the findings in the first user study, with the purpose of improving level of expressiveness and usability. Two new products were used in this study: Lantus OptiSet, an insulin injector pen; and Genotropin MiniQuick, a disposable syringe for growth hormone treatment.

7.1 The technical solution – redesigned

The major difference from the first implementation was that a new 3D player with extended functionality was added. Figure 7-1 shows what the new version of the application looks like.

Figure 7-1. The new version of the AssistancePlus showing the redesigned 3D player. The advisor version is to the left and the consumer version to the right.

The 3D player now has support for playback of pre-recorded animation sequences. This can be used to demonstrate the steps involved in using a specific pharmaceutical product (in Figure 7-1 the product is MiniQuick Genotropin, which was one of two products used in the second user study). The animation sequences can be divided into sections by entering
control data into a separate xml-file. For each section, a header and a text describing the section content can be added (see Figure 7-2 for a close-up). Also, snapshot thumbnails, shown below the timeline; and comments, shown in red at the bottom of the 3D image, can be added at specified points in the sequence. The section headers and comments are shown to both the advisor and the consumer. The section description text and the thumbnails are shown only to the advisor. The structure of the xml-file is presented below. Since the xml-file data is read at run-time, it can be updated without having to modify the 3D content.

The control panel located under the 3D image is used to control the playback of the animation sequence. As can be seen in Figure 7-2, the panels are different for the consumer and the advisor. The consumer’s control panel has been designed with simplicity in mind. The advisor’s panel is more advanced. Both versions have a timeline with a play-button to start and stop playback. As the animation is played, the play-button moves along the timeline from left to right. When the play-button reaches the right side of the timeline, the entire timeline is automatically scrolled to the left to show the next part of the sequence. Animation sequences of any length can be shown. The play-button can be clicked and dragged to move it to an arbitrary point along the timeline. When the play-button is dragged all the way to the border on either side of the timeline the timeline is scrolled in the opposite direction. The speed of the scroll is variable and depends on how far outside the border the
cursor is dragged. The play-button can also be positioned by clicking on a section heading or by clicking directly on the timeline. Both advisor and consumer versions also have a rewind button (left border, top) and a help button (right border, bottom). The help section is only shown for the user, but can be remotely activated by the advisor.

![Playback control panels](image)

**Figure 7-2.** The playback control panels for the advisor (top) and the consumer (bottom)

The advisor has several extra features not available to the consumer. The thumbnails visible below the timeline show snapshots of the 3D scene at the points specified in the xml-file. This simplifies navigation and allows the advisor to prepare in advance for the next step in the sequence. The advisor can add or remove thumbnails using the plus and minus buttons on the left border, for example to mark out points on the timeline which he/she intends to return to. By hovering the cursor over the timeline, the advisor can get an instant thumbnail preview of that specific part of the animation sequence. Other extra features are: a menu pop-out which
allows the advisor to jump to a selected section (left border, top); a timer showing the current place in the animation sequence (drops down below the play-button); a preview of the section text by hovering the cursor over a section heading; buttons to scroll the timeline (the angled brackets symbols on either side of the timeline); and activation of anti-aliasing – anti-aliasing improves visual quality by blurring edges, but also uses more processor power (right border, second from the bottom – pressing this button activates anti-aliasing for both parties).

The rotation, pan and zoom controls have been re-designed. The 3D control panel is gone and has been replaced with a click and drag system with the following functions:

- Left mouse button drag left/right – rotation around the y-axis
- Left mouse button drag up/down – zoom in and zoom out
- Right mouse button\(^1\) drag up/down/left/right – panning the view on the x/y-plane

Rotation around the x- and z-axes is no longer available, but the video recordings revealed that neither of these was used on a single occasion in the first study. Informal testing with the new click-and-drag system showed it to be intuitively easy to learn for users. The 2 missing degrees of freedom were not missed and for most purposes, zoom and rotation around the y-axis is probably sufficient. Panning can come in handy, though, at high levels of magnification.

To make it visible to the consumer how the 3D model is controlled, the actions performed by the advisors are visualised in the right top corner of the consumer’s 3D image. A small icon appears that shows which mouse button is being pressed and which direction the mouse is being dragged. This can be used as a pedagogical aid in teaching the consumer how to control the model.

The rotation, pan and zoom controls are independent of the animation sequence. They can be used when the animation is paused, but also during animation playback. This means that the 3D scene can be rotated, panned

\(^1\) For one mouse-button systems the alt-key is used to produce right mouse button clicks.
and zoomed by the user, while running an animation sequence also containing pre-recorded rotation, panning and zooming. This is accomplished by using camera and object animation in the animation sequence; and scene rotation, zoom and pan for the 3D controls. A restore button is located at the top of the 3D image that allows either user to reset the added transformations so that the animation sequence can be viewed in its original state.

Other changes that were made were: improved audio and video quality; more control over video settings; option to enlarge the video image (can be remotely controlled by the advisor for the consumer); and a new visual appearance for the remote cursors (see below) – “Farmaceut” stands for pharmacist and “Konsument” stands for consumer. The backing colour for the pharmacist’s cursor is green and for the consumer it is grey.
8 User Study II

A second user study was set up to try out the new version of the AssistancePlus application. While the first study was explorative and broad in scope, the second study is evaluative and more focused. The purpose of the second study is to evaluate what a representative sample of consumers think about the AssistancePlus application as a channel for pharmaceutical advice; and specifically to penetrate the issue of the usefulness of 3D as a communication mediator in this setting.

8.1 Objectives

- Evaluate AssistancePlus with a realistic user group
- Evaluate how the new version of the 3D player is received and how it is used
- Investigate the dynamics of the consumer/advisor interaction
- Suggest further improvements for the application design

8.2 Experimental design

For this study it was important that the participants be truly representative of the intended target user group. Therefore, participants were recruited from a number of evening classes, with topics ranging from water painting to elk-hunting. The recruitment strategy produced a participant group with a good spread in ages, backgrounds and interests. 23 people (13 women, 10 men) were recruited with ages ranging from 18 to 70+. Three licensed pharmacists (2 women, 1 man; ages: 36-50+) from the National Cooperation of Swedish Pharmacies’ call centre played the role of advisors.

As was the case in the first study, the participants assumed the role of a concerned relative and they were instructed to try to find out as much as possible about two pharmaceutical products. Each participant participated in two 15 minute advice-giving sessions, first using the telephone with one product and then using AssistancePlus with the other. The telephone was included in this study to provide a point of reference for the participants with which to compare their experience of AssistancePlus; and to provide a comparative baseline in the evaluation of AssistancePlus. The two products were Lantus OptiSet (a pen injector for injection of insulin glargin) and Genotropin MiniQuick (a disposable syringe for injection of a human growth hormone equivalent) – see Figure 8-1, and also Appendix 3,
which shows snapshots taken from the animation sequences for the two products. The order of the products was balanced, with 12 participants starting with Lantus OptiSet and 11 starting with Genotropin MiniQuick.

![Snapshots of Lantus OptiSet and Genotropin MiniQuick](image)

**Figure 8-1.** The two pharmaceutical products used in the second user study, Lantus OptiSet to the left and Genotropin MiniQuick to the right.

The telephone session was done from the participant’s homes. Each participant received a letter a couple of days in advance that described the role they were to assume for the trial (see Appendix 3). For Lantus OptiSet it was the role of a relative to Emma, a 12 year-old girl who has recently been diagnosed with diabetes; and for Genotropin MiniQuick it was the role of a relative to Isabelle, also 12 years old, who has been prescribed growth hormones. The pharmacist advisors telephoned each participant at a pre-arranged time and then the participant had 15 minutes to find out as much as possible about the given product. The audio from the telephone session was recorded and later transcribed in full.

A day or two after the telephone session, participants received a second letter, this time describing their role for the AssistancePlus session (see Appendix 3). The same characters (Emma and Isabelle) were used as in the telephone trial. The experimental set-up was similar to that of the first study. The participants were scheduled at 30 minute intervals. When they first arrived they were shown into a waiting room and handed a copy of the letter they had received to make sure that they had read this properly before starting. They also signed a consent form that they agreed to the trial being recorded on video. They were then shown into the
experiment room and placed in front of a standard PC computer and instructed to initiate the session whenever they felt ready. As in the telephone setting, they had 15 minutes at their disposal to find out as much as possible about the given product. Video recordings were made on the consumer side, and screen and audio recordings on the advisor side. After the advice-giving session was completed the participants were shown into a different room and asked to fill in a questionnaire, which took about 20 minutes to do. The questionnaire covered the following areas (see the full questionnaire in Swedish in Appendix 3):

- Demographic data – gender and age
- Attitude towards computers and the Internet
- Experience of computers and the Internet
- Experience of seeking information about pharmaceutical products
- Comparisons between telephone and AssistancePlus
- General evaluation of AssistancePlus
- Evaluation of audio and video features
- Evaluation of co-browsing and the remote cursor function
- Evaluation of the 3D functionality and content
- Experienced sense of control and level of activeness
- Areas of use for an application such as AssistancePlus
- If they would use AssistancePlus if it were available

Finally, they participated in a 30-minute semi-structured interview focusing on their experiences of the 3D features with the purpose of exploring how the use of 3D affects the dynamics of the communicative exchange between consumer and advisor in the advice-giving setting (see Appendix 3 for an example of the type of questions that were asked).
User Study II

The experimental design is summarised below:

**Participants:** Three licensed pharmacists in the role of instructors (2 women, 1 man; ages: 36-50+) and 23 ‘ordinary people’ in the role of consumers (13 women, 10 men; ages: 18-70+).

**Procedure:** Telephone setting: Consumers played the role of a concerned relative to a little girl trying to find out as much as possible about one of the following two products: Lantus OptiSet or Genotropin MiniQuick. AssistancePlus setting: Consumers again played the role of a concerned relative to a little girl trying to find out as much as possible about the other product. They then filled in a survey and were interviewed.

**Data collection:** Video recordings
Survey
Semi-structured interview with focus on the consumers experience of the 3D features.

8.2.1 The participant group’s composition

Descriptive data was collected from the participants in order to examine the group composition. Table 8-1 summarises the results.

Table 8-1 Descriptive data describing the composition of the participant sample

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>25-34</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>35-49</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>50-64</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>65+</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Age distribution</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No, absolutely not</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>No, not very</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Yes, partially</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Yes, absolutely</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Early adopter</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive towards computers</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Not at all</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Once or twice</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Many times</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Daily</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Computer use past month at work</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Once or twice</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Many times</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Daily</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Computer use past month at home</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Once or twice</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Many times</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Daily</td>
<td>13</td>
<td>N/A</td>
</tr>
</tbody>
</table>

We can see that the age distribution is somewhat skewed towards the high end of the scale. This, however, can be argued is representative of the typical user of pharmaceutical products. A more marked bias can be seen in attitudes towards computers and towards new things in general. A large portion of the participants label themselves early adopters and as being positive towards computers. Furthermore, their reported pattern of
computer use shows that they are accustomed to computers and have experience of using the Internet. This could also be said to be representative of the target group, since a service like AssistancePlus would probably be accepted first by the (reasonably) early adopter with some computer experience. It does call for caution, though, in how findings on acceptance issues, such as how technological and usability thresholds are experienced, are generalised.

8.3 Results from the questionnaire

8.3.1 Comparisons between AssistancePlus and the telephone

Participants were asked to rate their experience of using AssistancePlus and the telephone on seven dimensions. For each dimension the participants were asked to distribute 10 points between AssistancePlus and the telephone. Figure 8-2 displays the difference scores – the difference between the AssistancePlus score and the Telephone score, and median, inter-quartile range and total range (min/max) values for each dimension. Positive values indicate that AssistancePlus was rated higher that the telephone, negative values that the Telephone was rated higher.

![Differences in ratings](image)

Figure 8-2. Rating differences between AssistancePlus and telephone
Wilcoxon signed-rank test was used to assess the results (see Table 8-2). For all dimensions except *Ease of use*, difference scores were shown to be statistically significant. All the difference scores tend towards the positive side. For *ease of communication, personal contact* and *trust*, the magnitude is moderate; but for *explanatory power, understanding* and *efficiency* it is more pronounced.

### Table 8-2. Difference scores comparing AssistancePlus and Telephone

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Median (quartile deviation)</th>
<th>Mean (standard deviation)</th>
<th>Z from Wilcoxon signed-rank test</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of use</td>
<td>0 (3)</td>
<td>1.04 (2.69)</td>
<td>-1.596*</td>
<td>.110</td>
</tr>
<tr>
<td>Ease of communication</td>
<td>2 (3)</td>
<td>2.26 (2.58)</td>
<td>-3.448*</td>
<td>.001</td>
</tr>
<tr>
<td>Personal contact</td>
<td>2 (4)</td>
<td>2.26 (2.43)</td>
<td>-3.454*</td>
<td>.001</td>
</tr>
<tr>
<td>Explanatory power</td>
<td>4 (4)</td>
<td>4.22 (2.63)</td>
<td>-4.042*</td>
<td>.000</td>
</tr>
<tr>
<td>Understanding</td>
<td>4 (4)</td>
<td>3.57 (2.63)</td>
<td>-3.758*</td>
<td>.000</td>
</tr>
<tr>
<td>Trust</td>
<td>0 (2)</td>
<td>1.48 (2.78)</td>
<td>-2.401*</td>
<td>.016</td>
</tr>
<tr>
<td>Efficiency</td>
<td>4 (3)</td>
<td>3.96 (2.06)</td>
<td>-4.078*</td>
<td>.000</td>
</tr>
</tbody>
</table>

*a.* Based on negative ranks for [AssistancePlus score]– [Telephone score].

*b.* H₀: No difference between scores

#### 8.3.2 Ratings for AssistancePlus

Participants rated AssistancePlus on six opposite-pair scales fetched from the QUIS questionnaire (Questionnaire for User Interface Satisfaction). The QUIS questionnaire was developed as a tool for evaluation of information systems and has been used in many projects to evaluate how user interfaces are perceived (Chin, Diehl, & Norman, 1988; Jordan, Thomas, McClelland, & Weerdmeester, 1996; Williamson & Shneiderman, 1992). Figure 8-3 displays the mean and standard deviation values for each scale. Unfortunately there are no standardised or validated mean values for the QUIS scale with which to compare the collected values, but the results seem to indicate that the participants are satisfied with the user experience and that they find AssistancePlus both easy to use (to a high degree), and powerful and flexible (to a slightly lesser degree).
8.3.3 Ratings for co-browsing features

Respondents were very positive towards being able to view and browse web pages together with the advisor \( (\bar{x} = 5.52 \text{ (max: 6)}, \sigma = 0.99) \) - see Figure 8-4. They were equally positive towards being able to see the advisor’s remote cursor \( (\bar{x} = 5.52 \text{ (max: 6)}, \sigma = 0.90) \) and they also valued that the advisor could see their own cursor \( (\bar{x} = 5.88 \text{ (max: 6)}, \sigma = 0.50) \). Not all respondents were aware, however, that the advisor could indeed see their own cursor, as reported in a separate question. Two respondents reported not being aware of the advisor being able to see their cursor; four hadn’t thought about it during the trial; and a further two answered that they did not know. Including the *not aware* and *did not think about it* responses, the resulting mean score comes down slightly to: \( \bar{x} = 5.65 \text{ (max: 6)}, \sigma = 0.75 \).

---

1 The questions for co-browsing (view common material, see remote cursor, use own cursor) were phrased if they thought the feature was *valuable*. 

---

Figure 8-3. Ratings for AssistancePlus as a whole
8.3.4 3D content

The answers to the questions relating specifically to the 3D features are presented in Figure 8-5. The participants thought the information presented with the aid of 3D material was easy to understand ($\bar{x} = 5.35$ ($max: 6, \sigma = 1.07)^1$. Furthermore, the distribution of scores for this question was heavily skewed ($skewness = -1.99, S_E = 0.48$) towards the positive end with 13 out of 23 respondents agreeing completely. Scores for value of being able to control the 3D model themselves had a similar mean value and distribution ($\bar{x} = 5.42$ ($max: 6, \sigma = 0.90; skewness = -1.52, S_E = 0.52$); as did answers to the question if they would appreciate being able to review the 3D-material on their own at a later point in time, where 15 out of the 23 respondents chose the agree completely alternative ($\bar{x} = 5.48, \sigma = 0.79; skewness = -1.13, S_E = 0.48)^2$. Median values for all three questions were 6 – agree completely.

---

1 The question on information with 3D support was phrased if it was easy to understand.
2 The questions on own control over 3D content and view by oneself were phrased if they thought the feature was valuable.
Figure 8-5. Ratings for 3D content

In Figure 8-6 the results from the question if participants prefer a true-to-life or a stylised presentation style for the 3D content are presented. The results indicate that the participants seem to prefer a true-to-life presentation style over a stylised one, although the variance and range were quite high for this (variance = 3.35, range: 6 (3 – 9)).

Figure 8-6. Preferences between stylisation and photorealism

8.3.5 Activity level and sense of control

Respondents reported similar, moderately high, activeness scores for both AssistancePlus and telephone (telephone: $\bar{x} = 6.83$ (max: 9), $\sigma = 1.75$; AssistancePlus: $\bar{x} = 7.00$ (max: 9), $\sigma = 1.85$) - see Figure 8-7. For the question on level of control there seemed to be a difference in feeling of control between ratings for the telephone and for AssistancePlus, with control tending towards the participant for the telephone and towards the advisor with AssistancePlus - see - Figure 8-8. (telephone: $\bar{x} = 4.74$ (max: 6),
\( \sigma = 2.34; \text{AssistancePlus: } \bar{x} = 5.96 \ (\text{max:} \ 6, \ \sigma = 1.80. \) \) The difference between feeling of control for telephone and for AssistancePlus was tested with Wilcoxon signed-rank test but yielded a non-significant result \((z = -1.86; p = 0.064)\).

Did you feel active or passive in the telephone session and the AssistancePlus session, respectively?

Figure 8-7. Reported activity levels

Who did you feel controlled the dialogue for the telephone session and AssistancePlus session, respectively?

Figure 8-8. Who did they feel controlled the dialogue.

There was a significant relationship (at the 0.05 level) between activity level and sense of control for the telephone session \((\text{Spearman rho} = -4.14, p = 0.031 \ (\text{one – tailed})\) indicating more active participants feeling more in control. For AssistancePlus, the same relationship between activity level and sense of control was not significant \((\text{Spearman rho} = -2.09, p = 0.181 \ (\text{one – tailed}))\).
The relationship between *level of control* and how pleased they were with the level of control was explored (see Figure 8-9), but was found not to be significant, neither for the telephone nor the AssistancePlus (*telephone*: Spearman rho = −0.25, *p* = 0.456 (one – tailed); *AssistancePlus*: Spearman rho = 0.278, *p* = 0.111 (one – tailed)).

The relationship between *activity level* and how pleased respondents were with their level of control was significant (at the 0.01 level) for the telephone session (Spearman rho = −6.56, *p* = 0.000 (one – tailed)), but not for the AssistancePlus session (Spearman rho = 0.080, *p* = 0.362 (one – tailed)). It seems that activity level is more important for how pleased users are with their level of control, than their actual level of control; but only for the telephone, not for AssistancePlus. On the whole, respondents seemed pleased with their level of control in both the telephone and the AssistancePlus session with \( \bar{x} = 4.87 \) (max: 6), \( \sigma = 1.14 \) for the telephone and \( \bar{x} = 5.17 \) (max: 6), \( \sigma = 0.98 \) for AssistancePlus.

![Image of chart](Image 190x342 to 468x415)

Figure 8-9. Feeling pleased with level of control

### 8.3.6 Preferred information channels

Figure 8-10 shows the distribution of mean preference ratings for four selected information channels - Telephone, AssistancePlus, The Pharmacy store and the Internet – and four different types of pharmaceutical products – Simple non-prescription, simple prescription, complex prescription and complex requiring handling. For each product type, respondents were asked to distribute 10 points among the information
channels to indicate their preference. See Table 8-3 for the actual numerical values and standard deviation values.

Figure 8-10. Preferences among information channels depending on product characteristics.

Friedman tests were used to test the significance of the trends visible in Figure 8-10 both on channel type and product type – see Table 8-3. For product type, the respective preference ratings given for Telephone, AssistancePlus, Pharmacy store and Internet were compared for one product type at a time (front to back in Figure 8-10). The variation was found to be significant for all product categories except for Complex products. The non-significant result for complex products might stem from participants having difficulty separating this category from that of Complex products requiring handling. For channel type, the preference ratings given for the four product types were compared for one channel type at a time (left to right in Figure 8-10). The Friedman tests showed that for AssistancePlus and Internet the differences were significant, but not for Telephone and Pharmacy store. The results indicate that type of product does indeed affect the choice of communication channel. For
AssistancePlus it is clear that it is considered a channel suitable for dealing with products that are complex and/or require handling. AssistancePlus is not a preferred choice, though, for simple products, where Internet or the Pharmacy store is favoured.

Table 8-3. Friedman test on preferences among information channels

<table>
<thead>
<tr>
<th>Type of product</th>
<th>Telephone</th>
<th>AssistancePlus</th>
<th>Pharmacy store</th>
<th>Internet</th>
<th>Friedman Test ($\chi^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple non-prescription</td>
<td>mean 0.70</td>
<td>1.09</td>
<td>4.70</td>
<td>3.52</td>
<td>22.35 * *</td>
</tr>
<tr>
<td></td>
<td>std 1.06</td>
<td>1.20</td>
<td>3.42</td>
<td>3.25</td>
<td>( p = 0.000 )</td>
</tr>
<tr>
<td>Simple prescription</td>
<td>mean 1.09</td>
<td>1.78</td>
<td>4.83</td>
<td>2.30</td>
<td>17.15 * *</td>
</tr>
<tr>
<td></td>
<td>std 1.35</td>
<td>1.93</td>
<td>2.95</td>
<td>2.40</td>
<td>( p = 0.001 )</td>
</tr>
<tr>
<td>Complex</td>
<td>mean 1.43</td>
<td>3.17</td>
<td>3.61</td>
<td>1.83</td>
<td>7.608</td>
</tr>
<tr>
<td></td>
<td>std 1.56</td>
<td>2.98</td>
<td>2.66</td>
<td>1.83</td>
<td>( p = 0.055 )</td>
</tr>
<tr>
<td>Requiring handling</td>
<td>mean 1.09</td>
<td>5.91</td>
<td>2.27</td>
<td>0.61</td>
<td>43.05 * *</td>
</tr>
<tr>
<td></td>
<td>std 1.31</td>
<td>2.25</td>
<td>1.86</td>
<td>0.89</td>
<td>( p = 0.000 )</td>
</tr>
<tr>
<td>Friedman Test ($\chi^2$)</td>
<td>3.329</td>
<td>43.01 * *</td>
<td>5.949</td>
<td>24.53 * *</td>
<td>( p = 0.356 ) ( p = 0.000 ) ( p = 0.114 ) ( p = 0.000 )</td>
</tr>
</tbody>
</table>

* significant at the 0.05 level (two-tailed)
** significant at the 0.01 level (two-tailed)

Figure 8-11 shows that participants believed that they would probably use a service such as AssistancePlus if it were available. Taking the results from the channel preference questions into account, it seems reasonable to conclude that the positive attitude towards using AssistancePlus applies primarily to complex products requiring handling and not for simpler products.

Figure 8-11. Would-use ratings for AssistancePlus.

8.4 Results from the interviews

8.4.1 General impression

The participants were generally very pleased with AssistancePlus and the way it worked. None of the participants reported having any problems learning to use it or having any apprehension towards using it again. The
information conveyed using AssistancePlus was found to be clear and easy to understand (e.g. P4:15:1, P6:13:1, P16:7:1) and they described the functionality as well suited to its purpose. There were a number of criticisms and suggestions for improvement but most concerned details in the design of individual functions and a few participants had objections based on general preferences or prejudices. For instance, a couple of participants reported that they just didn’t like video communication (e.g. P3:1:1, P21:1:1).

Participants were asked to choose which set of features out of 1) audio/video, 2) co-browsing and 3) 3D they thought was most important for the advice-giving situation. Table 8-4 shows the results. A majority of the participants chose 3D as most important and it was clear that the 3D demonstration functionality was considered the defining feature of AssistancePlus. 3D was also considered the feature that made AssistancePlus stand out in comparison with other communication alternatives and the feature that would make someone choose this channel over others.

Table 8-4 Answers to the question of which feature set out of audio/video, co-browsing and 3D they thought most important.

<table>
<thead>
<tr>
<th>Audio/video</th>
<th>Co-browsing web page content</th>
<th>3D</th>
<th>The combination of features</th>
<th>Inconclusive/missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>13</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

8.4.2 The 3D model – quality and level of realism

All the participants were, in general, pleased with the way the 3D model was used to demonstrate the handling of the pharmaceutical product and they thought it appropriate for the task (e.g. P9:4:3, P11:8:2, P19:4:1-2). The 3D model was seen to make the instructions more direct and decreased the room for error or inexactness, in particular when paired with the remote cursor functionality (e.g. P7:8:1, P10:9:1, P23:6:2). One participant thought the visual impression was a bit messy (P12:12:1) and a few questioned if not a video feed with a filmed demonstration of the real physical product would be more appropriate (e.g. P12:2:2, P21:1:1).

1 The codes used here show which participant said what and give a reference to where in the interview material this can be found according to the following schema: P[participant number]:[question number]:[part].
One of the sections of the 3D animation sequence was criticised by several participants. For both products there was a section that showed the injection of the drug, in which the consumer was instructed to pinch the skin before injection. The actual pinching of the skin was not shown. This was seen as an important step in the sequence and several participants said that they would have liked to have seen it demonstrated in more detail (e.g. P9:2:4, P17:4:3-5, P18:5:1).

The participants were asked if they preferred a photorealistic 3D model or a stylised 3D model. The question divided the participants in two groups. This was also a question in the survey. In the survey the mean value showed a strong preference for photorealism (see Figure 8-6). The interviews revealed, though, that both alternatives were seen to have merit. Photorealism was argued could facilitate the transfer of knowledge into the real-world; and would also make it easier to identify the product correctly (P8:1:1-4, 20.13:3, P21:3:1). Another argument was that users might expect high quality graphics from what they have seen in games and films and might be disappointed when shown a stylised model (P10:6:1).

“It is better if the image there in the computer is fairly exactly like the real thing”\(^1\) (P5:10:5)

Others thought photorealism was less important as long as the model was informative (e.g. P9:5:4, P11:8:2). A couple of participants suggested that an even stronger level of stylisation should be used, for example to make it possible to look inside products (P11:7:1, P15:4:1-3, P18:11:1), or to use non-realistic but distinctive colours for pedagogical purposes (P18:3:1-3). As long as this added to the informative value it was seen as positive (P11:7:1, P11:8:1, P18:11:1).

“Well, it wasn’t that \textit{realistic}, but it was \textit{informative}.”\(^2\) (P9:4:2).

\(^1\) Swedish original: "En fördel om bilden där i datorn är ganska exakt som vad den ser ut i verkligheten."

\(^2\) Swedish original: "Den var inte så realistisk, men den var informativ."
Whatever the stated preference for photorealism contra stylisation, *none* of the participants reported feeling displeased with the used 3D model’s informational value and power.

8.4.3 Controlling the 3D model

Not all participants were aware of that they could control the 3D content themselves (e.g. P3:3:1, P12:10:3-7, P17:13:4). Many of the participants picked up on how to use them by watching the advisor (e.g. P8:3:2, P14:13:3) or by experimenting (e.g. P5:11:2-15, P8:3:2). The play controls seem to have been the easiest to learn. Fewer picked up on how functions for zoom, rotation and pan were operated.

“Yes, I stopped and started and went forwards and backwards and rotated and stuff...”¹ (P17:13:3)

Many of the participants explicitly stated that they would have welcomed more instructions before the session started (e.g. P10:10:5, P14:3:4, P16:15:1) or that they could have tried out the 3D controls by themselves before the instruction session begun (P5:12:1, P14:14:1). Several participants also thought that the advisor could have encouraged them more to be active and take control (e.g. P13:2:2) and that the advisor should have asked them more questions to make sure that they had understood properly, or even had them demonstrate their knowledge using the 3D material (e.g. P2:10:3, P7:7:1, P13:2:2, P13:6:2). Many participants said that they would like to be able to review the 3D material by themselves at a later point in time to refresh their memory (e.g. P14:2:5, P18:12:1).

8.4.4 Shared material and the role of the remote cursor

The *shared* material was seen as very helpful. A few participants said that having the *same* material was sufficient; the difference being that with the same material, synchronisation and indication must be accomplished using only verbal cues, i.e. no shared view. The great majority, though, thought that the shared view was an important feature and several participants regarded it the most important contribution of AssistancePlus.

---

¹ Swedish original: “Ja, jag stoppade och startade och gick framåt och tillbaka och snurrade och sådär...”. 
“Well, I suppose it’s because we both know we’re looking at the same material. I mean, this reduces the risk of misunderstandings a lot.”1 (P7:8:4)

Several participants noted that it was helpful having the exact same view (P10:7:1, P16:8:2, P18:7:1), and in particular the same viewing angle, as the other party. This was seen as something were AssistancePlus actually improved upon the physical setting. In the physical setting the viewpoint is typically not shared (for example: when standing opposite each other, the object is viewed from opposite sides). Being able to see through the same set of shared eyes, so to speak, was seen to add to precision (e.g. P11:19:1, P20:14:1).

A few participants made a distinction between the text-based information and the 3D demonstration material. For text material, remote cursor indication was seen only as moderately helpful (e.g. P 5:4:3). Some participants even thought it unnecessary. They felt that verbal cues were sufficient to indicate focus in texts (e.g. P14:9:3, P21:18:1). However, for the 3D material, verbal indication was considered too imprecise and the remote cursor was welcomed as a way to improve on precision in the indication of details and the direction of user focus (e.g. P4:1:3, P6:6:2-4, P10:9:1).

“At that time I interrupted her and used my cursor to point – is this the part you mean? Yes, that’s right, she said.”2 (P7:5:1)

Precise indication with the remote cursor was seen as important in building understanding; and also for the advisor to be confident that understanding indeed has been achieved. Although the remote cursor was seen as useful and helpful, its design was also criticised. Three points were mentioned: its size, its position and smoothness of movement. Several

---

1 Swedish original: ”Nämen, det är väl att båda vet att båda tittar på samma material. Allså, risken för misstolkningar minskar ju väldigt mycket.”

2 Swedish original: ”Då frågade jag och avbröt henne och jag visade med musen på markören då – är det den här delen som du menar då? – Ja, just det, sa hon.”
participants also noted that the cursor occasionally obstructed their view of the 3D content (e.g. P1:1:1-2, P8:7:2-3).

8.4.5 Activity level, level of control

Several participants reported feeling less active when using AssistancePlus in comparison with the telephone. However, this was not in general seen as a problem; rather it was seen as a natural state of affairs (e.g. P6:4:1, P10:10:4, P16:14:1). Many participants said that, while they might not have been very active in using the 3D controls or in browsing the text material, they still felt that they were active participants in that they used their voice to be active and control the direction of the instruction session (e.g. P4:10:1, P16:16:2, P21:16:3). One participant expressed it like this:

“She did the talking... I did the watching”\(^1\) (P11:15:1).

One participant suggested that it was positive that the pharmacist was the controlling party, because it left the user free to focus on his/her questions and to think up follow-up questions (P11:15:3). There were also suggestions that the animation control panel could be removed altogether for the consumer (P11:15:4). Most participants, however, wanted to be able to control the action. They felt that having the option to be more active increased the sense of presence (e.g. P14:12:6, P16:13:1) and personal contact (e.g. P6:5:3, P8:10:1) and did so whether or not they actually took advantage of this option.

One reason participants gave for why they were not more active and controlling was that they felt that the application in some respect “belonged” to the advisor (e.g. P8:10:2, P:9:12:1) and they did not want to disturb his/her demonstration. Another reason was that AssistancePlus was new to them and as novices they were a bit careful in the beginning. However, the main reason participants stated for not being more active and controlling was simply that they did not feel the need (e.g. 19:15:5).

There were some differences in the communicative style between the three pharmacists who participated in the study as advisors. This is especially true of how much they encouraged the user to be active and demonstrate their knowledge verbally and/or visually (e.g. P23:2:1). The

\(^1\) Swedish original: ”Det var hon som pratade… och jag bara tittade”.

communicative style of the advisors does not seem to have had any significant effect on how pleased the participants were with their level of control, though. Indeed, the participants were all pleased both with their activity level and level of control. Moreover, they thought it appropriate for the situation.

8.4.6 Personal contact
Most of the participants thought that being able to see the other person contributed positively to the sense of personal contact and they were generally pleased with the way it worked in AssistancePlus (e.g. P15:11:2, P17:11:2, P18:6:3). Several of the participants spontaneously compared it with the feeling of a physical face-to-face meeting (e.g. P6:5:3, P15:7:2, P22:5:1). A number of participants also reported feeling that the 3D model added to the sense of personal contact in that it increased the sense of presence (e.g. P3:10:5, P14:12:5).

“It felt more immediate – it is nearly like you’re in the same room”\(^1\) (P20:10:2)

Several participants mentioned that personal contact is not always wanted. Anonymity is sometimes sought deliberately. Participants volunteered examples of situations for which this is true: for questions concerning sex (P19:18:1), anal discomfort (P8:4:1), and pregnancy- and contraceptive-related issues (P6:13:1).

8.4.7 Trust, reliance, confidence
Being able to see and interact with the same shared material was seen to contribute to security and reassurance (e.g. P5:1:2-6, P7:8:1) and seeing that there was a real person on the other side to trust and reliance (e.g. P7:1:1, P16:6:1).

“It gave a feeling of security actually – to see someone on the other side”\(^2\) (P7:1:1)

---

\(^1\) Swedish original: “Det känns mera omedelbart – det är nästan som att man fanns i samma rum”.

\(^2\) Swedish original: “Det gav en känsla av trygghet faktiskt – att se någon på andra sedan”
Most participants did not think that there was a big difference in trust between AssistancePlus and the telephone. They trusted the pharmacist, the person, on the phone as much as when using AssistancePlus. But several participants said they had more trust in the information given with AssistancePlus. Reasons given were that they were more confident that they had understood correctly (e.g. P16:8:3-4) and that the information given was validated in what they could read and see (e.g. P3:7:2, P7:8:1).

“On the telephone she [the pharmacist] could be talking nonsense – I wouldn’t know. Here, one can see that it actually says so in print too.”1

A few participants mentioned that the need for trust is related to how serious the question at issue is – how important it is that given information is correct, or put differently: how dangerous it would be if it wasn’t. With medication that can have life-altering effects, which is the case with both insulin and growth hormone, it is vitally important that the advice is correct and that it is trusted (e.g. P5:7:2-6, P7:2:5, P14:15:1).

8.4.8 Expressiveness

There was strong agreement among participants that the expressive power in AssistancePlus was high and clearly sufficient for the task at hand. Some of the participants mentioned the lack of tactile sensation as a drawback, though – i.e. not being able to experience the actual manual handling of the product (e.g. P9:15:1, 18:4:2). However, this was only mentioned as a shortcoming in relation to the injection phase of the demonstration.

Several participants said that they felt that it was easier to come up with new questions when using AssistancePlus than on the telephone because the visual content acted as triggers (P17:8:4-6). Also there was more time to think with AssistancePlus (P17:8:2-3). In a voice-only medium such as the telephone, the tolerance for silence is lower than for AssistancePlus.

---

1 Swedish original: “I telefonen så kan hon [farmaceuten] sitta och svamla egentligen om vad som helst. Här har man ändå lite mer att det står ju faktiskt här”.

82
8.4.9 Understanding

There was strong agreement among participants that the combination of both verbal instructions and visual cues in AssistancePlus was positive for understanding (e.g. P11:3:1, P17:3:1) and that AssistancePlus was superior to the telephone in this respect (e.g. P6:13:1, P18:6:1). The telephone was seen as sufficient, though, for less complex materials.

“If what is showed is more complicated than what one could read, one isn’t helped by it”\(^1\) (P6:13:3).

A few participants touched on the importance of being able to signal understanding. They found that it was easier to do this with AssistancePlus than with the telephone (e.g. P6:7:1, P10:4:1-2, P20:14:1) since the combination of voice, video and visual communication carries more signals than voice only.

8.4.10 Interactivity

Participants reported being pleased with level of interactivity for the 3D player. They were pleased that one could jump to specific sections or specific positions on the timeline and go backwards and forwards (e.g. P8:6:4). The participants were also pleased with the 3D manipulation controls. The control of rotation, zoom and placement of the 3D models was seen as sufficient for the task and easy to use. Many of the participants did not actually use the 3D manipulation controls, but evidently they understood how they were used.

8.4.11 Field of application

Few wanted AssistancePlus to replace any existing channel and saw AssistancePlus instead as a valuable complimentary channel. It was seen as an alternative to the telephone when a higher level of expressiveness is needed and an alternative to the face-to-face meeting when convenience is prioritised.

Some participants claimed that they would choose AssistancePlus even over the physical face-to-face meeting. Further probing revealed that this depended on contextual factors though, not on the actual characteristics of either medium. The face-to-face meeting at the pharmacy store was seen as a place that is non-private, noisy and sometimes stressful.

---

\(^1\) Om det man visar blir mer komplicerat än det man läser så har man ju inte hjälp av det.
User Study II

AssistancePlus, in contrast, was seen as a place that is private and relaxed (e.g. P3:10:1, P5:16:1, P10:9:2). Many participants also stated that they were in a more appropriate state of mind to ask the right questions when they were in their home environment (P3:10:1, P10:3:1).

8.4.12 Video

The participants were in general pleased with the quality of the video. Some commented, though, that they felt it was a bit on the small side (e.g. P13:5:3) and that the quality could be improved (P22:1:5). A few participants commented that they would have liked to have a larger video image in the beginning of the session. Later on in the session, this was less important, since focus naturally shifted to the shared material. But they wanted to get a good look in the beginning to get a feel for what the person is like (P2:5:1-4, P9:6:4, P16:1:1-4). One participant suggested that a smaller version of the video image could be used when focus was on the web page or 3D material and a larger version when focus was on communicating with the other party (P16:1:2).

Several participants commented on the placement of the web cameras. It was felt that the placement to the side of the monitor made it difficult to achieve eye contact since looking at the other’s video image actually meant looking away from one’s own camera (e.g. P1:3:1-2).

“It was a small image and over to the side. I felt she looked in the wrong direction – that she wasn’t looking in my direction.”¹ (P1:3:1)

A few participants (all female) said that they did not like video communication on principle. One participant said that it was not that she minded seeing the advisor, nor did she really mind the advisor seeing her, but she found her own video image distracting and annoying. She described it as giving a too strong sense of presence (P21:13.2).

8.4.13 Audio

The participants were in general pleased with the sound quality. A few participants remarked that the sound was low in volume (e.g. P9:1:2, P22:1:2) or that there was the occasional slight delay or cut-out in the

¹ Swedish original: "Det var en liten bild och den var lite avsides. Jag tycker också att hon tittade snett – att hon inte tittade mig i ögonen.”
Most said that they didn’t really think about the sound quality, though, and that they felt that it was like using the telephone.

8.4.14 Comparison between the telephone and AssistancePlus sessions

All of the participants reported feeling pleased with the AssistancePlus experience and rated it superior to the telephone for conveying advice on complex issues. There was some disagreement, however, on the feeling of personal contact and how easy and natural the communication felt. Several persons stated that they felt more at ease using the familiar telephone medium (e.g. P9:6:1, P11:18:1, P13:1:1). It was also pointed out that the high level of expressiveness with AssistancePlus is only necessary in some situations. In situations where it is not, the telephone is still the preferred channel for seeking advice over distance.

“Well, you can ask questions that are more silly on the phone, because then you don’t see each other.”¹ (P12:9:1)

8.5 Discussion

The participants in this study were clearly more representative of the target user than those in the first user study. But there was a bias in the participant group concerning their willingness to try new things and in their experience of and attitude towards computers and the Internet. This calls for some caution in the generalisation of findings, especially for those relating to technical and usability thresholds.

8.5.1 General impression

The participants rated AssistancePlus highly on the QUIS scale. They also rated AssistancePlus as having more explanatory power, giving better understanding and being more efficient than the telephone, while being no more difficult to use than the telephone. Of course, in the study the computer and web cam was set up for the participants in advance. Still, with some reservations regarding technical availability, the communication experience seems to meet both the goal of expressiveness and usability-related availability. The interviews also showed that AssistancePlus was

¹ Swedish original: ”Ja, man kunde ju ställa lite dummare frågor på telefonen, för då ser man ju inte varandra.”
seen as superior to the telephone on expressiveness, understanding and efficiency and to promote trust for given advice.

8.5.2 Level of activity and control

The survey answers showed that participants felt equally active in the telephone and AssistancePlus sessions. The interview results partly corroborated this, but also showed that participants were active in different ways. In the telephone session participants were active with their voice, but with AssistancePlus they could be active also in other ways – with facial expressions, indicating with the remote cursor and controlling the 3D model. On the question of who controlled the action, the survey did not show a significant difference between the telephone and AssistancePlus sessions, but the interview results indicated that the participants felt that the advisor controlled the action more in the AssistancePlus session. This was not seen as negative, but rather a natural consequence of the communicative setting.

8.5.3 Signalling understanding

AssistancePlus provides a rich communication channel for the advisor to get his/her message across to the consumer. But the information flow in the other direction, from consumer to advisor, is just as important. A few participants did touch upon this subject in the interviews. They talked about it being important to be able to signal if one has understood or not; and how video and 3D were helpful in this respect. The screen recordings also show that most participants, to varying degrees, did in fact make active use of the video and 3D features for this purpose. They did not, however, seem aware (at least not consciously aware) of the importance of sending such signals. Therefore it is up to the advisor to encourage the consumer to demonstrate his/her understanding.

8.5.4 The role of video

Participants were generally pleased with the video feature, although some participants would have preferred not to have to see themselves. The reason for displaying the own video image is to make the person aware that he/she is visible (and also keeps within the framing of the picture). Knowing that the other party can see you is essential for visual
communication – it is only when you know the other party can see you that you use visual cues to communicate – consciously or unconsciously1.

The size of the video image was criticised for being too small, but it did not seem a very important issue for the majority of the participants. The most valued contribution of the video seemed to be just seeing that there is a real person on the other side. It could be that once the advice-giving session is under way, focus is primarily on the content (web page or 3D content). It is possible, though; that if a considerably larger video image had been used, this would have changed the entire dynamic of the advice-giving session. Of course, increasing the size and quality of the video image would reduce availability and potential benefits need to be weighed against this.

The position of the video image was also criticised. The current position meant that it was difficult to establish eye-contact. The video image of the other party should be placed as close as possible to one’s own camera so that looking at the other’s video gives the impression of looking straight into the camera. Since web cameras can be placed in many different positions, the solution could be to make the video image moveable so it can be positioned as close as possible to the camera within the confines of the screen area.

8.5.5 The unimportance of audio

The audio features were not given much attention at all by the participants. It could be that the novelty of the video communication features and 3D features made them forget about the audio. It could also be that audio is taken for granted since the experience is similar to using the telephone. Audio is probably something that is only really attended to when it doesn’t work. A few participants pointed out some minor problems with the sound, but other than this, audio was not mentioned much. This does not mean it is not important. On the contrary, every effort should be made to assure that audio stays a non-issue. The audio features should be taken for granted because this means everything is working fine.

8.5.6 Sense of personal contact

Being able to see the advisor was seen to contribute to the feeling of personal contact. The feeling was not, however, seen to be markedly

1 Visual cues are used to some extent also in situations where they are not seen. An example that most people have experience of is finding oneself nodding or using other gestures when speaking on the telephone.
different from that experienced over the telephone. This probably depends on the telephone being a more familiar medium. With more experience of AssistancePlus, the situation might change. However, AssistancePlus is designed specifically for the first-time user. The participants reported the communication situation in AssistancePlus feeling as easy and nearly as natural as using the telephone. This means that there is room for improvement here. AssistancePlus should feel as natural as the telephone and at the same time feel more personal.

8.5.7 Sense of presence

Seeing the advisor and having access to 3D models representing physical products was seen to contribute to the feeling of presence in the advice-giving situation. Being able to control the 3D content was seen as an important contributing factor. Interestingly enough, it is suggested in the interviews that it might be having the option to control the 3D content, rather than actually doing so, that produces the deepened sense of presence. It is an intriguing idea that providing the opportunity to express oneself might empower the individual in this way.

8.5.8 Choice of 3D representation

The issue of photorealism versus stylisation was discussed at some length in the interviews and seemed to be an issue that interested many of the participants. Although the majority of the participants stated a preference for photorealism over stylisation, many saw a potential pedagogical value in using stylisation. Of course, photorealism and stylisation do not necessarily exclude one another. By using elements of stylisation only where they add to the informational or instructional value, the benefits of both can be retained. The level of photorealism does affect technical availability though, and this can be a reason for opting for a more stylised representation.

It was suggested in the interviews that the 3D demonstration sequence could be replaced with a pre-recorded video or a sequence of photographs. The argument was that this would increase the level of realism and also that it would yield a solution that is easier both to implement and to use. The drawback is that the content can only be viewed from one angle – the one used to film/photograph it. Also it would not be possible to zoom in without a loss of quality. If these drawbacks are acceptable, a video or sequence of photographs is indeed more appropriate and should be used. Using 3D content limits both technical and usability availability and should be used only when the benefits are significant. For the two products tested in this study, the screen recordings
show that both zooming and rotation of the view are used quite frequently. Furthermore, the zooming function was used at magnification levels that would have required very high definition video/photographs to produce the same quality. The 3D medium adds an extra interactive dimension and this translates into more flexibility, but unless this is necessary, other representations are to be preferred.

8.5.9 A more forgiving medium

AssistancePlus provides a richer communicative environment than the telephone. This means that on the telephone, the advisor has to try harder. A communicatively skilled advisor can often compensate for lack of expressiveness with good advice-giving technique, but with AssistancePlus, communicative technique might not be as important. The more forgiving communicative setting effectively evens out individual differences between advisors and allows less skilled advisors to take on more complex issues. Of course, it also gives good advisors the opportunity to be even better; and the goal with AssistancePlus is definitely not to iron out these differences. On the contrary, the goal is to provide a communicative setting that gives the advisor headroom to express him/herself in whatever way suits his/her communicative style. But if this, at the same time, allows less skilled advisors to do better, this is an added bonus.

8.5.10 Field of application

Ratings on the survey question if the participants would use a service like AssistancePlus if it were available were very high. The preference ratings question, where participants got to choose which channel they would use to get information about products of varying complexity levels, showed that AssistancePlus would not be their first choice for all but the highest complexity level products. This active selectivity was also evident in the interviews. It seems that users don’t go for the most expressive channel, but rather the one that is just expressive enough. For simpler issues, simpler channels are favoured.

From this, one would expect the most expressive channel to be the first choice for the most complex product. It was not. In fact, the on-the-surface most expressive alternative, the face-to-face meeting at the pharmacy store, shows an inverse relationship with product complexity. It could be that the intuitive scale going from simple non-prescription to complex requiring handling was not seen as incremental (or maybe not even ordinal). But since the relationship with product complexity level is more or less linear, this is not probable. The reason was revealed in the interviews. The participants saw the pharmacy store meeting, not as an
expressive and personal face-to-face interaction, but as a fleeting encounter in a non-private, noisy and stressful environment. This demonstrates that the choice of channel depends not only on the actual communicative properties of the channel medium, but also on how the channel is perceived. AssistancePlus was perceived as a channel that offers a relaxed and non-stressful setting and this was evidently considered more important than pure expressiveness.

8.6 Implications for design

Based on the results from the user study, the following modifications are suggested.

**Video:**

- **Size and quality:** The size and also quality of the video images should be modifiable so that they can be enlarged if bandwidth and processor power allows it. To avoid complicating things for the consumer, all such modification should be remotely controlled by the advisor. The size of the video can be controlled in this way in the current version, but only in two steps and it is only the size that is increased, the quality is unchanged.

- **Position:** The position of the video images should be modifiable so that the consumer’s video image can be placed near the own web camera or the own video image near the focus area. The video image could also be made to follow the cursor. This would require testing to make sure that it does not obstruct the view.

- **Turn it off:** The current version of AssistancePlus has controls for turning of both video and audio, but the controls can be made more obvious.

**Audio:**

- **Audio settings:** Improved control over audio settings such as sampling rate, echo reduction and input and volume levels. Again, this should be remotely controlled by the advisor to avoid complicating things for the consumer. It may also be possible to make the configuration of sound settings automatic.

**Remote cursor:**

- **Size and visual appearance:** Experimentation is required with different sizes and designs to find a good balance between visual
salience and avoiding obstructing the view. The design should be considered separately for the consumer and the advisor.

- **Seeing own remote cursor:** The local cursor could be replaced with one that looks the same as what the remote cursor looks like for the other party. This would make it more obvious to the consumer that the advisor can see his/her cursor. It will also help to avoid content being inadvertently covered by the remote cursor (which can happen if the local cursor is a different shape than the remote cursor).

- **Smoothness of movement:** Redesign the way the remote cursor position is updated to avoid choppiness of movement and duplication of the remote cursor.

- **Additional remote cursor features:** Experiment with additional features such as visualising mouse clicks, highlighting of text and visualisation of movement. Some features could be made available to both consumer and advisor, others only to the advisor.

**3D player:**

- **Visual quality and style:** The issue of photorealism versus stylisation needs to be explored further to find out which mix of stylisation and photorealism is appropriate for different situations and purposes.

- **Moveable parts:** The interactivity in the current 3D player is limited to scene rotation, zooming, panning and replay of pre-recorded animation sequences. For products with moving parts the manual handling could be simulated, which would provide consumers with the opportunity to practice manual handling in a safe environment and to demonstrate learnt skills for the advisor.

- **3D animation sequence content:** Make sure that all the steps in the demonstration of how the product is handled are properly represented in the animation sequence. Soft tissue animation, for example the pinching of the skin before injection, might be difficult to properly visualise in 3D, but if this is the case this step should be represented in some other way, for example by using a separate photograph or video.
• **Other 3D content**: The 3D content could be extended to include for example demonstrations of how medicine functions inside the body.

• **Automatic pedagogical aids**: In the current 3D player, the actions the advisor performs to rotate, zoom and pan are signalled to the consumer using an icon that shows which mouse button is pressed and in which direction it is dragged. This functionality could be extended with other pedagogical aids such as automatic help texts to encourage the consumer to be more active.

• **Use a mix of technologies to improve availability**: The potential reach for the 3D content could be improved by implementing the 3D player using several different technologies. Candidate technologies are Papervision (Flash), Java and Acrobat 3D. The consumer could use one version and the advisor another, with the choice of version being made automatically at run-time.

**Information about the consumer:**

• **Automatic collection of technical specifications**: Many of the suggested improvements require knowing something or other about the technical specifications on the consumer side. For example, to decide if it is appropriate to increase the size of the video image, the advisor needs to know the available bandwidth. Information can be automatically collected about things like processor power, operating system version, screen resolution, web browser version, available plug-ins and bandwidth. These specifications can then be made available to the advisor to aid him/her in making such decisions.

**General:**

• **Record for later review**: The entire advice-giving session could be recorded automatically. This could be used for live rewinding to replay earlier parts of the session or to provide the consumer with the opportunity to review the session contents at a later time.¹

¹ Technically, this could be accomplished quite easily. Since all communication passes through a communication server and is time-tagged as it does so, it could easily be recorded and replayed later.
8.7 Conclusions

The balance between expressiveness and availability is the key issue in the design of AssistancePlus. There are different tactics that can be used to combine expressiveness and availability. One can set a target level for expressiveness and then do everything one can to increase availability while maintaining this level of expressiveness; or one can set a target level for availability and then try to squeeze in as much expressiveness as possible. In the user studies, the telephone and the face-to-face meeting have been used to provide points of reference - something to compare with and also something to strive towards. In the pursuit of finding a suitable balance between availability and expressiveness for the advice-giving setting, this has been very helpful.

So how does AssistancePlus measure up? In a straight-off comparison with the telephone on availability and with the face-to-face meeting on expressiveness, AssistancePlus in its current manifestation falls short in both. It is not as available as the telephone and it is not as expressive as the face-to-face meeting.

Availability is lower for AssistancePlus than for the telephone because the technology (internet-connected computer and preferably a web camera) is not as common or as accessible as that of the telephone. Also, using the computer is more complicated than using the telephone (both because it is a more complicated apparatus and because people are less used to it). This said, the purposeful design of the technical solution and the focused usability strategy targeting the first-time user, has created a service with a potential reach that covers a large proportion of the Swedish population.

On expressiveness, it was found that AssistancePlus is more expressive than the telephone, but it is not as expressive as the face-to-face meeting. This is not very surprising, since AssistancePlus in many ways represents an attempt to emulate the face-to-face setting with video offering fulfilling the visibility criterion and 3D emulating co-presence. However, no emulation can match the expressiveness and ease of use of the face-to-face interaction, which we all – literally – have a lifetime of experience with. Still, in the second user study, several participants said they actually preferred AssistancePlus over the face-to-face meeting at the pharmacy store. Although this was shown to be very much influenced by how the setting at the pharmacy store was perceived (stressful and non-private), it is interesting to note that AssistancePlus was considered expressive enough to provide a viable alternative. Furthermore, the meeting at the
pharmacy store, situational factors and all, is the major face-to-face option consumers have if they want to talk to a pharmacist\(^1\). Thus, from a practical perspective at least, this is what AssistancePlus \textit{should} be compared to.

So AssistancePlus loses out against both to the telephone on availability and to the face-to-face meeting on expressiveness. However, it wins against the telephone on expressiveness. And this is what really matters. The stated purpose of the current project is to improve availability for expressive advice-giving. AssistancePlus places itself somewhere in between the telephone and the face-to-face meeting on expressiveness. But, while the face-to-face meeting is not available over distance, AssistancePlus is. Thus, AssistancePlus accomplishes the goal of increasing availability for expressive advice-giving and it does so by providing a complimentary alternative to the telephone for use when the telephone’s level of expressiveness is not enough.

The goal may have been fulfilled, but this is the start rather than the end of the journey. The current implementation of AssistancePlus provides proof-of-concept that 3D-mediated communication indeed can contribute to increasing availability for expressive advice-giving. But there is much to improve and much to understand about the dynamics of the advice-giving setting and the role of 3D in this setting. In the final chapter of this thesis, a suggestion is made for a theoretical framework to be used to guide the continuing work.

Meanwhile, here is a list of questions that would be interesting to explore:

- Will AssistancePlus be received as well in a real-world setting with real patients with real problems?
- Does the higher level of expressiveness in AssistancePlus improve the quality of advice as measured in actual handling skill.
- Can the expressiveness of AssistancePlus be developed in ways so that it actually goes beyond what can be achieved in the face-to-face setting, for example showing how a medication works

\(^1\) It is not the only face-to-face option. Many pharmacies in Sweden now offer the service of a sit-down meeting in a private setting; and consumers also have face-to-face contacts with healthcare professionals such as doctors and nurses. Still, the face-to-face meeting at the pharmacy is the most common and typical setting in which consumers receive face-to-face advice from a pharmacist.
inside the body or by using super-realism to augment demonstration?

- Will the addition of an extra channel confuse the consumer rather than help the consumer, because it means more choices to be made and it is difficult for the consumer to make the right choice for his/her specific situation?

- Can the communication model investigated here be used for other types of advice-giving in other domains – for example, instructions for installing the new flatscreen or assembling the new dinner table from the flatpack retailer? – What is different and what is the same in other content domains?
9 The road ahead

Suggestions for further design work and further empirical studies were presented in the previous chapter. But there are several issues that require a different kind of insight than that gained from empirical work alone. An attempt was made to explore the dynamics of the relationship between consumer and advisor in the second user study. This offered only limited insight on the topic though. People simply do not divide their communication experience into neat compartmentalised units. It was decided to look for an appropriate theoretical framework that could be helpful in the exploration of the dynamics of the consumer-advisor interaction.

There are many candidate theories. Shannon-Weavers model of signal transmission is one that has asserted great influence on how communication has been viewed, especially within the computer science and engineering disciplines. The Shannon-Weaver model (Shannon & Weaver, 1963) is good for describing signal transmission, but is not really suited for describing human-to-human communication. This is too multi-layered, unpredictable and complex. The signals that are sent could actually be described with Shannon-Weaver style models, but they tell only a small part of the story (Linell, 1990, 1994). Herbert Clark’s theory of language use is more appropriate in this setting. Clark takes into account all the complexities and layering found in the interpersonal dialogue and provides a framework both to describe and to understand what happens when people interact. It is suggested that Clark’s work on human dialogue, and especially on the grounding of communication, is a promising candidate to provide the sought after theoretical framework for the continued work.

In this final chapter, an interpretation and modification of Clark’s theories is presented. It is used to describe and analyse the advice-giving setting and also to describe the way the advisory dialogue is played out using a technical mediator such as AssistancePlus.

9.1 Theory of language use

Clark argues that the main purpose of language is, simply put, to help people do things together (Clark, 1992, 1996). He argues that all social interaction is dependent on the norms, practices, skills and expectations shared between the participants and their mutual expectations of each other. This forms the basis for what Clark labels their common ground.
Clark convincingly argues that there can be no communication without at least a minimum of common ground; and, furthermore, that the efficiency of the communication exchange is directly dependent on the ease with which this common ground can be established.

Common ground can be illustrated as overlapping areas of knowledge and skills. This is illustrated in figure 9-1. The larger ovals represent the individual knowledge and skills of two communicating parties, here labelled A and B. The overlapping area represents the knowledge and skills that are shared by A and B. This is not their common ground though. The common ground is made up of only that part of the overlapping area that A and B mutually know they share.

Common ground is not a static concept. Clark describes it as consisting of initial common ground at the start of an interaction, the current state of the joint activity, and public events so far. Thus common ground evolves as the conversation/interaction progresses. Each piece of information that is brought into the conversation adds to or modifies the common ground\(^1\). But it does so only if it is mutually acknowledged – that A believes that B has acknowledged it and B believes that A has acknowledged it. This requirement of mutuality is at the core of the concept of common ground. The concept of what constitutes mutuality is complex, but for current purposes this description is sufficient. What is important in the present context is that one way of achieving this mutual knowledge is through the participants’ co-presence, i.e. being in the same physical place, seeing the same things, and seeing that the other participant is seeing the same things.

\(^1\) The effect is not a simple addition of the piece of information. It can also include that which can be assumed by association. For example, if one party makes the utterance: “It is a fine day for tennis”, the communicating parties might also assume that the speaker plays tennis on occasion, is the sporty type, is posh or whatever assumptions seem reasonable to make. The belief does have to be shared by the other party though, since it must be mutual for it to be considered part of the common ground.
Figure 9-1. Illustration of overlapping areas of knowledge and skills and mutually established common ground for persons A and B.

9.1.1 Joint actions

In Clark’s view, conversations can be regarded as a hierarchy of joint actions, each joint action adding to or modifying the common ground. Joint actions can be described in three dimensions: levels, tracks, and layers.

Levels describe the way atomic joint actions are managed in the presentation and consideration of a single proposition. First the addressee needs to attend to what is being communicated; then to identify the words, sentences and signals that are sent; next to understand the intention of the message; and finally to actually consider the proposition that has been communicated. Communication according to Clark is never a one-way process, though. At each level the sender of the message needs to be able to ascertain that the receiver actually has attended, understood and considered the proposition. And it is only when both parties recognise that the proposition has been considered, that it affects the common ground. According to Clark, the actual messages that are sent between the communicating parties consist of three basic methods of signalling, or composites thereof. The three methods are: describing-as, indicating and demonstrating. Describing-as is using language to describe something. Indicating is directing attention or pointing to referents. Demonstrating is used to non-verbally demonstrate something.

Tracks divide the conversation into two parallel tracks: the primary track and the secondary track. The primary track deals with the “official business” of the communication, i.e. the subject of the conversation. It is not what is actually said though. It is what is meant with the communicative act. For example, the utterance “Brrr, chilly!” constitutes a communicative act carrying the meaning: I assert that it is cold. The secondary track deals with meta-communicative acts. These are acts about communicative acts. To continue from the previous example, the communicative act I assert that it is cold may be intended to carry the
meta-communicative signal that this was intended as a question, or rather as an invitation for the other party to agree or disagree with the given assertion (adapted from Clark, 1996 – Using language). Both tracks involve signalling, with the primary track dealing with signals of meaning and purpose; and the secondary track of understanding and attention.

Layers, finally, deal with the intended meaning when this differs from that expressed in the surface communication, for example, when joking or lying. This aspect of joint actions is not covered here.

9.2 Theory of language use applied to the advice-giving situation

In Figure 9-2, Clark’s framework has been modified to suit the advice-giving setting. The figure shows the different layers of communication that occur in the exchange between consumer and advisor. The exchange is divided into four dimensions going from the transfer of data, at the most basic level, to inducing motivation to act in accordance with gained knowledge, at the top level. Each dimension builds on the next lower level.\(^1\)

\(^1\) In the real-world situation the dimensions are not as clear-cut as the diagram suggests. For instance, motivational aspects affect every level of the exchange, and the hitherto gained knowledge, or evolving common ground, shapes the way transfer of data is performed. Still, it is believed that the diagram describes the general dynamics and the layered nature of the advice-giving exchange.
Figure 9-2. Overview of the client-instructor communicative exchange.

At the data transfer level, data is exchanged. At the next level the data is interpreted as propositions, which in turn make up joint actions in the form of questions and answers. At the next level again, the questions and answers that have been exchanged, produce the knowledge that the consumer needs. At this point the consumer knows what he/she should do. This does not mean that he/she will do it. The final motivational level is not found in Clark’s work, but was added to underline the importance in advice-giving of assuring that the consumer is also properly motivated to act in accordance with what he/she knows.

Common ground plays a role at every step in this process. At the joint actions level it helps the communicating parties interpret the propositions that are exchanged so that the common ground can be expanded. At the knowledge level, the common ground represents what the advisor knows that the consumer knows. And at the motivational level, the common ground represents what the advisor knows about the consumer’s motivation to act in accordance with what he/she knows.

The consumer-advisor advice-giving situation represents a special type of communication setting. The two communicating parties have set roles that determine their behaviour and there is a known, and expected,
difference in initial knowledge level between them: the advisor is assumed to have a lot of knowledge, while the consumer is assumed to have little. The act of advice-giving should not, however, be regarded simply as a transfer of knowledge. The advisor, as the domain expert, is responsible both for deciding what knowledge the consumer needs and to judge if the consumer has achieved this level of knowledge. It could be argued that the consumer is the one who should decide both of these. The consumer is definitely an equal partner in this and the advisor can never force his/her opinion on to the consumer. But it would simply be unfair to lay the responsibility for these decisions on the consumer. After all, the consumer finding him/herself in an advice-giving situation by definition means that he/she is in (at least partly) unfamiliar territory.

For the advisor to be able to judge if the knowledge that the consumer has is sufficient, this knowledge must be in the common ground\(^1\). When it is, the advisor has completed the task of instruction. For the task of advice-giving to be completed, though, the advisor must also ascertain that the motivational status of the consumer is in the common ground and that it is positive. Thus, the criterion on which the success of an advice-giving session should be judged, is that the advisor is assured that the consumer has sufficient knowledge and is motivated to put it to use\(^2\).

9.3 The role of the technical support system

It is only at the data transfer level that data and signals are physically sent. The joint actions, the built knowledge and the motivational influence only actually exist in the minds of the communicating parties. Consequently, it is only at the data transfer level that the technical support system can make a difference. The difference carries over, though, to the next level, and the next, and the next.

All the verbal and non-verbal signalling that is transmitted occurs at the data transfer level. Thus, the usefulness of the technical support system is measured in terms of what expressive bandwidth it can muster. Clark describes the face-to-face meeting as the prototypical rich communication setting and as the basic mode of communication against which other

\(^1\) Common ground consists of other things than topic-specific information. It contains such things as general knowledge and skills in language use. But to simplify the description of the building of common ground, only topical knowledge is considered here.

\(^2\) The ideal situation, and ideal criterion for success, would be that the consumer recognises that the advisor is assured that the consumer has the required knowledge and is motivated to use it. But, again, this is demanding too much of the novice user in an unfamiliar situation.
forms of communication should be compared. The characteristics of the face-to-face conversation are defined by Clark and Brennan (Clark & Brennan, 1991) as follows:

- **Immediacy**
  - Co-presence – sharing of physical environment
  - Visibility – seeing each other
  - Audibility – hearing each other
  - Instantaneity – no perceptible delay

- **Medium**
  - Evanescence – quickly fading
  - Recordlessness – leaves no record
  - Simultaneity – sending and receiving at the same time

- **Control**
  - Extemporaneity – formulation and execution of actions is decided as one goes along
  - Self-determination – participants determine what to do
  - Self-expression – taking actions as oneself

The telephone was used in the second study to provide a comparative baseline. The comparison between the telephone and AssistancePlus is valid because the telephone is the medium that today gives access to personal advice-giving over distance. For the AssistancePlus application to be meaningful, it must add something more to that which the telephone offers and the goal in the design of the AssistancePlus application was to create a solution that is more expressive than the telephone. If we compare the telephone to the face-to-face setting we find that they support many of the same features, but not all. The ones that are missing are co-presence and visibility.

Co-presence and visibility are related concepts and often overlap. That which is co-present is usually visible and that which is visible is usually co-present. The defining difference between the two concepts is that visibility concerns only our visual impression, while co-presence describes physical access to people, objects and ephemeral, non-visible sensory experiences, such as smell and touch.

In AssistancePlus the visibility criterion is satisfied by the video feature. Of course, there are different levels of quality of visibility. In the face-to-face meeting the ability to pick up on more subtle visual signals such as facial expressions is clearly superior to that in AssistancePlus with its small video image. Still, the interview results from both user studies showed that
the video was well received and was seen to add something extra in comparison with the telephone; both regarding feelings of personal contact and general expressiveness.

Co-presence in the form that Clark describes is not achievable in AssistancePlus, but it can be simulated. For shared documents (web pages) it can be simulated with the co-browsing feature; and for pharmaceutical products with the 3D features. In the case of the 3D representation, it becomes a proxy for its physical counterpart.Clark uses the term external representation to describe co-present objects that are used to guide or document a conversation. The 3D objects become such external representations. They give a shared visual record of public events, which means that both parties know (or can be reasonably sure) that the other party sees the same thing. This helps establish the mutuality that is so central for achieving common ground.

There are also differences between the telephone and AssistancePlus on signal fidelity. Clark’s three signalling methods — describing-as, indicating and demonstrating — can all be used in each medium. However, the power of expression, or signal fidelity, varies. On the telephone one is restricted to using one’s voice to carry all the types of signals. Indicating is limited to verbal indication and demonstration to verbal demonstration. In AssistancePlus the user has more powerful tools both for indication and demonstration. The shared view and remote cursor allow the users to unequivocally indicate referents and direct attention more effectively than is possible with voice alone. For demonstration the 3D model can be used together with the remote cursor to demonstrate understanding. Demonstration is a very potent signal to help the advisor judge the consumer’s level of knowledge.

AssistancePlus does not reach the signal fidelity and, consequently, the expressiveness of the face-to-face meeting, but it does offer a similar communicative experience and one that is superior to the telephone in several aspects. Below is a summary of the connections between concepts found in Clark’s framework and specific features in AssistancePlus:

- **Attention** – verbal indicators through audio; and visual indicators through video, remote cursor activity and control actions (web page change, scrolling, controlling the 3D model)

---

1 Examples are presentation slides or notes on a whiteboard.
• *Signal fidelity* – describing-as through audio and video with the video strengthening ability to transmit track 2 signals.

• *Indication* – verbal indication through audio; physical indication with remote cursor

• *Demonstration* – verbal demonstration through audio; physical (simulated) demonstration on the 3D model

• *Common ground* – providing an expressive communication environment and using external representations to stimulate the building of common ground

### 9.4 Conclusions

Clark’s theory of language use has been found to be helpful both in the description and understanding of the communicative setting and the dynamics of the advice-giving setting. This has only been a quick exploration of the usefulness and appropriateness of Clark’s theory. Much work remains to describe and understand the advice-giving situation in depth so that design suggestions can be generated. The goal is still to provide a (improved) solution for the problem of how to increase availability for expressive advice-giving – this work is not finished. The theoretical framing is an instrument in this process to support the ultimate goal, which is to contribute to improved compliance by making sure the consumer has the right information, no strike that – the right *knowledge*.

The following two questions are added to the list of things worth investigating further:

• Can Clark’s theory of grounding in communication contribute to a better understanding of the consumer-advisor communication situation and the role of the 3D medium in this; and, furthermore, can this be translated into improvement in application design?

• Can studies on 3D-mediated advice-giving, as an exploration into a new type of technically mediated communication, contribute to the theory of grounding in communication?

*A map of the road ahead is helpful, but you never know what it will be like until you get there – isn’t that great!*

---

1 Martin Östlund, 2008-05-16, two minutes before sending off the manuscript to the printers.
10 References


KOM. (2007). Meddelande från kommissionen till europaparlamentet och rådet om rapport om nupraxis för patientinformation om läkemedel. (E. g. kommission o. Document Number)


Zamaria, C., Caron, A. H., & Fletcher, F. Canada Online - A comparative analysis of Internet users and non-users in Canada and the world: Behaviour, attitudes TM of CDF and trends 2004 o. Document Number)


Appendix 1. Materials used in the pre-study

Actor cards:

**Kunden Bruno**

**Kunden Petronella**
Petronella borjar bli lite tillbaka. Hon äter regelbundet medicin för högt blodtryck och blir snabbt andfläckad när hon går i trappor. Hon har dock inte tagit upp att gissa huruvida hon har rätt till att prova på nya saker. Hon var två gånger först i trappan, uppåt som var uppsnappad mot något. Petronella håller sig informerad om saker och ting, t ex om sina mediciner och hur de fungerar.

**Experenten Dr. Piller**
Dr. Piller kan allt om allt och i synnerhet kan han allt om läkemedel. Han vet precis vad som händar i kroppen när man tar en alltidavl-b eller en enkelledisensidiskt, lösning om man känner ett par ting. Han kan gå och leka ett par ting och få dem att tyckas om det. Dr. Piller kan också svara på de flesta frågor som man kan ha.

**Kundkommunikatören Karl**
Karl tycker om att hjälpa folk och det passer bra då det är det han gör i sitt arbete. Han svarar på frågor från kunden med käggor och allt från oppeänder till frågor om mediciner, recept och friskvädd. Karl brukar kunna svara på de flesta frågor han får (förutom kanske hur Kopparbjudan störvar). Annars vet han till vem han kan skicka vidare frågan.

**Läkaren Lena**
Lena har jobbat som allmänpraktiserande läkare i 10 år. En stor del av hennes arbetet består av att skriva ut läkemedel till patienter och hon behöver sänka till en hel del om läkemedel och det som inte finns i huvudet når hon upp eller frågar en farmaceut.

**Farmaceuten Fabian**
Fabian är en erfaren farmaceut. Han har jobbat i apotek sedan lång tid tillbaka och kan det mesta om de läkemedel som finns tillgängliga i apotekets sortiment. Han kan också all de där praktiska saker om mediciner som man inte kan läsa sig till i böcker, utan måste läsa sig genom erfarenhet.

**Den intelligenta agenten James B.**
James B. finns inte. Han finns bara som ettor och nollor i ett dataprogram. Även är James B. en omykad fil, som har höljt många viktig meningar att hitta rätt bland de läkemedel som kan inte förstå en fråga på samma sätt som en människa, men han är riktigt duktig på att göra sig tillvad man menar och han är absolut en fina på att leta sig igenom miljontal filer och dokument för att på nolltid presentera relevanta saker.************
Kickstarter cards:

<table>
<thead>
<tr>
<th>Innehåll</th>
<th>Innehåll</th>
<th>Innehåll</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilket informationsinnehåll ska systemet ha?</td>
<td>Hur visas information om läkemedelsförpackningar?</td>
<td>Hur visas information om läkemedel?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Innehåll</th>
<th>Innehåll</th>
<th>Innehåll</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hur visas läkemedlets funktion och sätt att fungera?</td>
<td>Vilka tjänster är viktiga?</td>
<td>Vilken typ av tjänster passar bäst för den valda tekniken (VR)?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process</th>
<th>Process</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hur ställer jag frågor i systemet?</td>
<td>Hur söker man efter information i systemet?</td>
<td>När använder man systemet?/ När använder man inte systemet?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process</th>
<th>Aktörer</th>
<th>Aktörer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Var använder man systemet?/ Var använder man inte systemet?</td>
<td>Vem använder systemet?/ Vem använder inte systemet? - vilka olika kategorier av användare finns det?</td>
<td>Vad är nytta för olika användare av systemet?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aktörer</th>
<th>Aktörer</th>
<th>Upplevelsen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilken typ av information söker olika kategorier av användare?</td>
<td>Vilken typ av tjänster efterfrågar olika kategorier av användare?</td>
<td>Vad får användaren att börja använda systemet?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Upplevelsen</th>
<th>Upplevelsen</th>
<th>Upplevelsen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vad får användaren att fortsätta att använda systemet?</td>
<td>Vad är viktigt för att ge en positiv upplevelse av att använda systemet?</td>
<td>Vad är det som ska vara nyskapande i systemet?</td>
</tr>
</tbody>
</table>
**Documentation form:**

Scenariebeskrivning, användarfokus

Titel för scenariot:........................................................................................................

Gruppdeltagare:
....................................................................................................................................
....................................................................................................................................... 
....................................................................................................................................... 

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

*Använd gärna extralad om utrymmet ej räcker till.*

*Var god vänd blad.*
För det beskrivna scenariot, försök att bryta ut följande saker.

Tjänsten – vilka tjänster erbjuder det i scenariot beskrivna systemet. Försök att beskriva tjänsten i allmänna ordalag, ofärgat av den tekniska miljön.

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................

Användaren/användarna – vem är det som använder tjänsten/tjänsterna?

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................

Nyttan – vilken nytta tillför tjänsten allmänt; och vilken nytta tillförs tjänsten genom användandet av VR-teknik?

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................

Genomförbarhet – är det beskrivna systemet genomförbart, om inte – vad är det som gör att det inte är genomförbart?

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................
### Question cards:

<table>
<thead>
<tr>
<th>Mötesplats för kunder, kundkommunikatörer, farmaceuter, experter etc</th>
<th>Community - ta del av andra användares synpunkter, råd etc</th>
<th>Community - expertgrupper</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-dimensionell visualisering av läkemedel - förpackning och läkemedlet</td>
<td>3-dimensionell demonstration av hur man använder läkemedlet</td>
<td>3-dimensionell demonstration av hur läkemedlet fungerar i kroppen, sidoeffekter, biverkningar, interaktionseffekter med andra läkemedel etc.</td>
</tr>
<tr>
<td>Föreslå och motivera alternativ (generisk substitution)</td>
<td>Kommunikation med virtuell representation (avatar) av kundkommunikatör (text, röst, bild, video)</td>
<td>Fullsortimentsapotek - visar hyllor med alla produkter i apotekets totala sortiment i virtuell form</td>
</tr>
<tr>
<td>Automatisk lotsning av användaren till rätt kommunikationskanal och kommunikationsnivå</td>
<td>Intelligenta agenter - virtuell farmaceut</td>
<td>Sömlös integration av olika medier (text, bild, ljud, video, 3D)</td>
</tr>
<tr>
<td>Användning på fysiska apotek med mixed reality</td>
<td>Webbcoaching - ett coachingsystem där klienter har kontinuerlig (virtuell) kontakt med en kontaktperson som coachar dem (t ex inom friskvård)</td>
<td></td>
</tr>
</tbody>
</table>
The result from the discussion phase (copied from the whiteboard):

<table>
<thead>
<tr>
<th>tjänster/funktioner</th>
<th>Innehåll</th>
<th>Nyta</th>
<th>Upplevelse</th>
<th>Användare</th>
<th>Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produktinfo</td>
<td>Produkter som är besvärliga att använda</td>
<td>Enkelhet</td>
<td>Anonymitet</td>
<td>Allmänheten/ privatpersoner/ slutkonsumenter</td>
<td>Ökad effektivitet, kvalitet i kommunikation av läkemedels-information</td>
</tr>
<tr>
<td>Produktdemonstration</td>
<td>Produkter som är besvärliga att förklara hur de används (t ex över telefon eller i text)</td>
<td>Tydlighet</td>
<td>Aktivt lärande</td>
<td>Informatörer i vårdkedjan</td>
<td></td>
</tr>
<tr>
<td>Stomiprodukter</td>
<td>Dynamik</td>
<td>Roligt</td>
<td>Kund-kommunikatörer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stolpiller</td>
<td>Flexibilitet</td>
<td>Lockande</td>
<td>Hitta målgrupp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhalatorer</td>
<td>Ökad informationskvalitet</td>
<td>Lärande</td>
<td>Professionell användare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ögondroppar</td>
<td>Bygger bort missförstånd</td>
<td>Privat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kolla statistik för att kolla vilka produkter som kunderna har svårt med</td>
<td>Rätt information vid rätt tillfälle</td>
<td>Tid att koncentrera sig på innehållet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det lagerlösa apoteket</td>
<td>Fullsortiment - alla mediciner</td>
<td>Frihet från rummets begränsningar</td>
<td>Ta sin tid utan tidspress eller social press</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olika generationer av läkemedel - gamla läkemedel</td>
<td>Tillgänglighet</td>
<td>Aktiverar flera sinnen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sortering av produkter</td>
<td>Genom att välja en kategori av läkemedel t ex allergi, kan enbart produkter som tillhör denna kategori visas</td>
<td>Personlig anpassning</td>
<td>Trygghet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatisk anpassning av språk - nivå, nationalitet</td>
<td>Effektiv sökning</td>
<td>Prova/testa, flera försök</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personliga anpassningar</td>
<td>Kvalitetssäkring</td>
<td>Omedelbar feedback</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Läkemedels-genomgång</td>
<td>Effektivare kösystem</td>
<td>Samarbete, synkronisering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tester</td>
<td>Visa effekt av läkemedel på allmäntillståndet</td>
<td>Realism</td>
<td>Förstärka det personliga mötet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Läkemedelsprofiler</td>
<td>Det virtuella medicinskåpet</td>
<td>Inte bara emulera, utan att utnyttja mediet fördela fullt ut för att ge mervärde</td>
<td>Socialt stöd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 källa - flera vyer</td>
<td>Fullsortiment - alla mediciner</td>
<td>Frihet från rummets begränsningar</td>
<td>Ta sin tid utan tidspress eller social press</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visa det som inte kan visas</td>
<td>T ex vad som händer inuti kroppen när man tar ett läkemedel</td>
<td>Förbätta den faktiska miljön</td>
<td>förbätta den faktiska miljön</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flerpuntskommunikationer med n parter</td>
<td>Bättre än verkligheten</td>
<td>Nya dimensioner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-learning</td>
<td>Effektivare inlämning</td>
<td>Roligare inlämning och djupare inlämning</td>
<td>Studenter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navigering, orientering</td>
<td>Hälsokiosk</td>
<td>Verklighetskiosk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synkronisering av olika kommunikationskanaler</td>
<td>Virtuellt apotek - miljö</td>
<td>Entertainment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12 Appendix 2. Materials used in the first user study.

The interview questions:

Beskrivning av intervjun:


*Alla:* Det kommer att vara frågor om din upplevelse av att använda prototypen, dina synpunkter om vad en sådan tjänst kan användas till, hur den skulle kunna förbättras, vad som du tycker saknas i tjänsten, hur du skulle vilja se den utvecklas och hur du skulle vilja se att rådgivningstjänster kring läkemedel ser ut i framtiden.


För frågor markerade med O så används videoinspelningen för att observera försöket. För frågor markerade med F så ställs de företrädesvis till farmaceuten (rådgivaren).

Frågeområden:

- **Användning**
  - O Observera hur deltagarna använder sig av tjänsten.
  - O Hur använder sig deltagarna av 3D-modellen
  - O Hur mycket använder de sig av de olika mediatyperna? Vad används websidorna, 3D-objekten, respektive röst- och videokommunikation till för typ av information och hur mycket används receptive medietyp.
  - O Hur många manipulationer utför respektive deltagare på 3D-modellen?
- Bakgrundsvärder – *Endast kundkommunikatör*
  - F Beskriv din utbildningsbakgrund.
  - F Hur länge har du arbetat som kundkommunikatör?
  - F Har du annan erfarenhet som farmaceut.
  - F Har Du någon annan professionell erfarenhet inom rådgivning, call center verksamhet eller vården?
  - F Har Du någon annan utbildning, yrkeserfarenhet eller annan färdighet eller erfarenhet som Du tycker har påverkat dig i din roll som rådgivare?
  - F Beskriv din erfarenhet av att arbeta med datorer och med webben.
  - F Beskriv din inställning till datorer, webben och ny teknik i allmänhet.

- Allmänt intryck av funktionalitet (för frågorna om funktionalitet visas videoinspelningen från försöket för varje del av funktionaliteten för att trigga försökspersonernas minnen från försökstillfället och låta dem betrakta skeendet från ett utifrånperspektiv där de kan analysera vad som hände under försöket på ett annat sätt).
  - F Beskriv ditt första spontana intryck av assistansPlus når Du först såg det och använde det nu för första gången vid försöket.
    [Vad tänkte de på allra först när de såg applikationen första gången. Vilket är det generella intrycket av tjänsten, vad kommer försökspersonerna först att tänka på – för att ta reda på vad de tycker är viktigast. Kanske fråga något om förväntningarna som de hade innan de kom till försöket.]
  - F Beskriv din upplevelse av användandet av video- respektive ljudkommunikation.
  - F Beskriv din upplevelse av funktionen att samma webbsida visas för både dig och frågeställaren och ”fjärrmarkören” som visar var den andra parten pekar.
    [Vilken nytta kände deltagaren att det gav att kunna se och visa innehållet på en valfri webbsida för att ge rådgivning? Hur upplevde de fjärrmarkören.]
o F Beskriv din upplevelse av användandet av 3D-modeller.
   [Vilken nyttan kände deltagaren att det gav att kunna se och visa hur läkemedelsprodukten ser med hjälp av en 3D-modell som kan roteras, pannas och zoomas?]

o F Beskriv hur Du tycker att sättet som 3D-modellen visas och hanteras fungerar?
   [Vad tycker de om sättet som 3D-modellen visas och sättet som den hanteras; vad är bra och vad är dåligt. Hur skulle den kunna visas och hanteras istället – har de några förslag.]

o F Hur viktigt anser Du att det är att frågeställaren själv kan manipulera 3D-modellen?
   [Är möjligheten att samtliga kunna manipulera modellen viktig? Är det viktigt att frågeställaren kan manipulera modellen överhuvudtaget? Skilj här på när frågeställaren på egen hand utforskar materialet och i en rådgivningssession. Gäller synpunkterna som kommer fram bara för den här modellen och den enkla typ av manipulation som kan göras för denna – om det leda in diskussionen här på vilken annan typ av innehåll som skulle kunna visas i 3D-form och om det i dessa fall skulle vara mer användbart att kunna manipulera modellen själv.]

o Beskriv hur Du upplever att de olika typerna av funktionalitet fungerar tillsammans i kombination med varandra. De olika typerna är: video, ljud (röst), samtidig visning av websidor och samtidig visning av 3D-modeller?

- Användbarhet

  o F Tycker Du att det var lätt att lära sig och att komma igång med att använda sig av de olika funktionerna i tjänsten eller var det svårt? Vad skulle kunna förbättras för att göra det lättare att komma igång.
   [Här är jag intresserad av hur de upplever att det var att komma igång med att använda tjänsten. Det är viktigt att frågeställaren att komma igång uppptäckta som så låg som möjligt.]

  o F Tycker Du att någon del av tjänsten är svår att använda?
   [Identifiera vilka delar i tjänsten var särskilt svåra att använda och försök att ta reda på varför.]

- HUR/VARFÖR: Kvalitet

  o F Vad tillför en tjänst som assistansPlus?
   [Vad är det nya, vad är nyttan. Även om det är samma information som ges så kan kanalen som den förmedlas via påverka kvaliteten på information som tas emot och även om det inte är strikt nödvändigt att använda en kanal med “högre kvalitet” så kan det finnas anledning att göra det ändå just för att man vill höja kvaliteten. Försök här att få deltagaren att beskriva vilket bidrag till ökad kvalitet han/hon uppfattar att varje medieför att. Denna fråga ska utforska informationsgenomslagskraften i mediekombinationen som används.]

  o F På vilket sätt tror Du att användandet av en tjänst som assistansPlus skulle påverka sättet frågeställaren använder läkemedel?
   [Kan den ökade informationsräddomen/kvaliteten ge bättre genomslagskraft för den förmedlade informationen; både förståelsemässigt men också känsломässigt och härigenom ge bättre faktisk läkemedelsanvändning.]  

  o F Hur väl anser Du att frågeställaren har tillägnat sig informationen om läkemedlet genom att använda sig av AssistansPlus jämfört med 1) ansikte-mot-ansikte-rådgivning i Apoteketsbutik och 2) med telefonrådgivning.
   [Jämföra hur deltagarna tror att rådgivningen skulle fungerat med 1) ansikte-mot-ansikte-kommunikation]
och 2) telefonrådgivning jämfört med AssistansPlus för att vidare undersöka vilken nytta AssistansPlus tillför och vilket användningsområde den har.

- VARFÖR:
  - För hur stor andel av inkommande frågor till Apotekets kundcenter som går till farmaceut-utbildad personal uppskattar Du att en tjänst som AssistansPlus skulle ge ett signifikant, positivt bidrag i förhållande att ge ett tillfredställande svar på den ställda frågan?
    - [Få en uttalande om andelen frågeställningar som går till farmaceuter på kundcenter där användandet av AssistansPlus skulle tillföra något substantiellt.]
  - F Hur tror Du att användandet av en tjänst som AssistansPlus påverkar hur väl frågeställare kommer ihåg de svar som givits?
    - [Här är jag intresserad av att veta om deltagarna tror att hågkomsten kan förbättras i och med att frågeställaren kan spara länken till informationen som användes och kan gå tillbaka till denna på egen hand.]

- VARFÖR: Effektivitet
  - F Tror Du att användandet av en tjänst som AssistansPlus kan effektivisera rådgivningsamtalen?
    - [Effektivisering kan mätas i tid ett rådgivningsamtal från början till slut, men kan också innebära andra saker som att det är effektivt i ett längre perspektiv för att frågeställaren inte återkommer med samma fråga efter en tid.]
  - F Hur stor andel av rådgivningsamtalen skulle Du uppskatta skulle kunna effektiveras avsevärt genom att använda 1) en tjänst med röst/video-kommunikation och samtidig visning av webbsidor och 2) en tjänst med röst/video-kommunikation, samtidig visning av webbsidor samt gemensam visning av 3D-material.
    - [Här är jag intresserad av att undersöka vilket bidrag som de olika medietyperna ger till den totala uppskattade effektiviteten och i synnerhet vad det är som 3D-mediet tillför.]
  - Tror Du att användandet av en sådan tjänst skulle kunna utöka andelen frågor som skulle kunna hanteras av kundcenter?
    - [Ta reda på om deltagarna tror att tillgången till tjänster som AssistansPlus skulle kunna öka antalet frågor som kundcenter kan hantera. Sondera djupare för vardera av funktionerna röst/video, samtvisig visning av webbsidor samt 3D-modeller.]

- KÄNSLA: Inställning/attityd
  - F Hur upplevde Du relationen mellan konsumenten och kundkommunikatören?
    - [Hur upplever de att relationen mellan konsumenten och kundkommunikatör är vid användning av tjänsten – vem är det som styr interaktionen, känns kontakten personlig/nära, hur jämför sig kontakten med den vid fysiskt möte alternativt över telefon.]
  - F Kände Du att Du hade kontroll över det som visades på din skärm?
    - [Känslan av kontroll, upplevelsen av vem det var som styrde interaktionen, vad som gjorde så att det blev så att kundkommunikatören blev den styrande parten och frågeställaren blev passiv när det gäller att styra gränssnittet.]
  - F Tyckte Du om att använda tjänsten?
    - [Uppfattning för tjänsten som helhet samt för varje del i tjänsten om det skiljer sig från helheten. Vad är de som de tycker om – vad skulle få dem att tycka ännu mer om tjänsten.]
  - F Vad är din inställning till att visa dig med ditt ansikte i video-fönstret?
    - [Grundinställning till att visa sig med ansikte på nätet i denna typ av tjänst – dvs där man har en professionell roll.]
o F Vad är din inställning till att kommunicera med ljud (röst) över nätet?
   [Undersök den allmänna inställningen till röstkommunikation över nätet. Det kan handla om ljudkvalitet, hårdvarubehandling, säkerhets/trygghetsfrågor.]

o Vilka tror du är de viktigaste faktorerna för att en tjänst som AssistansPlus skulle komma att användas? – Individer, organisationer, strukturer

- VAD och NÄR: Innehåll/användningsområde

  o F Vilka typer av frågor passar det för? – och vilka frågor passar det inte för?
   [Vilka typer av frågor tycker deltagaren att tjänsten passar för. Vilken typ av information passar det att visa i en tjänst som assistansPlus – vilken typ av information passar det inte för. Det kan handla om frågor om olika typer av produkter, olika djup på frågor, olika allvarlighetsnivåer – kritiska frågor, i vilket sammanhang frågan ställs etc.]

  o F Vilken typ av innehåll passar att visa i en tjänst som assistansPlus?

  o Vilken annan typ av information skulle kunna visas i 3D-format? – exempel: hur läkemedel fungerar i kroppen, hur läkemedel interagerar.

  o När passar det att använda en tjänst som AssistansPlus? – och när passar det inte?
   [I vilka lägen passar det att använda en tjänst som AssistansPlus, vilka tider på dygnet, under vilka förhållanden, när passar det inte. Få fram en jämförelse med andra tillgängliga kanaler när AssistansPlus är lämplig att använda och när andra kanaler är mer lämpliga för att undersöka förhållanden som finns mellan de olika kanalerna. Frågor om tillgänglighet.]

- VEM: Användare/Målgrupper

  o För vilka användargrupper tycker du att det passar att använda en tjänst som AssistansPlus – och för vilka passar det inte?

  o F På vilket sätt tror Du att användandet av en tjänst som assistansPlus skulle kunna påverka sättet frågeställaren söker efter information om läkemedel?
   [Ta reda på hur tjänsten skulle kunna förändra sättet som konsumenter tillägnar sig information om läkemedel – att de t ex skulle kunna tänkas använda sig mer av webben på egen hand när de vet att de kan få hjälp om de kör fast.]

- HUR, VARFÖR, TILL VAD: Förbättringspunkter

  o Vilka problem ser du?

  o Vilka faktorer tror du är de mest kritiska för att få en tjänst som assistansPlus att användas?
   [Kan handla om funktionalitet, inställningar/attityder, säkerhet etc]

  o Vilka hinder ser du för att en sådan tjänst inte skulle komma att användas?

  o Vilka förbättringar kan du komma på om skulle förbättra tjänsten?
   [När det gäller röst, ljud, co-browsing, 3D-visning, 3D-collaboration]
o Saknar du några funktioner?
o Vilka nya funktioner skulle du vilja se?
o Har du några förslag till andra förslag till förbättringar, utökningar, inskränkningar
o Skulle det vara enkla att använda sig av en tjänst som denna om det fysiska gränssnittet var mer anpassat till uppgiften?
  [T ex att kundkommunikatörerna använder datahandskar, har en virtuell medicinförpackning eller liknande]
  o Användargränssnittets utformning – förbättringsförslag
  o Fjärrmarkören utseende och funktion.
  o Skulle kunna lista en rad med möjliga förbättringar och nya funktioner och fråga vad deltagarna tycker om dem.
  Textkommunikation, Anteckningar som sparas, koppling till läkemedelsförteckning, uppföljning, användning för hälso- eller läkemedelsoaching, översikt över alla användare på sidan – var de befinner sig, hur de förflyttar sig etc – men möjligheten att kunna erbjuda hjälp istället för att vänta på att de ska be om hjälp, möjlighet att göra ljud och bildinställningar på distans så att kundkommunikatören kan göra det åt konsumenten (sänka tröskeln)

- Övrigt/allmänt
  o F Skulle Du kunna tänka dig att använda denna typ av tjänst i framtiden som frågeställare; som rådgivare? [Deras inställning till att använda en sådan typ av tjänst i framtiden.]
  o F Tror Du att Apotekets kunder skulle kunna tänka sig att betala för att få tillgång till den högre kvalitet på information som en tjänst som AssistansPlus kan ge?
  [Om AssistansPlus skulle vara en betaltjänst, där då kunderna betalar för den extra informationskvalitet och effektivitet som tjänsten ger, tror de då att det skulle finnas en marknad för tjänsten. Frågan kan också ställas gällande professionella användare t ex inom vården.]
  o Om Du fick önska helt fritt hur skulle Du vilja att rådgivning om läkemedel gick till om 5 år respektive 10 år? [Användande av tidsperspektivet för att stimulera tankarna]
  o F Vad är din inställning till den ökande användningen av IT/telekomtjänster som hjälpmedel för att kommunicera med läkemedelskonsumenter och den förändring av yrkesrollen som farmaceut som det kan innebära?
  [Här är jag intresserad av deltagarens grundinställning till användning av teknik för att kommunicera och i synnerhet deras syn på att andelen rådgivningsamtal som kommer ske med hjälp av tekniska hjälpmedel kommer att öka och hur det kommer att påverka deras framtida yrkesroll.]
Appendix 3. Materials used in the second user study

Introductory letter for telephone setting, Lantus OptiSet:

Studie eHälsoinstitutet 2006

Du är inbokad för deltagande följande tider:

Första tillfället:.................................
(Du blir uppringd per telefon på det nummer som Du har angivit)

Andra tillfället: .................................
(På plats på Varvsholmen)

Beskrivning av roll vid första tillfället

Läs igenom detta informationsmaterial och börja fundera på vilka frågor som du vill ställa givet den roll som står beskriven nedan.


Du kommer att ha 10 minuter på dig att finna svar på dina frågor. Försök att utnyttja hela försöksstiden.

Rollbeskrivningen till det andra tillfället kommer Du att få senare.

Tack för din medverkan!
Introductory letter for telephone setting, Genotropin MiniQuick:

**Studie eHälsoinstitutet 2006**

Du är inbokad för deltagande följande tider:

**Första tillfället:**

(Du blir uppringd per telefon på det nummer som Du har angivit)

**Andra tillfället:**

(På plats på Varvsholmen)

**Beskrivning av roll vid första tillfället**

Läs igenom detta informationsmaterial och börja fundera på vilka frågor som du vill ställa givet den roll som står beskriven nedan.

Din uppgift är att spela rollen som anhörig till **Isabelle, 12 år gammal**. Du väljer själv vilken relation du har till Isabelle – mamma, pappa, äldre syskon, farmor, moster eller annan. Isabelle har alltid varit den som varit minst i barngruppen på dagis och i sin klass på skolan. En utredning har genomförts och man har beslutat sätta in medicinering för att låta Isabelle att växa lite snabbare. Medicinen som har ordinerats är ett tillväxthormon som heter **Genotropin Miniquick** och det är ett injektionsläkemedel som ska användas dagligen. Du var inte med vid läkarbesöket då läkaren demonstrerade hur läkemedlet används för Isabelle tillsammans med en annan anhörig. Du känner dig osäker på hur Du ska göra för att hjälpa Isabelle med hanteringen av läkemedlet och har därför bestämt dig för att ringa till Apotekets kundtjänst för att ta reda på mer.

Du kommer att få prata med en farmaceut från Apotekets kundcentrum och har **10-15 minuter** på dig att finna svar på dina frågor. Försök att utnyttja hela försöktiden.

Rollbeskrivningen till det andra tillfället kommer Du att få senare.

**Tack för din medverkan!**
Introductory letter for AssistancePlus setting, Lantus OptiSet:

Studie eHälsoinstitutet 2006

Tack för din medverkan vid första tillfället i studien. Välkommen till det andra tillfället:

..........................................................
(se bifogad karta för att hitta till Varvsholmen)

Beskrivning av roll vid det andra tillfället

Läs igenom detta informationsmaterial och börja fundera på vilka frågor som du vill ställa givet den roll som står beskriven nedan.


Du kommer att ha 10 minuter på dig att finna svar på dina frågor. Försök att utnyttja hela försökstiden.

Tack för din medverkan!
Introductory letter for AssistancePlus setting, Genotropin MiniQuick:

Studie eHälsoinstitutet 2006

Tack för din medverkan vid första tillfället i studien. Välkommen till det andra tillfället:

.....................................................

Beskrivning av roll vid det andra tillfället

Läs igenom detta informationsmaterial och börja fundera på vilka frågor som du vill ställa givet den roll som står beskriven nedan.


Du kommer att ha 10 minuter på dig att finna svar på dina frågor. Försök att utnyttja hela försökstiden.

Tack för din medverkan!
**The survey:**

**Beskrivning av enkäten**

Tack för att Du tar tid att delta i denna studie!


1. Marker - muspekaren som används för att peka på skärmen
2. Fjärrmarker - visar positionen på pharmacies markör
3. Videobild - visar ditt respektive farmaceutens ansikte

1. 3D-animation - den interaktiva film som användes för att demonstrera läkemedlets användning
2. 3D-modell - modellen som representerar läkemedlet i 3D-animationen

**Bakgrundssuppgifter**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Kön</td>
<td>Man</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Ålder</td>
<td>18-24</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Sökte Du beskriva dig som en person som brukar vara tidigt ute med att prova nya saker?</td>
<td>Nej, absolut inte</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Sökte Du beskriva dig som positivt inställd till datorer och internet?</td>
<td>Nej, absolut inte</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Hur många gånger har Du använt dig av dator i ditt arbete/studier den senaste månaden?</td>
<td>Inte alls</td>
</tr>
</tbody>
</table>

---

*[Ektortstitel, text och tabeller]*
Hur många gånger har Du använt dig av dator på dina fritid den senaste månaden?

<table>
<thead>
<tr>
<th>Inte alls</th>
<th>Enstaka gånger</th>
<th>Åtta gånger</th>
<th>Dagligt</th>
<th>Vet ej</th>
</tr>
</thead>
</table>

Hur många gånger har Du använt dig av Internet på dina fritid den senaste månaden?

<table>
<thead>
<tr>
<th>Inte alls</th>
<th>Enstaka gånger</th>
<th>Åtta gånger</th>
<th>Dagligt</th>
<th>Vet ej</th>
</tr>
</thead>
</table>

## Tidigare erfarenhet av läkemedelsrådgivning

Hur många gånger har Du på något sätt eftervört information om läkemedel det senaste året?

<table>
<thead>
<tr>
<th>Ingen gång</th>
<th>1-4 gånger</th>
<th>5-10 gånger</th>
<th>Mer än 10 gånger</th>
<th>Vet ej/Vill inte svara</th>
</tr>
</thead>
</table>

## Jämförelser mellan telefonrådgivning och rådgivning med AssistansPlus


<table>
<thead>
<tr>
<th><strong>Punkter</strong></th>
<th><strong>Telefon</strong></th>
<th><strong>AssistansPlus</strong></th>
<th><strong>Poäng</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lätt att använda</td>
<td>☐</td>
<td>☐</td>
<td>= 10</td>
</tr>
<tr>
<td>Lätt att kommunicera</td>
<td>☐</td>
<td>☐</td>
<td>= 10</td>
</tr>
<tr>
<td>Personlig kontakt</td>
<td>☐</td>
<td>☐</td>
<td>= 10</td>
</tr>
<tr>
<td>&quot;Förklaringskraft&quot;</td>
<td>☐</td>
<td>☐</td>
<td>= 10</td>
</tr>
<tr>
<td>Förståelse</td>
<td>☐</td>
<td>☐</td>
<td>= 10</td>
</tr>
<tr>
<td>Förträdande</td>
<td>☐</td>
<td>☐</td>
<td>= 10</td>
</tr>
<tr>
<td>Effektivitet</td>
<td>☐</td>
<td>☐</td>
<td>= 10</td>
</tr>
</tbody>
</table>
## Uppfattning av AssistansPlus


<table>
<thead>
<tr>
<th>Affära</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>Fantastiskt</th>
<th>Vot ej</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Förfärligt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Vot ej</td>
</tr>
<tr>
<td>b) Frusterande</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tillfredsställande</td>
<td>Vot ej</td>
</tr>
<tr>
<td>c) Träigt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stimulerande</td>
<td>Vot ej</td>
</tr>
<tr>
<td>d) Svårt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lätt</td>
<td>Vot ej</td>
</tr>
<tr>
<td>e) Kraftlost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Kraftfullt</td>
<td>Vot ej</td>
</tr>
<tr>
<td>f) Oflexibel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flexibel</td>
<td>Vot ej</td>
</tr>
<tr>
<td>g) Lätt att komma igång</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Svårt att komma igång</td>
<td>Vot ej</td>
</tr>
</tbody>
</table>

## Ljud och bild

11. Jag tycker att det var positivt att kunna se farmaceuten i bild (farmaceutens videobild)

| Instämmer inte alls | | | | | | | | | Instämmer helt | Vot ej |

12. Jag tycker att det var positivt att farmaceuten kunde se mig i bild (din egen videobild)

| Instämmer inte alls | | | | | | | | | Instämmer helt | Vot ej |


| Instämmer inte alls | | | | | | | | | Instämmer helt | Vot ej |

14. Jämför hur Du upplevde kvaliteten på ljudet i AssistansPlus jämfört den i telefonen?

| Mycket sämre än telefon | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Mycket bättre än telefon | Vot ej |

| Vot ej |
### Visa och peka

<table>
<thead>
<tr>
<th>15</th>
<th>Jag tycker att det var värdefullt att kunna titta på texter och bilder på webbsidor tillsammans med farmaceuten.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instämmer inte alls</td>
</tr>
<tr>
<td></td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>16</th>
<th>Jag tycker att det var värdefullt att kunna se vad farmaceuten pekade på med sin markör (den gråa markören märkt med texten ”Farmaceut”).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instämmer inte alls</td>
</tr>
<tr>
<td></td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>17</th>
<th>Var Du medveten om att farmaceuten också kunde se din markör?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ja</td>
</tr>
<tr>
<td></td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>18</th>
<th>Jag tycker att det är värdefullt att kunna använda min egen markör (pil) för att peka på saker.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instämmer inte alls</td>
</tr>
<tr>
<td></td>
<td>☐</td>
</tr>
</tbody>
</table>

### 3D-animeringen och 3D-modellen

Frågorna i denna del behandlar din upplevelse enbart av 3D-funktionerna som användes för att demonstrera läkemedlet.

<table>
<thead>
<tr>
<th>19</th>
<th>Jag tycker att jag tog till mig informationen om läkemedlet som förmedlades med stöd av 3D-funktionerna på ett bra sätt.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instämmer inte alls</td>
</tr>
<tr>
<td></td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>20</th>
<th>Jag tycker att det är värdefullt att man själv kan styra 3D-innehållet.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instämmer inte alls</td>
</tr>
<tr>
<td></td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>21</th>
<th>Föredrar Du att 3D-modellen som representerar läkemedlet ska vara verklighetsstrogen eller förenklad/stiliserad i sättet den ser ut?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Förenklad</td>
</tr>
<tr>
<td></td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>22</th>
<th>Jag tycker att det skulle vara värdefullt att ha möjlighet att titta på 3D-modellen på egen hand efter rådgivningen.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instämmer inte alls</td>
</tr>
<tr>
<td></td>
<td>☐</td>
</tr>
</tbody>
</table>
Känsla av kontroll

23. Kände Du dig aktiv eller passiv vid telefonrådgivningen, respektive rådgivning med AssistansPlus?
   a. Vid telefonrådgivningen
      Passiv: 1 2 3 4 5 6 7 8 9  Aktiv: 10
      Vet ej:  
   b. Vid rådgivning med AssistansPlus
      Passiv: 1 2 3 4 5 6 7 8 9  Aktiv: 10
      Vet ej:  

24. Vem upplevde Du styrde dialogen vid telefonrådgivningen, respektive rådgivning med AssistansPlus?
   a. Vid telefonrådgivningen
      Du själv: 1 2 3 4 5 6 7 8 9  Farmaceuten: 10
      Vet ej:  
   b. Vid rådgivning med AssistansPlus
      Du själv: 1 2 3 4 5 6 7 8 9  Farmaceuten: 10
      Vet ej:  

25. Jag känner mig nöjd med sättet dialogen styrdes vid telefonrådgivningen.
   Instämmer inte alls: 1 2 3 4 5 6 7 8 9  Instämmer helt: 10
   Vet ej:  

   Instämmer inte alls: 1 2 3 4 5 6 7 8 9  Instämmer helt: 10
   Vet ej:  

Användningsområde

27. Ange på vilket sätt Du trogen skulle söka information om läkemedel i följande fall. Högsta värden anger positiv inställning. Summan av poängen ska vara 10 (null-värden är tillåtna).

   Telefon:  
   AssistansPlus:  
   Apoteksbutiken:  
   Internet:  

   a. Enkla produkter
      För rådgivning om enkla preparat som är icke-receptbelegda huvudväktätablister.
      + + + + 10
   b. Enkla receptbelegda produkter
      För rådgivning om enkla typer av receptbelegda medicin.
      + + + + 10
   c. Komplexa läkemedel
      För rådgivning om komplexa läkemedel som inte kräver speciellt handhavande.
      + + + + 10
   d. Läkemedel som kräver handhavande
      För rådgivning om läkemedel av allers medicinska hjälpmedel som kräver handhavande.
      + + + + 10
## Användningsbenägenhet

Skulle Du använda en tjänst som AssistansPlus om den finns tillgänglig via Apotekets hemsida?

<table>
<thead>
<tr>
<th>Inte alls troligt</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>Mycket troligt</th>
<th>Vet ej</th>
</tr>
</thead>
</table>

## Öppna frågor

29. Vad det något drag i AssistansPlus som Du tyckte var irrationellt eller besvärlikt?

   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................

30. Har Du några förslag på hur AssistansPlus skulle kunna förbättras?

   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................

31. Vilken typ av frågor tycker Du att AssistansPlus passar för?

   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
   ...........................................................................................................................................................
Vilka troc Du det skulle bli som använder en tjänst som AssistansPlus?

Vad skulle få dig att INTE VILJA använda en tjänst som AssistansPlus?

Har Du några övriga kommentarer?

Tack för din medverkan!
Lantus OptiSet image sequence:
Genotropin MiniQuick image sequence:
Example of the questions that were used in the post-study interview:
(The content varied slightly between subjects as did the actual formulations of the questions).

- Hur upplevde du videokommunikationen – att du kunde se och höra farmaceuten och att han kunde se och höra dig?
- Tyckte du att videobilden var tillräckligt stor – och vad tyckte du om kvaliteten?
- Tycker du att videobilden bidrog till en ökad personlig kontakt?
- Hur upplevde du demonstrationen av läkemedlet med 3D-materialet?
- Hur realistisk tyckte du att 3D-modellen var?
- Hur tyckte du att känslan av personlig kontakt var om du jämför mellan telefontillfället och med AssistansPlus?
- Om du vid telefontillfället hade haft tillgång till läkemedlet och kanske bipacksedeln, hur tror du att det hade påverkat kommunikationen där?
- I AssistansPlus så hade du tillgång till ett delat material – att ni kunde titta och peka i samma material. Detta kan man jämföra med samma material – dvs att var och en har samma material på var sitt håll. Hur tror du att det påverkar?
- Kände du att farmaceuten kunde läsa av om du hade förstått på ett bra sätt – och då vill jag att du jämför igen mellan telefon och AssistansPlus?
- Kände du att farmaceuten kunde uttrycka sig väl - och jämför igen mellan telefon och AssistansPlus.
- Hur naturlig kändes kommunikationen – och jämför igen mellan telefon och AssistansPlus?
- Hur stark var din känsla av närvaro med AssistansPlus – och då får du lägga in din egen tolkning av begreppet närvaro.
- Om känslan av närvaro i den fysiska verkligheten är 100%, vad sätter du för siffra på vad din känsla av närvaro är på telefon respektive AssistansPlus?
- Vilket bidrag tycker du att 3D-modellen gav till känslan av närvaro?
• Kände du dig nöjd med sättet som du kunde vara aktiv och som du kunde vara styrande i AssistansPlus?

• Var det något tillfälle som du kände dig frustrerad över att du inte kunde vara mer aktiv eller styrande?

• Hur tror du att vetskapen om att du kunde gå in och kontrollera materialet påverkade din känsla av närvaro – och då menar jag oavsett om du utnyttjade den här möjligheten eller inte, bara vetskapen om att du hade möjlighet att kunna styra.

• Tror du att det hade höjt din närvarokänsla om du hade varit mer aktiv och styrt mer?

• Tror du att det hade höjt din känsla av personlig kontakt om du hade varit mer aktiv och styrt mer?

• Sista frågan: Om vi delar upp funktionaliteten i tre olika delar och då är den första delen att kunna se och höra varandra; den andra delen är att kunna titta på gemensamt material på webbsidan och att kunna peka med markören; och den tredje delen är allt som har med 3D-modellen att göra. Om du rangordnar de här tre olika delarna, vilken ordning hamnar de då i – och varför?
Johan Ringström: Compiler Generation for Parallel Languages from Denotational Specifications, 1993.
Generations of Parallel Multiparadigm Languages: Combining Object-Oriented and Rule-Based Languages - a Metaprogramming Environment, 1995.
No 742  Pawel Pietrzak: Static Incorrectness Diagnosis of CLP (FD), 1999.
No 766  Martin V. Howard: Designing dynamic visualizations of temporal data, 1999.
No 787  Charlotte Björkegren: Learning for the next project - Bearers and barriers in knowledge transfer within an organisation, 1999.
No 807  Svein Bergum: Managerial communication in telework, 2000.
No 820  Jean Paul Meynard: Control of industrial robots through high-level task programming, 2000.
FiF-a 34  Göran Hultgren: Nätverksinriktad Förändringsanalys - perspektiv och metoder som stöd för förståelse och utveckling av affärsrelationer och informationssystem, 2000.
No 842  Magnus Kald: The role of management control systems in strategic business units, 2000.


Fredrik Elg: Ett dynamiskt perspektiv på individuella skillnader av heuristisk kompetens, intelligens, mentala modeller, mål och konfidens i kontroll av mikrovärlden Moro, 2002.

Peter Bunus: Debugging and Structural Analysis of Declarative Equation-Based Languages, 2002.


Fredrik Elg: Ett dynamiskt perspektiv på individuella skillnader av heuristisk kompetens, intelligens, mentala modeller, mål och konfidens i kontroll av mikrovärlden Moro, 2002.

Per Oscarsson: Redovisning i skuggan av en bankkris - Värdering av fastigheter. 2001.


Fredrik Elg: Ett dynamiskt perspektiv på individuella skillnader av heuristisk kompetens, intelligens, mentala modeller, mål och konfidens i kontroll av mikrovärlden Moro, 2002.

Andreas Borg: Large Vocabulary Shorthand Writing on Stylus Keyboard, 2004.
Ioan Chisalita: Role and Identity - Experience of technology in professional settings, 2005.
He Tan: Aligning and Merging Biomedical Ontologies, 2006.
FiF-a 90 Amra Halilovic: Ett praktikperspektiv på hantering av mjukvarukomponenter, 2006.
FiF-a 91 Hanna Broberg: Verksamhetsanpassade IT-stöd - Designteori och metod, 2006.
No 1293 Jiri Trnka: Prerequisites for data sharing in emergency management, 2007.
No 1356 Erik Kuiper: Mobility and Routing in a Delay-tolerant Network of Unmanned Aerial Vehicles, 2008.
No 1361 Martin Karresand: Completing the Picture - Fragments and Back Again, 2008.
No 1363 Per Nybom: Dynamic Abstraction for Interleaved Task Planning and Execution, 2008.