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Scenarios and investigation of the Anoto technology

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This thesis investigates if the Anoto concept can improve the symptom control within the home health care. It describes the Anoto functionality as well as other digital pen concept.

One part of the thesis compares today's symptom control with the possibilities of the Anoto, fax or PC technologies. Part of the result is three symptom control forms, which can be used by the patients to mediate their symptoms, using the Anoto pen.

The thesis work also includes a usability study, which shows that many patients are able to use the Anoto pen and that several patients are positive towards using a digital pen to fill in symptom control forms.

**Nyckelord** (högst 8)  
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# **Use of digital pen technologies in home health care**

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# Table of contents

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<b>1</b>	<b><i>Introduction.....</i></b>	<b><i>1</i></b>
1.1	Background .....	1
1.2	Purpose.....	2
1.3	Methodology .....	2
1.4	Reader's Guide .....	3
1.5	Glossary.....	3
<b>2</b>	<b><i>Home Health Care .....</i></b>	<b><i>5</i></b>
2.1	Home Health Care Definitions .....	5
2.2	Why Home Health Care .....	6
2.3	Patients .....	6
2.4	Home Health Care in Östergötland.....	6
2.5	Difficulties within home health care .....	7
<b>3</b>	<b><i>The Anoto functionality.....</i></b>	<b><i>9</i></b>
3.1	The Anoto system.....	9
3.2	Applications .....	9
3.3	The role of Anoto.....	11
<b>4</b>	<b><i>The Anoto Technology.....</i></b>	<b><i>13</i></b>
4.1	The Anoto pen .....	13
4.2	The Anoto pattern.....	15
4.3	The Anoto functionality.....	15
<b>5</b>	<b><i>Competing Technologies.....</i></b>	<b><i>19</i></b>
5.1	Accelerometer-based pen .....	19
5.2	External Global Positioning System.....	19
5.3	Digital notepads .....	20
5.4	Conclusions .....	20
<b>6</b>	<b><i>Competing products.....</i></b>	<b><i>21</i></b>
6.1	ThinkScribe – digital notepad (IBM).....	21
6.2	IPen (Inductum) .....	22

6.3	Virtual Pen (GOU Lite).....	23
6.4	E-pen (InMotion) .....	24
6.5	N-scribe (Digital Ink).....	25
6.6	Compupen (Pen2Net).....	26
6.7	Conclusions .....	26
7	<i>Symptom control in palliative care</i> .....	29
7.1	Symptom Control at LAH today .....	29
7.2	Symptom control with the Anoto functionality .....	31
7.3	Symptom control with Fax technology .....	34
7.4	Symptom control with PC technology .....	34
7.5	Conclusions .....	35
8	<i>Usability study</i> .....	37
8.1	The design of symptom control forms .....	37
8.2	The study .....	39
8.3	Result.....	40
8.4	General observations at the usability study .....	42
8.5	Conclusions .....	43
9	<i>Discussion</i> .....	45
9.1	Future work .....	45
9.2	Summary.....	47
10	<i>References</i> .....	49
	<i>Appendix</i> .....	51

# 1 Introduction

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This Master's thesis documents the work that was done as a degree project in Medical Informatics at the Department of Biomedical Engineering, Linköping University.

The work presented in this thesis is a part of the "Advanced Home Health Care Environment" research project. During 2000-2001, a research group from the Department of Biomedical Engineering / Medical Informatics at the University of Linköping participated in the SITI<sup>1</sup> program "E-society: Electronic Markets and Public Services" within this project.

Several problem areas or dilemmas in home health care were identified in the project. One of these areas – symptom and status assessment of patients at home – was chosen as the focus of further work in the project.

## 1.1 Background

In this section the background to the *Anoto* concept and home health care is briefly described.

### 1.1.1 The Anoto Concept

The *Anoto* concept enables people to send handwritten notes to a computer or a mobile phone. *Anoto* AB in Lund developed the concept, which is based on a unique pattern on regular paper and a digital pen filled with high-technology components.

The technology allows handwritten notes to be digitally sent and stored and lets users send e-mail and SMS messages, for example, by using only pen and paper as an interface.

### 1.1.2 Home Health Care

Today, more patients are being treated and cared for in their own homes. *Advanced home health care* provides care for people who would otherwise be treated in a hospital.

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<sup>1</sup>SITI - the Swedish Research Institute for Information Technology

Treatment outside of a hospital puts more strain on the communication between patient and caregiver. Symptom control, which involves assessing and being aware of the symptoms as well as controlling them, is sometimes a problematic domain in home health care. The caregiver mostly performs symptom assessment during health care visits in the patient's home, for example by discussing the symptoms in question. Some patients, such as those who do not receive health care visits very often, could benefit from a more frequently performed symptom assessment. Also, even for patients who get frequent and regular visits from caregivers there may be a need for IT-support in the area of symptom assessment. Therefore a complement could be useful.

## 1.2 Purpose

The purpose of this thesis is to investigate if the *Anoto* concept can improve symptom assessment within home health care. This includes:

1. Gathering information about the *Anoto* functionality and technology.
2. Comparing the *Anoto* technology with other similar technologies and products. The different products will be compared with respect to application areas, technology and market.
3. Analysing how the *Anoto* functionality could be used within home health care in order to improve symptom assessment. In addition, a comparison between the usability of the *Anoto*, fax and PC technologies, and the advantages and disadvantages of each alternative.
4. Designing symptom assessment forms that can be used together with the *Anoto* pen.
5. Performing a usability study to evaluate if patients can handle an *Anoto* pen and understand and use the symptom assessment forms.

## 1.3 Methodology

This thesis is based on a literature study, visits to LAH (lasarettansluten hemsjukvård/Hospital-Based Home Care) in Linköping, which is an advanced home health care organization, and a usability study. The literature consists mainly of books describing home health care and material published on the Internet about the *Anoto* functionality and other competing products. Also, *Anoto* AB has provided detailed information about their concept.

When visiting LAH I have had the chance to discuss symptom assessment and other home health care topics with doctors, nurses and other caregivers. During a period of several days I was also able to accompany both doctors and nurses working with palliative patients. During the visits I was in contact with between 15 and 20 patients suffering from severe cancer who were being treated in their own homes.

The last part of the thesis consists of the usability study, which was performed by letting patients use an *Anoto* pen to fill in the symptom assessment forms.

## 1.4 Reader's Guide

This thesis covers issues in both technological and medical domains, and the intention has been to write so that people working in either of these fields will understand the main contents. However, for more in-depth understanding when reading this thesis, the reader should have some basic knowledge about information technology.

The following is a short description of the chapters in this thesis:

- Chapter 2** introduces the home health care concept and some of its dilemmas.
- Chapter 3** presents the *Anoto* functionality and the application areas that the *Anoto* system enables.
- Chapter 4** describes the technology behind the *Anoto* functionality.
- Chapter 5** provides information about other technologies that use a pen as an input device.
- Chapter 6** presents other products that can compete with the *Anoto* functionality. The products are described with a focus on the following aspects: application areas, technology and market.
- Chapter 7** defines symptom assessment and describes how it is performed today in home health care. The chapter also discusses how symptom assessment could work with *Anoto*, fax and PC technologies.
- Chapter 8** presents a usability study that was performed to evaluate if patients could handle an *Anoto* pen and the forms. This chapter also presents the results of the study.
- Chapter 9** summarizes the previous chapters and discusses possibilities for further work.

## 1.5 Glossary

ESAS	Edmonton Symptom Assessment Scale
LAH	Lasarettansluten hemsjukvård/Hospital-Based Home Care – a home health care organization
PLS	Paper Look-up Service
SITI	the Swedish Research Institute for Information Technology
VAS	Visual Analogue Scale

Palliative care – supportive care; care without the possibility of cure because of the patient's state of health. Often, but not necessarily, a palliative patient is in a terminal stage, that is, at the end of life



## 2 Home Health Care

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Home health care is an important part of the Swedish health care system, especially when it comes to care of elderly and very sick patients. The objective of the home health care is to offer skilled medical service in the patient's home environment [1].

### 2.1 Home Health Care Definitions

The WHO (World Health Organization) defines home care as “the provision of health service by formal and informal caregivers in the home, in order to promote, restore and maintain a person's maximal level of comfort, function and health including care toward a dignified death” [2].

Another definition of home health care is “medical service, that operates in the home of the patient, with or without participation from relatives and with professional support from the local hospital or other caregiver” [3].

In Sweden, home health care is divided into two areas, advanced home health care and basic home health care, with the following characteristics [4]:

Advanced home health care:

- is directed by a physician
- is team-based
- provides the possibility of care 24 hours a day
- is based on care that often makes use of advanced medical technology

Basic home health care:

- is directed by a nurse
- is carried out by caregivers who work alone
- encompasses day care
- makes use of little or no medical technology

Hospital based home care is one organizational form of advanced home health care where the only option would be to care for the patient in a hospital.

## *2.2 Why Home Health Care?*

The main reasons for treating and caring for patients in the home are [5]:

- Their own wish to be treated and cared for in their own home.
- The technical possibilities of offering highly skilled health care outside the hospital have increased.
- Experience shows that sick people feel better and recover faster in their own home environment.

## *2.3 Patients*

In many cases home health care is a humane alternative to traditional health care, but it should always be based on the patient's free will [1]. Patient groups that can receive skilled home health care are for example:

- Cancer patients
- Patients with disabilities (often along with long-term illnesses e.g. Parkinson's disease or multiple sclerosis).
- Patients whose state of ill health requires active rehabilitation in a home environment.
- Asthmatic patients and patients with respiratory insufficiency.
- Patients with serious heart problems.

These patients can be in a palliative state and palliative patients probably comprise the largest care group in advanced home health care. The WHO states that palliative care is the active total care of patients at a time when their diseases are no longer responsive to curative treatment and when control of pain, or control of other symptoms, is of great importance. The overall goal for palliative care is the highest possible quality of life for the patient, and a strong emphasis on relief from pain and other distressing symptoms [6].

## *2.4 Home Health Care in Östergötland*

One home health care organization in the county council of Östergötland is LAH in Linköping, which is a Hospital-Based Home Care organization that performs advanced home health care. This study focuses on LAH activities in Linköping.

LAH in Linköping consists of three fields of activity within the area of home health care [7].

- The palliative area is the largest and comprises 50 to 70 patients at a time. Most of the patients are gravely ill with cancer.
- The acute area cares for many patients with heart disease, usually around 15 to 25 at a time.
- The rehabilitation area cares for 20 to 30 patients per day.

LAH in Linköping also comprises a nursing ward with eight beds.

There are other organizations in Östergötland that also carry out home health care, e.g. municipal home health care. Several organizations can provide care and treat a patient at the same time. For example, LAH could be in charge of advanced health care while the municipality handles basic health care [4].

## *2.5 Difficulties within home health care*

In Sweden, as in most Western countries, there are certain dilemmas within home health care organizations [4]. More patients and sicker patients receive care in their homes today and, consequently, there is a need for improved symptom and status control. Also, patients often have different care providers at the same time, which implies a need for improved co-operation between caregivers within the different home health care organisations.

Communication and symptom assessment are areas that may possibly be improved through the use of a technology that shortens the logistics flow such as, for example, introduction of digital pens.



## 3 The Anoto functionality

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*Anoto* AB, hereafter called *Anoto*, was established in December 1999 in Lund, Sweden, and is a subsidiary of C Technologies. The company has combined a digital ballpoint pen with communication-friendly digital paper that enables users to send both handwritten text and drawings wireless from wherever they are to any computer in the world. The *Anoto* products do not require any computer skills from the user, and since only a pen and paper are required, almost everyone can use it. The main reference for this chapter is the website <http://www.anoto.com> [8].

### 3.1 The Anoto system

With the *Anoto* pen the user can send handwritten notes to a computer or a fax machine, for example. The pen sends messages via a Bluetooth wireless link to a mobile phone, which relays the messages to the Internet for further handling. Everything that is written is time stamped and can be encrypted. The technology that makes this possible consists of three parts: a special pattern printed on a paper, the *Anoto* pen and a Service Infrastructure.

The pen works like a regular ballpoint pen but is slightly larger than a normal pen. It is filled with high-technological components such as a camera, a processor and Bluetooth technology for wireless transformation. The paper, called digital paper, contains small dots that are printed in a unique pattern. The user can use the digital pen like any ordinary pen without understanding the technology behind it. Therefore only a short learning period is needed before using the *Anoto* products, especially when compared with other hi-tech products available today.

### 3.2 Applications

The *Anoto* system is basically an input system that uses a special pen and ordinary paper, pre-printed with a dot-pattern. The applications that the system enables are huge, but can be divided into three major groups: analogue output applications, communication applications and paper-based e-services applications.

#### 3.2.1 Analogue output

Analogue output applications involve using the pen and the paper mainly as an input device to the user's computer or mobile phone. This type of application corresponds to the personal use of the digital pen.



*Figure 1 - You to yourself*

Text or drawings in notepads can be transferred exactly as they were written via Bluetooth and a mobile phone to a computer. Different “text boxes” can be presented on the digital notepads to initiate certain actions needed for the notes. For example, when the user has written his notes, he ticks in the send box and the box initiates the action for sending the notes to the user’s computer.

### 3.2.2 Communication

The digital pen and digital paper can be used for global communication. The input from the digital pen can be transformed to a fax message, e-mail or a short message to a mobile phone.



*Figure 2 - You to someone else*

Applications for communication require access to the Internet. The digital paper can be prepared as forms for sending e-mail or short messages to mobile phones. There can be entry fields for block letters on the paper that can be used for writing the receiver’s address.

### 3.2.3 Paper-based e-services

Paper-based e-service applications include electronic payment, advertisements, menus and order forms.



*Figure 3 - You to an organization*

One example of a paper-based e-service application is an advertisement in a magazine combined with an order form. If part of the order form is printed on the *Anoto* pattern, the user can request more information by stating his address and ticking in a special box, which tells the pen to send a request to the owner of the advertisement.

### 3.3 The role of Anoto

When writing on the digital paper, the pen uses the camera to see the dots and locate the exact position of the pen. As the user writes on the patterned paper, the pen records the movements and creates a digital trace. When ready, the information is sent from the digital pen to a Bluetooth device. The device, such as a Bluetooth phone, relays the information to a Gateway.

The Gateway, a server on the Internet, sorts the information, establishes what to do with it and where to send it. For the recipient, it is like receiving any other message on the computer, mobile phone, etc.

*Anoto* contributes to the whole system with the special pattern and the digital pen technology. The company also provides the system with a Service Infrastructure, termed Paper Look-up Service (PLS), to ensure that all information originating from digital pens and *Anoto* patterned paper gets routed to the appropriate service provider.

*Anoto* does not produce the digital pens or the paper products. Their intention is to create a global standard for digital paper based on the *Anoto* functionality in close cooperation with several partners.

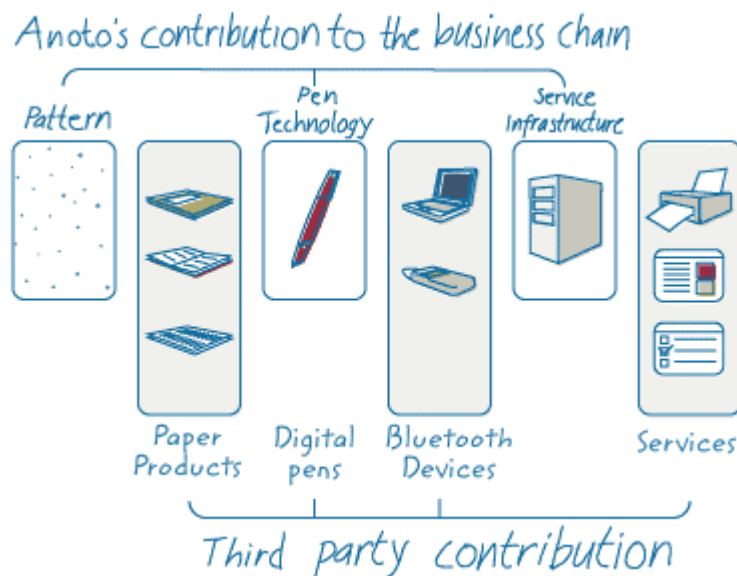


Figure 4 - Contributaion

Typical partners of *Anoto* are paper producers, pen licensees, and service providers. The paper producers design, manufacture and sell the paper. The pen licensees buy a license to produce, market and distribute digital pens. The service providers provide the end-user with service.



## 4 The Anoto Technology

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*Anoto* has developed a digital pen technology that consists of digital paper, a digital pen and a Service Infrastructure. The digital paper is ordinary paper with the special *Anoto* pattern printed on it, and when writing on this pattern, the digital pen creates a digital copy of the written information. The information is stored in the pen until a “send” box is ticked and the information is forwarded to a mobile phone via a Bluetooth transceiver. The task for the infrastructure service is to make sure that the information gets to the right place [8].

### 4.1 The Anoto pen

The digital pen looks like an ordinary ballpoint pen and is used in the same way. The pen is activated when the cap is removed, and deactivated when the cap is replaced again. It consists mainly of a digital camera, an advanced image-processing unit and a Bluetooth transceiver. The pen also holds a pressure sensor, an ordinary ink cartridge so that the user can see the written information, and a memory that can store several fully written pages.

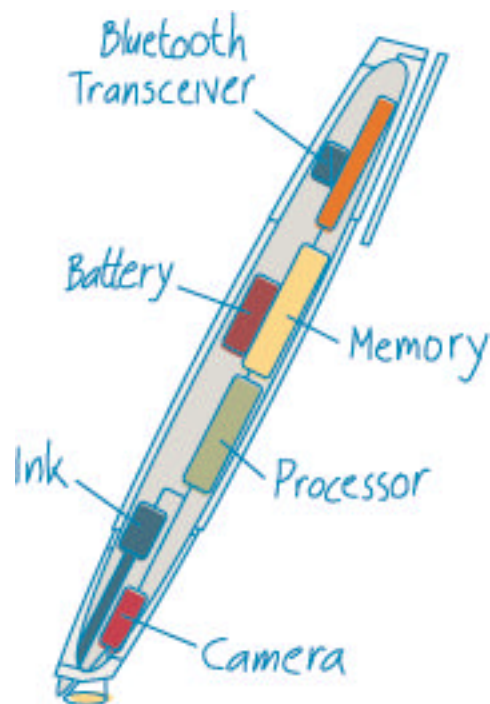


Figure 5 - The Anoto pen

#### 4.1.1 The camera

The pen uses the camera to take digital snapshots of the pattern so the pen can calculate its own position in the entire *Anoto* pattern. These snapshots are taken 50-100 times per second and infrared lights are used to make the dots visible to the digital camera.

The *Anoto* pattern is printed with carbon-based black ink, and the infrared light interacts with the carbon-based dots. The ink from the pen is not visible to the camera; its only function is to make written text visible to the human eye. This means that it is possible to write on the same piece of the paper over and over again without destroying the digital pattern.

#### 4.1.2 The image processor

Besides calculating the pen's position, the processor is used for gathering and storing information about the angle between pen and paper, the turning of the pen, and the pressure against the paper. For each snapshot an accurate timestamp is collected. All data from the image processor are packed and stored into the memory.

#### 4.1.3 The Bluetooth transceiver

To send the stored information, a Bluetooth transceiver is used. With Bluetooth the data can be forwarded via a mobile phone or a PC to the Paper Look-Up Service and to the application defined by the pattern used.

A transmission of information from the pen is initiated when the pen ticks a predefined area called "magic box". All the data is sent as an http-request, and each sample includes information including coordinates (x and y on the pattern), timestamp, tip pressure and the angle between the pen and the paper.

## 4.2 The Anoto pattern

The *Anoto* pattern, printed on ordinary paper, works as an input device for the *Anoto* system. The pattern consists of small dots that are barely visible to the eye; the pattern is perceived as a slightly off-white colour. A small number of dots uniquely define the position in the full pattern, and the full pattern area comprises about 60 million km<sup>2</sup>, which corresponds to an area equivalent to that of Asia and Europe.



Figure 6 - The Anoto pattern

The pen can recognize some parts of the pattern, called Special Function Pattern, directly. This pattern is reserved for special functions signifying that a special action is to be performed, such as sending the information. When the user writes on the paper, every line is stored in the pen until the “SEND” box is ticked. Then the information is sent off as an email or stored in a computer or some other application to which the Special Function Pattern refers.

Almost any paper can be used together with the *Anoto* pattern, and the pattern can be used in catalogues, magazine, calendars, diaries, etc. The paper can be in any desired size or shape depending on its intended use. Any colour except carbon-based black ink can be used to print on top of the *Anoto* pattern without disturbing the function of the digital pen.

## 4.3 The Anoto functionality

When the *Anoto* pen is ready to send the stored information via Bluetooth, the information takes a direction over the Internet via a mobile phone. In the future the information will probably choose between two directions. One is the direction described above while the other direction is directly to a local recipient such as a nearby computer

### 4.3.1 Sending information over the Internet

Sending information over the Internet is made possible by the Paper Look-up Service (PLS), which includes the servers that are the centre for the *Anoto* functionality. The PLS makes sure that the information from the digital pen is routed to the correct service provider. The information sent to the PLS includes only information about the receiver, while the written information stored in the pen goes directly to the current application or service provider.

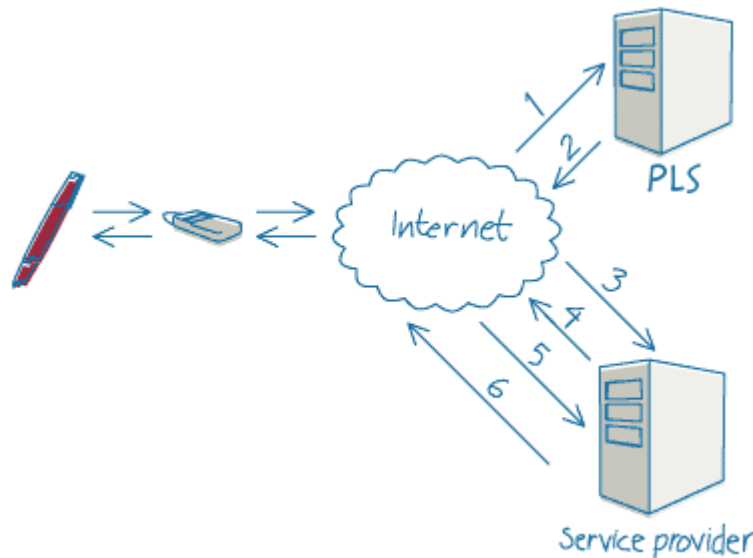


Figure 7 - Sending information over the Internet

The step-by-step operations are:

1. The information (Pen ID, x, y-coordinates) is forwarded via a Bluetooth device, such as a Bluetooth mobile phone. The phone relays this information to the Paper Look-up Service via Internet.
2. The Paper Look-up Service instructs the pen to contact the service provider's name server.
3. The information (Pen ID, x, y-coordinates) from the pen is sent to the provider's name server.
4. The provider's name server instructs the pen on what data to send, how to format and tag that data and where (to which service handler) to send that data.
5. Data is sent to the service handler.
6. "OK" is sent back to the pen, clearing the area

### 4.3.2 Information directly to a computer

Using the *Anoto* pen as input device to a nearby computer is an example of a local application. When the user ticks the appropriate check box, the information is directly transferred to the computer via the Bluetooth transceivers in both the pen and the computer.

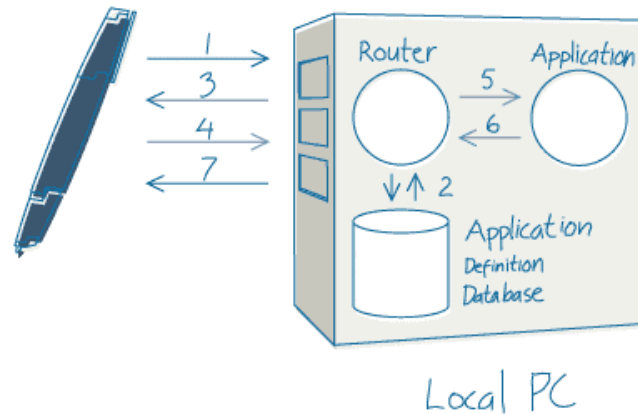


Figure 8 - Information directly to a computer

The steps in the operations to a local computer are:

1. Data (Pen ID, x, y-coordinates) from the digital pen is sent to the computer.
- 2 - 3. The software together with the Application Definition Database gives instructions to the pen on what data to send, how to format and tag the data, and to which local application to send the data.
- 4 - 5. Pen-stroke information, together with information about the local application, is sent to the local application that handles the request.
- 6 - 7. "OK" is sent back to the pen, clearing the area.



## 5 Competing Technologies

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There are a variety of techniques that use a pen as an input device to computers, mobile phones, etc. There is no other technique with the exact same features as those comprising the *Anoto* technology, although several perform some of the same functions.

Some of the technologies competing with *Anoto* consist of a digital pen that works like an ordinary ballpoint pen. This category includes the accelerometer-based pen technology, technologies that use the external Global Positioning System (GPS), as well as several other technologies [9].

There are also technologies that do not consist of a ballpoint pen but that can nevertheless compete with the *Anoto* technology in some areas that could be of interest to home health care. One example is digital notepads.

### 5.1 Accelerometer-based pen

An accelerometer-based pen uses a mechanical accelerometer to measure and interpret the pen's movement. This technology is still in a research phase, but the intended function is to allow the user to take notes as usual while the pen stores the notes digitally for transmission, for example, to a computer. The pen can be equipped with some kind of display or screen for optical feedback [9].

When the user writes on a piece of paper, a spatial-sensing device detects the pen movements that form letters and converts them into text. A pen based on accelerometer-based technology can usually store several pages locally before transmitting the information to a computer or some other computer device. The pen works by measuring its movements and matching these movements to the movements that produce letters, which are programmed in the pen memory. This technique does not require any digital paper and it allows the user to transfer what he/she has written with the pen regardless of where or on what the information is written.

### 5.2 External Global Positioning System

One major technology for tracking a moving object in 2-D space without a digitising tablet is the external Global Positioning System (GPS). This system can track the absolute position of an object, but requires an external system and a predefined working area [9].

The GPS can be implemented with numerous technologies; the simplest one is the Mechanical Tracking System. This technology links a pen to a reference point,

like a paper clip, via a physical link. The goal is to achieve a 0.3-mm resolution without a digital surface and without making the physical link an obstacle to free and comfortable handwriting. The writing is done with a ballpoint pen and allows the user to write on plain paper.

Another way to implement the GPS is with acoustic technology. This technology is based on measuring the time it takes for a sonic impulse to travel from a sound generator to a receiver (microphone), so that the distance can be calculated. By positioning two microphones on the drawing area, the two-dimensional area of the stylus can be calculated. A problem with this method is that echoes of the sound signal can be reflected and cause reception of “ghost” pulses by the receiver.

### 5.3 Digital notepads

Digital notepads can be differentiated from the previously described technologies in that it is the notepad and not the pen that bears the intelligence. Digital notepads can be divided into Electromagnetic Systems and Radio Frequency-based Systems (RF-based System). The first system uses LCD screens, where a stylus is used for handwriting directly on the display. Electromagnetic Systems are used, for example, in the PDAs [9].

RF-based Systems use a digital pen equipped with a radio frequency (RF) transmitter. The user writes on standard paper with a pen that transmits to a digital notepad underneath. The signals from the pen are stored as digital notes in the memory of the pad. When changing to a new digital paper, a “page change” button is pressed. Notepads can often store more pages of handwritten notes than digital pens before transmitting them to a computer.

None of the notepad systems has been successful. One disadvantage of the RF pen is that it has little feedback. If the user changes to a new page on the paper pad, the user must also tell the device by tapping a button. If that is forgotten, all the digital notes may end up as one page, which could be difficult to understand.

### 5.4 Conclusions

The main difference between the *Anoto* digital pen and the pens that are based on accelerometer-based technology or the external Global Positioning System is that the latter group of pens does not require any special paper and the user can freely write on anything. This could be seen as an advantage, but it is also the main weakness of these types of pen technologies. The paper has no “intelligence”, and the paper cannot perform any of the functionalities, such as sending email, that the *Anoto* digital paper is able to do.

The *Anoto* digital pen works in any environment, while this could be a problem for the accelerometer-based pen when, for example, the user sits in a vehicle that is accelerating or making quick turns.

One weakness of the digital notepads could be size. Besides carrying around a pen, and for some systems paper, the user must carry the notepad.

Electromagnetic Systems do not need a normal pen and paper, but they can be difficult to use since the writing is done in a special way that could be hard to learn.

## 6 Competing products

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This chapter describes products that can compete with the *Anoto* products in some way that will be of interest to LAH.

The competing products are described based on the following aspects: applications areas, technology and market. The products are also compared with the *Anoto* products. Information about the *Anoto* products can be found in chapters two and three.

### 6.1 *ThinkScribe – digital notepad (IBM)*

In February 2001 IBM (International Business Machines) launched a new version of its portable computer ThinkPad TransNote, together with the notepad ThinkScribe, which can process handwritten notes and save them in the accompanying computer. The digital notepad ThinkScribe is linked to the computer and stored in a briefcase. The notepad is also supplied with a “digital” pen [10].



*Figure 9 - ThinkScribe TransNote*

ThinkScribe allows the user to transfer notes to the computer and forward them to other computer users. The user writes notes on normal paper, which is laid on top of the writing plate, and the notes can therefore also be saved in paper form.

The notepad ThinkScribe together with the portable computer weighs 2.5 kg and costs around SEK 30 000.

#### 6.1.1 Application areas

The main application area is transferring handwritten information from paper to a computer. With a pre-installed software package, InkManager Pro, the information can be organized and searched. Data can also be stored as subject, name or date. The user can share notes and sketches with other users by dropping them into e-mail, word processing documents or presentations. The ThinkPad TransNote can also be used to fill out customized forms, but that requires software from a third-party solution provider.

### 6.1.2 Technology

ThinkScribe is a digital notepad connected to the computer ThinkPad TransNote. The computer is supplied with a digital pen that contains a radio-transmitter. When writing with the pen, the transmitter sends a signal to the digital notepad and the position of the pen is calculated. The information is stored in the notepad until the computer is switched on, and then it is automatically transferred over to the computer. The memory can contain 50 pages of information before having to be emptied.

### 6.1.3 The market

IBM expects to sell their portable computer with the digital notepad to people who prefer writing by hand rather than using a keyboard. The target groups are bank and insurance officials, journalists, and science and technology students (students who use many symbols that are difficult to write with a normal keyboard).

### 6.1.4 Comparison with Anoto

The ThinkPad TransNote with the digital notepad ThinkScribe can compete with *Anoto* products when it comes to digitising and storing handwritten text and pictures. A disadvantage of the ThinkPad is that it weighs 2.5 kg and needs a computer to store and send information. The IBM solution is therefore more cumbersome than the *Anoto* solution. The *Anoto* paper will also offer more functions than IBM, such as e-commerce and communication solutions.

## 6.2 IPen (*Inductum*)

Inductum, a Swedish company, has created a pen, IPen, that converts handwritten text into digital code. The pen works on any paper, and the main functionalities of the pen are text, drawings, mouse-compatibility, direct printout via a laser printer and e-mail. The company applied for a patent for its product in the autumn of 2000 [11].



Figure 10 - IPen, with the lid, the interchangeable nib and the pen body

### 6.2.1 Applications

The pen nib on the IPen is interchangeable, and the pen can be used as a graphite pencil, ballpoint pen or whiteboard pen. Applications include writing notes at meetings, lectures or interviews. Intuctum's intention is for IPen to be used for signing over the Internet.

### 6.2.2 Technology

The IPen is based on accelerometer technology, and the pen consists of a pen lid and a pen. When writing on paper, the lid is connected to the paper so it can determine the position of the pen. It is the movement of the pen in relation to the

lid that assures a correct reproduction of the notes. If there is no reference point (lid), the pen will store the movements in chronological order.

The IPen is activated when the lid is removed, and the movement is stored digitally when the nib touches the paper. The sensor for measuring the movements is an accelerometer, and when the pen is activated it communicates with the pen lid.

### 6.2.3 The market

There is almost no information available about Inductum's plans for marketing, but it seems that the pen can be used for basic areas such as e-mail and SMS. It also seems as if the IPen not is a product that is ready for the market. The pen is limited to the function contained in the pen, and any new function requires a new version of the pen.

### 6.2.4 Comparison with Anoto

Unlike the *Anoto* pen, the IPen works on any paper. The problem with IPen is that the pen can reproduce written text as a digital copy, but as the paper has no information about the context, the user himself has to give this information to the pen. Without instructions from the user, the pen has no idea what it is doing and there is a significant risk that the system and the user will have different perceptions of what is happening.

## 6.3 Virtual Pen (*GOU Lite*)

GOU Lite, a company with its head office in Israel, is developing a digital pen called Virtual Pen or VPen. The pen works like an ordinary pen and can transmit writing, drawings and email from any surface directly to a mobile phone, PDA or PC. VPen is expected to be on the market in the beginning of 2002 [12].

### 6.3.1 Applications

The main application of the VPen is to write and transform text into a digital form, send e-mail and SMS, and access websites. It can also be used as a mouse to control the user's movements around a computer screen, and for digital signatures.

### 6.3.2 Technology

The VPen is based on the Optical Translation Measurement (OTM), which is a technology that measures the relative movements between an OTM sensor and an object moving in front of its optical apertures. A digital pen can use the OTM component to measure the movement of the pen tip in relation to the surface, and send the information using Bluetooth technology to a computer. The technology has not been tested, and it is therefore difficult to determine how well a digital pen using OTM will work in practice.

### 6.3.3 The market

GOU Lite is planning to expand into Europe, and will soon be establishing an office in one of the Nordic countries. Operators and mobile phone manufactures are considered to be the principle customers.

### 6.3.4 Comparison with Anoto

It is difficult to evaluate the technology and functionality of the VPen because of the lack of information. How well the VPen will work in practice is still not clear to outsiders.

The function of the VPen is claimed to be the same as the *Anoto* function. One of the advantages with the pen is that it will work on any surface and does not require any special paper, but it is still unclear how GOU Lite will replace the information contained in the *Anoto* paper without burdening the pen or the user with far too many settings and function options.

## 6.4 E-pen (*InMotion*)

The E-Pen system, created by the Israeli-owned company InMotion Inc., captures the user's handwriting and converts it into a digital form. The electronic E-Pen is a patented product containing two components, a receiver module and the pen itself. The pen does not require any special paper in order to function and is expected to cost around SEK 2 000 [13].

### 6.4.1 Applications

The E-Pen makes it possible for the user to convert handwritten text into a digital copy. The receiver module can be connected to a computer, a PDA or a mobile phone, and functions together with products from PALM, Nokia and Samsung. Apart from saving handwritten notes digitally, the E-Pen allows the user to send handwritten text as e-mail, fax or SMS.

### 6.4.2 Technology

The receiving module functions as a measuring device, and it is fastened to the top of the paper on which the user writes. The e-pen uses an external Global Positioning System to register and save movements. When writing, the pen transmits an infrared light that is registered by the sensors in the receiver. The receiver contains a microprocessor that processes the information and converts it into digital form, and by connecting the receiver to a computer the information can be forwarded digitally.

### 6.4.3 The market

InMotion believes that the biggest market for E-pen is the Asian market. The reason for this is that the digital pen system can offer Asian users the ability to continue with their natural writing habits in their native language when interacting with a PC. InMotion claims that the E-pen can be customized for various applications and vertical markets depending on the needs.

#### 6.4.4 Comparison with Anoto

Like other digital pens that do not rely on special paper to operate, all information concerning function and context has to be in the pen or in the measuring device. Providing the pen or receiver module with information makes heavy demands on the user.

### 6.5 *N-scribe (Digital Ink)*

The only product produced by the US company Digital Ink is the digital pen N-scribe. This consists of an electronic pen and a pen case, which works as a measuring instrument. Like most digital pens, N-scribe converts handwritten text into a digital code, and the pen does not need any special paper. Digital Ink is planning to launch N-scribe the last quarter of 2001 and to charge around SEK 3 000 for the product during the launching time, but after that a price around SEK 1 000 is recommended [14].



*Figure 11 - N-scribe*

#### 6.5.1 Applications

Sending e-mail and faxes and saving handwritten notes digitally are the main application areas of the N-scribe.

#### 6.5.2 Technology

N-scribe uses a Global Position System. The pen case contains a microprocessor that processes the information and converts it into digital codes corresponding to the pen's movement. The information is stored in the pen case as jpg or pdf images, and can be sent to a computer via an IR port for further distribution.

#### 6.5.3 The market

Digital Ink plans to license and sell its technology to a variety of strategic partners. They are also planning to create specialized products for markets such as health care, education, consumers and entertainment.

#### 6.5.4 Comparison with Anoto

N-scribe has the same problem as other digital pens like the Ipen and the E-Pen that do not depend on special paper.

## 6.6 Compupen (*Pen2Net*)

The company Pen2Net has developed a digital pen concept, Compupen, which digitises handwritten information. Compupen comes in three different variants: MediPen, SciPen and NotePen. The pens work independently of the surface area and are used in almost the same way as traditional pens. They are equipped with a display, menus and command buttons so the user can supply the pen with information about the context of the text. Without instructions, the pen digitises the information in chronological order [15].

### 6.6.1 Applications

The three different pens from Pen2Net have different areas of application. MediPen is intended to be used by doctors and other hospital personnel for writing prescriptions and medical notes, etc. SciPen can be used by engineers and researchers for report writing and drawings. NotePen is intended for writing such things as study notes. The written information from all pens can be sent to other users in the form of fax, SMS or email.

### 6.6.2 Technology

Pen2Net states that in a previous phase the pens were based on accelerometer-based technology, but this technology was rejected in favour of an optical technique, which (just like the *Anoto* technique) photographs and recognizes different fields of the document after the user has fed the pen with information about the context. It is hard to evaluate this technology because the company fails to explain how recognition of the different fields is possible.

### 6.6.3 The market

Pen2Net is focusing on three business categories, one for each pen. MediPen is intended for healthcare, SciPen for research, and NotePen for education.

### 6.6.4 Comparison with Anoto

Pen2Net sees itself as a strong competitor to *Anoto* in the areas of health care, research and education. It is hard to say if that is true because of the lack of information about the technology. One disadvantage with the Compupen system is that it requires a lot of information about the context from the user, and providing the pen with this information demands much from the user.

## 6.7 Conclusions

All the previously described products can compete with *Anoto* in the area of transferring handwritten information from paper to a computer. The products differ concerning the technologies they use and the features the products provide to the users.

The main advantage of the *Anoto* system is the special paper. With this paper the *Anoto* system provides the user with features that most of the other products are not capable of, e.g. paper-based e-commerce and the ability to fill in customized forms. In addition to the previously described features, the digital paper also enables the *Anoto* pen to calculate the pen's own position in the entire pattern.

Digital pens that do not rely on special paper, e.g. IPen, E-pen and N-scribe, must let all information about the functions and the context be in the pen or possibly in a measuring device. The user must provide the pen with information, and this makes heavy demands on the person using the pen. If the user does not instruct the pen, there is a risk that the system and the pen have different perceptions of what is happening. This kind of digital pen is probably not as user-friendly as the *Anoto* digital pen, as the digital paper in the *Anoto* system helps the user to carry out certain actions like sending e-mail.

The digital notepad ThinkScribe has many features, e.g. it can be used to fill in customized forms, but the weight and size make it cumbersome to use compared to the *Anoto* system. This is especially true if the user is going to use the notepad in different places or does not have the space or need for the whole computer.

The functions of the VPen and the functions of the Compupen are claimed to be the same as the functions of the *Anoto* products. Both pens will work on any surface and do not require any special paper. Because of the lack of information about the technologies, it is difficult to evaluate the pens' functionality, and it is unclear how GOU Lite and Pen2Net will replace the information contained in the *Anoto* paper without burdening the pens or the users.



## **7 Symptom assessment in palliative care**

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The aim of palliative care is to alleviate as many of the patient's symptoms as possible, and in that way provide "the best quality of life" for patients and their families [16]. To achieve this goal, the doctor must have precise knowledge about the patient's condition and needs. If a symptom is not mentioned to the doctor, it is unlikely to be treated. Therefore, good symptom assessment is one of the most important components of delivering effective care to palliative patients [17].

Usually a doctor collects information about the patient's symptoms when talking to the patient, relatives or the patient's other caregivers. Another way to measure symptoms is to use a symptom questionnaire, for example the Edmonton Symptom Assessment Scale (ESAS), which is a validated, reliable instrument for measuring nine different symptoms [17]. The ESAS can be used to compare symptoms in the same patient during different time periods or to compare symptoms in different patients.

The ESAS consists of nine 100-mm visual analogue scales (VAS), which correspond to the following symptoms: pain, activity, nausea, depression, anxiety, drowsiness, appetite, sense of well-being, and dyspnoea (shortness of breath). The patient rates his/her symptoms on the visual analogue scale, with a higher score for a symptom indicating a worse condition. The scales are anchored by words such as: "No pain – Severe pain" and "Very active – Not active" [17]. If the patient is too debilitated to complete the form, a nurse or possibly a relative can assist the patient. The ESAS allows a rapid assessment of multiple symptoms, fast interpretation, and improved continuity of care when different health professionals care for the patient over time.

### ***7.1 Symptom assessment today at LAH***

Today the caregivers at LAH in Linköping have several ways of performing symptom assessment. The most common are:

- The patient informs the doctor or nurse about the symptoms during health visits in the patient's home. LAH caregivers visit the patient both on a regular basis and when the patient has an acute need for medical care.
- The patient can telephone LAH around the clock and inform the personnel about new or aggravated symptoms.
- A third party, e.g. relatives or other caregivers, can inform LAH about the patient's condition and symptoms when the patient is not able to do so himself/herself.

The symptom assessment described above is done regularly and often in LAH, but LAH has also tried other methods for finding out about patients' symptoms such as a special pain record and the ESAS.

For some patients who experience pain problems, a special pain record ("Smärtjournal" in Swedish) is used. The pain record consists mainly of a pain analysis, for which the patient's doctor is responsible. In the record, the doctor writes where the pain is located, what kind of pain it is, the cause of the pain, and what kind of measures to take against the pain. The pain record also consists of a follow-up of the patient's pain. In the follow-up sheet the new pain situation is assessed to see if it is different than it was the previous time.

LAH's goal for patients with severe pain is that a pain analysis should be performed and treatment begun within 24 hours after the patient has contacted LAH. The follow-up should be within one to two days after the first treatment. Patients with moderate pain should have the pain analysis and treatment within two or three days, and the follow-up within three days after the first treatment. For all patients who have undergone pain analysis regularly, follow-ups should be done even if the pain decreases. Unfortunately this is not always done due to a lack of time. The pain record is used so the doctors can follow the patient's pain over time and be able to evaluate whether or not the medical measures have had results.

As a trial, LAH let some patients fill in the ESAS (Edmonton Symptom Assessment Scale). The intention was to let the patients fill it in on a regular basis, but this has been done with very few patients. The values from the ESAS forms can be entered by hand in the diagrams so the doctors can easily see how the values differ over time. This is almost never done, however, because it is very time consuming.

### 7.1.1 Advantages of the current symptom assessment

Although caregivers at LAH can see limitations with the current way of doing symptom assessment, they are satisfied with parts of it. Having the doctor see and talk directly with the patient about the patient's symptoms is a way of improving the sensitive and important doctor – patient relationship, which is based mainly on trust. It is also a natural way for the caregiver and patient to exchange information about the patient's condition and treatment.

For some patients, the only way to inform LAH about their symptoms is by directly telling the doctor or nurse. The patient may be unable to use pen and paper, a fax or even a phone to communicate, and the only option is to tell other people directly. Therefore, this kind of symptom assessment is very important and cannot be entirely replaced by other methods.

### 7.1.2 Problems with the current symptom assessment

The caregivers at LAH often feel there is not enough time in the care situation. As a result, symptom assessment utilising the ESAS and the pain record, for example, is not used to the extent that is wished for. The caregivers think the pain record is an important aid in improving the patient's quality of life, but the doctors who perform the pain analysis have no time to do it. The pain analysis sheet is also too

difficult to understand for a layman, and it may therefore be impossible for the patient to fill in by himself/herself.

The ESAS, on the other hand, is easy to understand and could be filled in without the presence of a caregiver, but this is seldom done. Even if patients filled in the ESAS themselves, there is no natural way to send the form to LAH. Another problem with the ESAS is that interpreting the results is too time consuming, and caregivers do not have the time to fill in the values in the diagrams by hand.

Patients' needs for medical care differ. Some patients are visited several times daily by LAH, and symptom assessment for these patients is therefore good and caregivers learn how to interpret the patient's condition. Some patients do not see a doctor or nurse more than several times a month. For some of these patients, the usual symptom assessment performed during a doctor's visit is not enough.

A previous investigation showed that symptom assessment is one of the dilemmas in home health care [4], and that the present method of symptom assessment can be improved. Although talking directly to the patient is a natural way to do symptom assessment, it could be made much more efficient for patients who do not see a doctor very often.

## 7.2 Symptom assessment with the Anoto functionality

If LAH had access to *Anoto* functionality, the patients could report their symptoms while in their own home, between the home visits, without the presence of a doctor or nurse. With digital pens and paper used via a mobile phone, the patients could fill in symptom assessment forms, pre-printed with the *Anoto* pattern, about their current symptoms, and send this information to LAH electronically. The reported symptoms could afterwards be discussed with the doctor/nurse during the next home visit.

The assessment forms should be easy for patients to understand and include questions about different symptoms relevant for the patient. Such symptoms are, for example, pain, nausea, dyspnoea, anxiety and sense of well-being.

### 7.2.1 A general symptom assessment form

One form could be more general and include all the symptoms mentioned above. It could be presented like the ESAS with visual analogue scales (VAS). The patients would rate their symptoms on the scale by drawing lines crossing the different scales, and send the information to the caregivers. See example below:

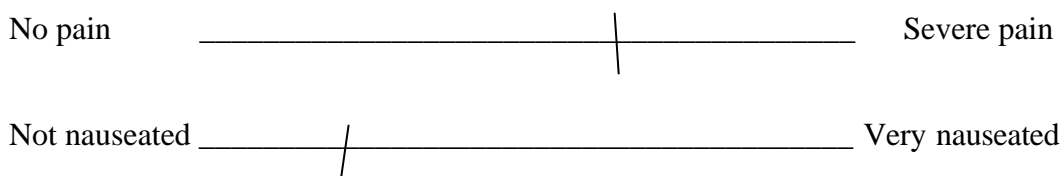


Figure 12 - ESAS

The main part of the form would be the symptom scales, but a small part could be a free text area where the patient could write about other symptoms that are not

pre-printed on the form. The free area could also be used for writing short messages to the doctor.

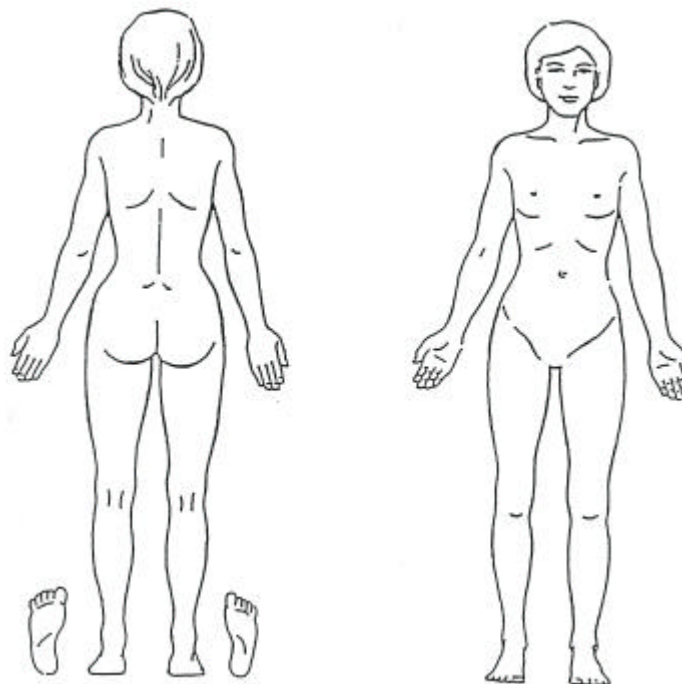
It is preferable that the patient himself/herself is able to fill in these forms so the rating of symptoms is as accurate as possible, but if the patient is not able to do this, a relative or a caregiver, perhaps from home help service, could assist the patient. Before a form is sent to LAH, the person who filled it in, e.g. the patient, a relative or a caregiver, should be indicated on the form.

The form must contain a send box. When the patient ticks in the send box, the information would then be relayed to a computer or fax at LAH, where the doctors and nurses can read it. Patients should fill in the form on a regular basis. How often this is done should be decided together with the doctor.

### 7.2.2 A pain assessment form

Many palliative patients have major problems with pain. For these patients a specific pain assessment form could be useful. This form should include a more in-depth pain analysis, where the patient writes, for example, where the pain is located and when it hurts.

The patient would describe his/her pain on a regular basis on the pre-printed form. The form would contain drawings of a body (see figure below). All the places where the patient feels pain should be marked on these drawings. Different symbols could be used when describing the pain, corresponding to different types of pain.



*Figure 13 - Pain assessment*

Another part of the pain form would contain questions such as:

- When does it hurt?
- Does movement influence the pain?
- How strong is the pain?

The information would be sent to doctors and nurses at LAH when the patient ticks in a pre-printed send box.

### 7.2.3 Advantages of the Anoto functionality

By using the *Anoto* functionality to perform symptom assessment, the doctors and nurses would get current information on a regular basis about the patient's condition. This would result in three major advantages:

1. The caregivers would be aware in advance of the patient's condition and could thus be better prepared before visits.
2. Patients who do not see their doctors very often would get a more frequent symptom assessment.
3. Information from the patient could be automatically processed and thus save time.

Examples of the first advantage: If the patient indicates that he is nauseous, the doctor can take medication for that to the patient on the next visit. It is also easier for LAH personnel to focus on important factors when visiting a patient if they have information about the patient's symptoms and condition in advance.

The frequency of LAH visits differs from patient to patient. Some patients need frequent home visits, perhaps twice a day, and others do not need them more than once or twice a month. If patients who do not see LAH caregivers very often used the digital pen to regularly fill in symptom assessment forms, LAH could monitor these patients' symptoms more closely. The doctor could follow the patient's condition and see changes over time.

If the patient has a problem with severe pain, he/she would regularly mark where the pain is located, and how severe it is, on the pain assessment drawings. The computer would process this information and the doctor could then see how the pain changes over time and relate it to the kind of treatment the patient is getting during this time.

### 7.2.4 Problems with the Anoto functionality

Using the *Anoto* functionality for sending information about symptoms requires that the patient, relatives or a daily caregiver can use the pen. Sending information electronically is relatively simple, but the patient or relative must still be able to handle the digital pen and the pen's equipment. The digital pen and the mobile phone must be charged in order to work. The phone must also be turned on so it is able to relay the information from the pen.

The patient or perhaps a relative must remember to charge the pen and the mobile phone regularly, and to save the pen's battery the patient must replace the pen cap after use. Always having the pen and mobile phone charged and turned on could be a problem for some patients.

Another problem could be that patients do not trust this kind of technology. For example, the patient may doubt whether the information has really been sent away or if it will reach the right receiver. The patient could also be afraid that if he uses the *Anoto* functionality, visits from doctors and nurses will be fewer and perhaps shorter. These problems also apply to other digital pens.

### 7.3 Symptom assessment with fax technology

One alternative to the *Anoto* functionality could be the use of a fax machine. The patients fill in the same kind of symptom assessment forms as above in the *Anoto* example, but the forms are printed on regular paper and the patient must send them to LAH by using a fax machine.

#### 7.3.1 Advantage of the fax technology

As when using the *Anoto* functionality, the advantage is that doctors and nurses get regular and rapid information about the patient's condition and symptoms and that caregivers can prepare for the visit. Symptom assessment for patients who seldom get visits from doctors and nurses will probably be improved, as may be the case when the *Anoto* functionality is used. If software is used that can receive faxes and transfer them into computer format, the faxed information can automatically be processed.

Compared to the *Anoto* alternative, the fax machine is a well-tried product that has been on the market for several years. Fax machines do not need special paper in order to work and they are always connected to power and therefore do not need any charging.

Some patients who have used fax machines or have relatives who can use fax machines could feel more comfortable with this technique with which they are already familiar.

#### 7.3.2 Problems with the fax technology

The fax can be difficult to use for people who have never or seldom used it. Many older patients who are able to fill in the form themselves are still not able to use a fax machine to send the information.

The fax machine is not a mobile product and it is therefore more cumbersome to use than a digital pen and a mobile phone. For a bedridden patient it would not be a problem to fill in the form and send it to LAH using the *Anoto* functionality. Sending it with a fax machine could, however, be a problem because the machine is probably not at the patient's bedside, and even if it is, it is difficult to use when lying in bed.

A fax solution also has the same problem as the *Anoto* solution. If the patient is not able to use a pen and paper he/she cannot fill in the forms unless someone is available to help him/her.

### 7.4 Symptom assessment with PC technology

Another alternative is the PC technology. The patient could have a computer at home and use it for filling in symptom assessment forms and for sending the forms away to LAH. The patient fills in the same kind of forms as in the previous examples, but the forms are in the computer and the patient has to use a mouse or keyboard and then send them away as an email to LAH.

### 7.4.1 Advantage of the PC technology

PCs are mature and reliable products. Security can easily be handled when using PC technology; for example, encryption ensures that a third party cannot see the information.

Another advantage of a PC is that the patient can get feedback when sending the forms to LAH. An example of feedback is an email that confirms that the patient's symptom assessment forms have arrived at LAH.

### 7.4.2 Problems with the PC technology

A problem with many computers is that they are not portable. Apart from not being portable, a stationary computer is often large and cumbersome, and furthermore it occupies a relatively large place in the patient's home. Even a laptop is large compared to the *Anoto* pen. It also must be charged in order to work.

Using a PC to describe symptoms can be difficult for patients with no computer experience. Most patients at LAH would need training in order to be able to handle a computer.

Using a computer mouse or keyboard to fill in the forms could be less exact than writing with an *Anoto* pen because it is hard to get the mouse in the right position.

## 7.5 Conclusions

Symptom assessment for LAH patients has potential to be improved by using the *Anoto* alternative as a complement to the current symptom assessment. The way LAH assesses patients' symptoms today, mostly by letting the patients talk directly about the symptoms during health care visits or on telephone, has several important advantages that are irreplaceable. But the current system also has its limitations, for example for patients who do not receive health visits very often.

By using the *Anoto* functionality as a complement in symptom assessment, the symptom control has potential to be improved and thereby improving the quality of life for palliative patients. The advantages of the current assessment method would be preserved, and because of the *Anoto* functionality, doctors could get regular symptom updates even from patients they do not see very often.

Using a fax to send forms about symptoms from the patients to LAH may not provide as many advantages as when using the *Anoto* functionality. Furthermore, a fax machine is cumbersome to use for patients who are not used to it. The PC alternative has the important advantage of providing feedback to the patients, but it also has several disadvantages.

Table 1 summarizes the advantages and disadvantages of the three different ways of performing symptom assessment.

	<b>Symptom assessment as it is today</b>	<b>Anoto technology</b>	<b>Fax technology</b>	<b>PC technology</b>
<i>Ease of use</i>	Good. Most patients are able to talk.	Good. Most patients are able to handle a pen and a paper.	Poor. Most patients are not used to handling a fax machine.	Poor. Most patients have never used a computer.
<i>Technical Investment (price/ patient)</i>	None.	Anoto pen + Mobile phone + Additional Telephone costs ~8200SEK	Fax machine (SEK 1990 <sup>2</sup> ). Additional: Separate phone line, telephone costs, program that processes the information	Stationary computer (SEK 11990 <sup>3</sup> ) Mobile computer (SEK 13990 <sup>4</sup> ) Additional: Separate phone line, telephone costs, costs for cryptographic software
<i>Security (patient confidentiality)</i>	Good, if no outsider overhears the classified information.	Good, the information is encrypted from the pen to the receiver.	Poor, the information is not encrypted.	Good, if the information is encrypted.
<i>Automation</i>	No, the information must be processed by hand.	Yes, an application can process the information automatically.	Yes. If a special program like Readsoft is used.	Yes
<i>Need for support</i>	None	Yes, if the pen does not work or if the user does not know how to handle the pen	Yes, if the fax does not work or the user does not know how to handle the fax	Yes, if the PC does not work or if the patient does not know how to handle the PC.
<i>Learning time</i>	None	Very short. A short introduction is probably enough for most patients.	Varies, some patients would probably need a short introduction to learn how to handle a fax and others more time to understand it.	Long. Most patients would probably need computer education.

*Table 1: Summary*

<sup>2</sup> Philips PPF 465 Fax, SIBA, 2002-01-28

<sup>3</sup> HP Pavilion 7915 together with 17 inch screen. SIBA, 2002-01-28

<sup>4</sup> Toshiba 1800-204, SIBA, 2002-01-28

## 8 Usability study

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Chapter 7 shows that by using the *Anoto* functionality within home health care, there are possibilities to improve symptom assessment.

To evaluate how useful the *Anoto* products can be in home health care, a usability study was carried out with a number of patients. In order to perform the usability study, symptom assessment forms were designed and a small application was developed. The application makes it possible to write with the *Anoto* pen and then relay the information to a nearby computer. The major goals were to see if the patients could handle an *Anoto* pen and understand and use the forms.

### 8.1 *The design of symptom assessment forms*

Three symptom assessment forms were designed with the collaboration of two senior physicians at LAH, Waldemar Bau and Kerstin Toss, and senior physician Per-Anders Heedman, a member of the Palliative Consultation Team at the University Hospital in Linköping.

The forms were designed in part to evaluate the usability of the *Anoto* concept and in part to evaluate whether patients could use these kinds of forms by themselves. The first form is based on the well-known symptom questionnaire ESAS, and the second form is based on a pain analysis form used in both Sweden and other countries. A third form, called the quality assurance form, was used as a pre-control form. However, this form was never used in the usability study. The forms were printed in Swedish so that they could be tested on the Swedish patients at LAH.

All forms consist of entries for the current date and patient information. At the bottom of each page the *Anoto* “magic box” is placed together with the text “SEND TO LAH”. The forms also include a short description of usage and three boxes, which are used to indicate who fills in the form, the patient, a relative or a caregiver.

### 8.1.1 Enhanced ESAS – a general symptom assessment form

The first form is called “Enhanced ESAS” and is designed to describe the patient’s general condition by using 10 different symptom scales. The form consists of the nine visual analogue scales that are used in the Edmonton Symptom Assessment Scale and an extra scale that corresponds to quality of life (see appendix A). The patient fills in the form by drawing lines crossing the different scales.

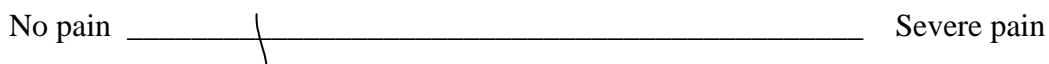


Figure 14 - One of the symptom scales

### 8.1.2 Pain analysis – a pain assessment form

The second form, called “Pain Analysis”, is a pain assessment form that consists of a drawing of a body with back and front views. Six different symbols can be used to describe different kinds of pain. The patient is supposed to use the symbols that correspond to his/her pain, and write them on the drawings (see appendix B).

Molande smärta: M M (dull pain)	Brännande smärta: X X (burning pain)	Stickande: . . . (stabbing pain)
Huggande smärta: /// /// (twinge)	Domning: = = (numbness)	Muskelkramp: S S (spastic pain)

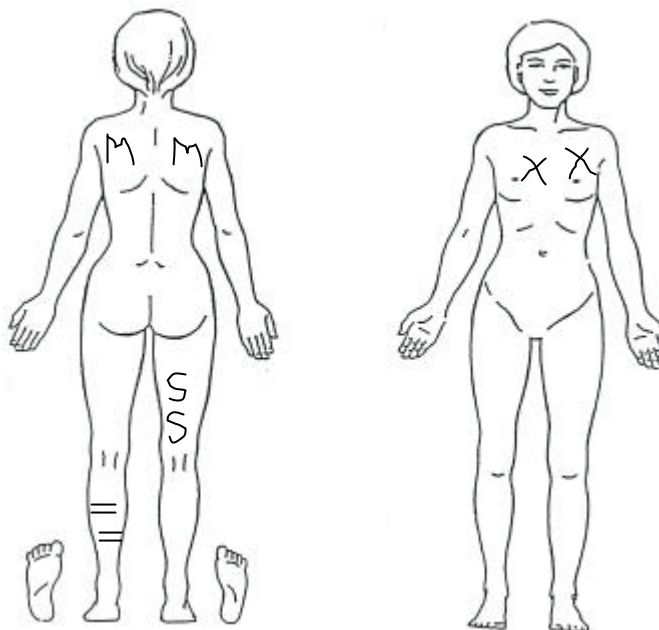


Figure 15 - Pain analysis

### 8.1.3 Quality assurance form – a pre-control form

The third form is actually supposed to be the first one given to the patient and is called the quality assurance form. It consists of only two visual analogue scales, corresponding to pain and sense of well-being (see appendix C). Pain is a common symptom in palliative cancer patients, and it has been shown that sense of well-being usually correlates with the other eight symptoms in the ESAS [18]. For example, if a patient is nauseous, it is most likely that sense of well-being is rated as not good.

The third form can be used for patients who are relatively alert. The idea behind this is that the patient begins by filling in the quality assurance form and sending it to LAH. If the values on both the pain scale and the sense of well-being scale are low (less than 35 of 100), this indicates that the patient is feeling relatively well and does not need to fill in anything more. If the value on the sense of well-being scale is high (bad), this indicates that some other symptoms are bad, and the patient will be asked by personnel from LAH to fill in the enhanced ESAS form. If the pain scale values are high, the patient is asked to fill in the pain analysis form.

## 8.2 The study

To evaluate whether patients at LAH could use the *Anoto* pen and the symptom assessment forms, a usability study was performed. The main goals were to investigate if patients could use the *Anoto* pen and if they could handle the symptom assessment forms. This was done by observing the patients and asking them questions about the pen and the forms.

The usability study served to answer the following questions:

- Can the patients understand the forms and use them in order to convey their symptoms? Can the forms be improved?
- Can the patients use and understand the *Anoto* pen? Is the *Anoto* pen easy or difficult to use? Is the *Anoto* alternative suitable for all patients?
- How do the patients experience filling in the form with the *Anoto* pen? Would they prefer some other alternative by which to inform caregivers about their symptoms?

### 8.2.1 Method

In short, letting the patients use an *Anoto* pen to fill in the forms and send the information away by ticking in the “magic box” performed the usability study. The test was performed with LAH patients who were in their homes in order to make the test situation as realistic as possible. Only two of the forms were tested; the Enhanced ESAS and the Pain Analysis form.

To evaluate the pen and forms, a special demonstration application was used. It consisted of an *Anoto* pen, a laptop with a Bluetooth card, and a program that could display and store the written information on the laptop. When using the application, the user fills in information on one of the forms. When finished, he/she ticks the magic box and the written information is relayed to the nearby

computer via Bluetooth. The results can be shown directly on the computer screen.

Before the patient started filling in the forms, short instructions were given about both the pen and the two forms. Each patient did the test one time by filling in the forms with current information about their symptoms. During the test, the patient was observed and notes about the session were taken. After the test the patient answered questions about the *Anoto* pen and the forms (see appendix D). The questions were designed to correspond to the main goals.

## 8.2.2 Patient group

Since most of the patients at LAH are very sick and their condition can change quickly, it was difficult to find patients who could take part in this usability study. A total of five patients evaluated the forms and the *Anoto* pen. The patients were of different sexes and ages. All patients lived in their own home and were gravely ill with cancer. The selected patients were asked in advance to participate by personnel from LAH and took part voluntarily in the usability study.

Patient	Age group, years	Sex
P1	56 – 70	Female
P2	Over 71	Male
P3	56 –70	Male
P4	Over 71	Female
P5	20 – 40	Female

Table 2: Patients in the usability study

## 8.3 Results

The results were divided into four areas: how the patients experienced the forms, the *Anoto* pen, filling in the forms, and opinions about the technology in general. The results are shown here.

### 8.3.1 How the patients experienced the symptom assessment forms

Four of the patients thought that both forms were easy to understand and use, and three of the patients had used similar forms before. The fifth patient (P4), who had never used an ESAS form before, thought the forms were relatively easy to use but had some problems understanding how to interpret the scales. Because she did not feel any pain, she never filled in the pain analysis form. All patients could read the form without any help, but some of them would have preferred slightly larger text.

One patient (P2) said that it was easy to convey his symptoms using the forms, but he thought that the forms should be combined with free text areas so he could explain the symptoms in more detail. Two patients thought it was relatively easy to convey their symptoms using the forms, while the last two (P1 and P4) thought

it was relatively hard. One of them suggested that the scales in the ESAS form should have a one to ten scale instead of just an unnumbered scale.

### 8.3.2 How the patients experienced the Anoto pen

All the patients said they clearly understood how the *Anoto* pen functions, and all but one patient thought the *Anoto* pen was easy to use. The latter (P1), who is female, said that the pen was somewhat clumsy but relatively easy to use.

The male patients were satisfied with the size and weight of the pen, but two of the females (P1 and P4) said the pen was a little too big. The third female patient said that she found the size of the pen acceptable but that it would be better if the pen were formed in accordance with the hand, and had a rubberised surface to prevent it from slipping.

All patients thought the pen gave good, clear visual feedback. Most of them understood the feedback upon activation of the “Magic Box”, but some wished that the vibrations were a little bit stronger. One patient (P4) did not feel the vibration at all the first time she activated the “Magic Box”. When she tried again she could feel it faintly.

### 8.3.3 How the patients experienced filling in the forms

One of the patients (P1) was too tired to answer the questions in this part. The other patients answered all the questions, and all of them thought that the instructions given to them beforehand were adequate.

Two of the patients had no experience using fax machines or computers and said they would strongly prefer using the *Anoto* concept instead of the other two alternatives. One patient (P2) had previous experience with a fax machine and said that he could use the fax alternative but would prefer the *Anoto* concept because it seemed easier. He did not think the computer alternative was any good. Another patient (P5) had previously worked with computers and said that the *Anoto* alternative and the computer alternative were equally good. She was not used to a fax machine and would prefer the *Anoto* concept.

### 8.3.4 The patients' opinions about the technology in general

Two of the patients had a positive attitude toward today's technology, while the other three had a far more negative attitude. Despite this, all of them liked the *Anoto* concept in general. The patients had different opinions about whether the *Anoto* concept would be useful to them. Two patients were sure that it would be useful and two thought that it had possibilities for being useful. One patient (P1) did not think it would be useful to her.

The patients who thought the *Anoto* concept could be useful to them also thought that the concept could give them better care, but they were not sure how much better. The patient who did not think the pen would be useful did not think it would give her better care.

One patient thought he could trust that the information was relayed to the correct receiver. The other three were not sure, but two of them said that it was likely that it would be.

## 8.4 General observations from the usability study

During the usability study the patients were observed and notes about their behaviour and opinions were taken. The most important observations are described in the following section.

All the patients were able to fill in the enhanced ESAS form completely after receiving the short introduction, but two of them drew the lines above the scales and not on the scales. Moreover, one patient (P4), the one who wondered how to interpret the visual assessment scales, had some problems using the form, especially in interpreting the sense of well being and the quality of life scales. After receiving information from a nurse she filled in the two scales, but it seemed as if she was still confused over the difference between the two scales. It should be noted that the description of the form that was given before the test was rather superficial, and the different symptoms were not explained separately.

All the patients who used the pain analysis form said that it was easy to use and to understand, but it seemed as if most of the patients had problems translating their pain into the symbols corresponding to the different kinds of pain. Some of the patients took a long time deciding which symbols to use, and one patient (P2) looked for a symbol that could correspond to the kind of pain he had in his arm. When he did not find such a symbol he did not write anything at all.

There are six different symbols in the pain analysis form. Four of them were used during the usability study. The symbol M that corresponds to dull pain was the most frequently used symbol. The other symbols, S (spastic pain), X (burning pain) and // (twinge), were used by only one patient each.

As mentioned above, almost all patients said that the *Anoto* pen was easy to use and understand, but attitudes towards the pen varied. It seemed that the patients who were feeling rather well during the usability study were the ones who liked the whole concept best. The male patients thought it was fun to try out the pen, and both of them were positive toward the pen concept. Although one of them, P3, generally did not like modern technology, he thought that the pen could be useful to him and improve his medical care.

One female patient, P1, was feeling very ill during the test and did not think she would have the energy to use the pen. Despite this, she was able to use the pen to fill in both forms, but after the test she was too tired to answer all the questions. Although she was able to use the pen properly, she did not like it. She thought it took too much effort to write with any pen, and she did not think the *Anoto* concept would be useful or give her better care.

Another female patient, P4, was initially sceptical toward the *Anoto* pen, but after trying it she said with some surprise that it was just like using a regular pen, except for the fact that the *Anoto* pen was a bit clumsy. She said she would not mind using the *Anoto* pen in the future if it would definitely improve her medical care, but she pointed out that it was important that this would not reduce the number of visits from caregivers.

The last female patient, P5, had previously worked with computers and other modern equipment and had a positive attitude towards the *Anoto* concept right from the beginning. She was interested in trying out the pen, and her only

complaint was that she would like to have some feedback to confirm that the information had reached LAH.

## 8.5 Conclusions

All the patients generally seemed to be able to use the form fairly well, but even though they all said it was easy or relatively easy to understand and use the forms, some of them had problems filling them in correctly.

In general, the ESAS form seemed to work quite well, but two out of five patients nevertheless drew the lines incorrectly. To improve the form, the description could be changed so that it cannot be interpreted in two ways. Since ESAS forms are well tested and are used in many countries for symptom assessment, the form will probably not need any major changes.

The four patients who filled in the pain analysis form had no problem understanding the form, but it seemed as if most of them had problems in mapping their own pain by means of the different symbols. It is difficult to say whether the different kinds of pain in the form correspond poorly with the kinds of pain that are common in cancer patients, or if it is always difficult to compare your own pain with descriptions of pain. One problem was evident when one patient, P2, did not find a symbol that corresponded to his pain, resulting in the fact that he did not write anything at all. Because of this, further investigation is needed concerning which kinds of pain should be pre-printed as symbols on the form.

All patients were able to use the *Anoto* pen and clearly understood how it worked, but two women thought that the pen was a bit too big. In general, the patients felt that the feedback from the pen was good, with the exception of one patient who did not feel the vibration too well. Although all the patients could use the pen without any visible problems, attitudes toward the *Anoto* concept varied. It seemed as if the patients who were more alert enjoyed using the pen more than those who were more exhausted due to their health state. Introducing the *Anoto* functionality to a palliative patient can therefore preferably be done when the patient is in a more stable and alert state. It is likely that these patients better could adopt and benefit from this technology, since some of them do not need frequent visits from LAH personnel. If the patients get worse, they will hopefully already know how to use the technology and can continue to do so without much effort.

None of the patients would prefer to use a fax or a computer instead of the *Anoto* pen, but the patients who had previous experience with these alternatives were more positive than the other patients.



## 9 Discussion

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The aim of this thesis was to investigate whether the *Anoto* concept can improve symptom assessment within home health care. Studying the *Anoto* concept as well as other digital pen concepts comprised one part of the work. In addition, today's symptom assessment was compared with the possibility of using the *Anoto*, fax or PC technologies.

The thesis has resulted in three symptom assessment forms that can be used together with the *Anoto* pen. The idea is that patients at LAH could use the forms in their home in order to convey their symptoms to caregivers. By using the *Anoto* functionality as a complement to symptom assessment that is currently in use, symptom assessment can probably be improved, for example, for patients who are a little more stable during certain periods and who therefore do not get frequent visits from caregivers. Also, even for patients who get frequent and regular visits from caregivers there may be a need for IT-support in the area of symptom assessment.

The usability study showed that most patients in the study group were able to handle the *Anoto* pen and that many of them were also positive towards using a digital pen to fill in symptom assessment forms. An analysis in this thesis (see chapter 7) indicated that the *Anoto* concept has more possibilities to improve symptom assessment than fax or PC technologies.

Possibilities for further work are discussed in this chapter. Previous chapters and the conclusions are also summarized.

### 9.1 Future work

This study has shown that symptom assessment in home health care has potential to be improved by means of the *Anoto* concept. This is the basis for future development of an *Anoto* application that can be tried in a pilot study in home health care. Below are suggestions for further work.

#### 9.1.1 Development of an application

The development of an application that can send symptom assessment information from patients to caregivers must be done in close cooperation with doctors and nurses who work in home health care. Factors to consider during this development are the information flow, the receiver application, security aspects and the symptom assessment forms.

Information flow: How does the information travel from patients to doctors? How is the information received and where is it stored?

The receiver application is a program that receives information from the patient, processes it, and shows it to the doctor. Aspects to consider are: What are the requirements for the receiver program? How should the information from the patients be processed and displayed?

Security aspects: The application must fulfil the security requirements of the health care system.

Improvement of the symptom assessment forms: Adapt the forms based on the results of the usability study.

### 9.1.2 Evaluation of the application

After the application is built, it should be tested and evaluated in a pilot study.

Since the usability study only tested whether patients could use the *Anoto* pen, further investigation is needed to determine if they can handle and use the whole *Anoto* concept. A complementary study is recommended to evaluate if patients can use the pen on a regular basis to fill in forms, and if they can handle the mobile phone. It is also recommended that a larger number of patients evaluate the concept in order to get more reliable results.

The receiver application and its use must be evaluated carefully regarding, for example, whether the receiver application does the right things, fulfils the requirements, and how useful it is to the caregivers.

In addition to the above aspects, the symptom assessment forms need to be evaluated.

### 9.1.3 Another application area for the Anoto concept

This study has focused on how to improve symptom assessment within home health care. During this work, additional ideas have come up about other applications that may also result in improvements through the use of the *Anoto* concept. One example is an application that could improve the communication between caregivers in different organizations.

One dilemma within home health care concerns communication. The patient often has several caregivers from different organizations, and communication between these caregivers is frequently limited. The result is that the different caregivers do not know what other caregivers have done.

The routine today is that when a caregiver has visited a patient, he/she writes what has been done in a file, which is always in the patient's home. When the next caregiver visits the patient he/she can look in the file to see what other caregivers have done.

To simplify this process, the papers in the file could be printed on the *Anoto* patterned paper, and when caregivers write with an *Anoto* pen in the file, this information would be automatically sent to the other caregivers. In this way, all caregivers are directly notified and, in addition, the caregiver can send the information to himself/herself to avoid having to document it twice.

## 9.2 Summary

Home health care is a medical service operating in the patient's home with professional support from a local hospital or other caregivers. The objective is to offer skilled medical service to patients who wish to be treated and cared for in their home environment. LAH is an organization that performs advanced home health care in Linköping. One problem area in home health care is symptom and status assessment. By introducing digital pens, it may be possible that the area of symptom assessment could be improved.

The *Anoto* pen gives the user the possibility of sending handwritten information to a computer or a fax machine. The digital pen communicates via a Bluetooth link with a mobile phone, which relays the messages for further processing. The *Anoto* technology consists of three parts: a special pattern printed on paper, the *Anoto* digital pen, and a Service Infrastructure. The pen works like a normal ballpoint pen, but it is filled with high-technological components. Therefore there is only a short learning period needed in order to use the *Anoto* products.

In addition to the *Anoto* pen, a variety of technologies exists that use a ballpoint pen as an input device to computers. Some digital pens use accelerometer-based technology, and some use an external positioning system. Digital notepads do not use a ballpoint pen, but can nevertheless compete with the *Anoto* alternative in some areas that could be of interest for use in home health care.

There is no other technology with the exact same features as the *Anoto* technology, although other technologies can perform at least some of same functions. The main difference between the *Anoto* digital pen and most of the other digital pens is that the latter do not require any special paper. That the *Anoto* pen needs special paper can be seen as a weakness, but it is also its main advantage when compared with the other pen technologies. The pattern on the *Anoto* paper makes it possible to predefine the functionality that the pen can detect, such as sending e-mail, sending specific data to a specific database, etc., which the other pens are not able to do.

Good symptom assessment is one of the most important components of delivering effective care to palliative patients. Today, caregivers at LAH have several ways of performing symptom assessment, the most common of which is for the patient to inform the caregiver about the symptoms during the health visit in the patient's home. The advantages of today's symptom assessment are that it improves the relationship between doctor and patient, and that it is a natural way for patient and caregiver to exchange information about the patient's condition and treatment. For many patients in home health care, such as those who live far from the caregivers and who do not receive health care visits very often, there may be a need to assess the symptoms between the home visits.

If LAH had access to *Anoto* functionality, the patients could report their symptoms while in their home, between the home visits, without the presence of a doctor or nurse. With *digital* pens and paper used via a mobile phone, the patients could fill in symptom assessment forms, pre-printed on the *Anoto* patterned paper, about their current symptoms, and send this information to LAH electronically. The reported symptoms could afterwards be discussed with the doctor/nurse during the next home visit. By letting patients use the *Anoto* functionality,

caregivers get current information on a regular basis about the patients' conditions. This results in three advantages:

- The caregivers know the condition of the patient in advance.
- Patients who do not see their doctors often get better symptom assessment.
- Information from the patients can be automatically processed and thus save time.

Using a fax or a PC to send information about the patient's symptoms to LAH has disadvantages as compared to *Anoto* functionality. For example, a fax or a PC can be cumbersome for patients who are not used to these technologies.

Symptom assessment for the patient at LAH has the potential to be improved by using the *Anoto* functionality as a complement to current symptom assessment. The advantages of the assessment that is currently used would be preserved, and the *Anoto* functionality would enable doctors to get regular symptom updates from the patient.

The usability study, which was carried out to evaluate if the patient could handle an *Anoto* pen and understand and use symptom assessment forms, was performed with five patients in their home environment. The results showed that all patients understood and could use the *Anoto* pen well. However, two women thought it was somewhat too big. Attitudes toward the pen varied; it seems as if the patients who were more alert and stable enjoyed using the pen most. None of the patients would prefer to use a fax or a computer instead of the *Anoto* pen.

The patients said that the symptom assessment forms were easy to use, but some had problems filling them in correctly. By changing the instructions on how to use the ESAS form it is more likely for the patient to fill in the form in the correct way.

In general, this study shows that symptom assessment in home health care has potential for improvement through the use of the *Anoto* functionality.

## 10 References

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- [1] Eriksson M, Muzikants S: Hemsjukvård. Astra Läkemedel AB 1991. ISBN 91-86326-34-1
- [2] [http://www.who.int/ncd/long\\_term\\_care/index.htm](http://www.who.int/ncd/long_term_care/index.htm) (2001-10-01)
- [3] Borelius P: Närståendes upplevelser av palliativ omvårdnad – en utvärdering vid LAH kliniken i Linköping. Linköpings universitet 1996.
- [4] Lind L. Internal Report: Information flow within the Home Health Care Organisation, Department of Biomedical Engineering, Linköpings universitet
- [5] Arnell J: Sjukvård i hemmet. Handikappinstitutet 1997. ISBN 1101-1033
- [6] Beck-Friis B: Borta bra men hemma bäst. Spris förlag 1994. ISSN 1586-1691
- [7] Vårda & vårdas hemma. Landstinget i Östergötland 1996.
- [8] <http://www.anoto.com> (2001-10-09)
- [9] <http://www.anoto.com/technology/documents/> (2001-10-09)
- [10] <http://www.ibm.com/> (2001-09-20)
- [11] <http://www.inductum.com/> (2001-09-20)
- [12] <http://www.goulite.com> (2001-09-21), Current name of the company is OTM Technologies, current website is <http://www.otmtech.com> (2002-07-04)
- [13] <http://www.e-pen.com/> (2001-09-25)
- [14] <http://www.n-scribe.com> (2001-09-28)
- [15] <http://www.compupen.com/> (2001-10-02)
- [16] Strömngren A S, Groenvold M, Pedersen L, Olsen A K, Spile M, Sjögren P. Does the medical record cover the symptom Experienced by cancer patients receiving palliative care? A comparison of record and patient self-rating. Journal of Pain and Symptom Management, Vol. 21 No 3 march 2001.
- [17] Dudgeon D J, Harlos M, Clinch J J. The Edmonton Symptom Assessment Scale (ESAS) as an Audit Tool. Journal of palliative care 15:3/1999;14-19.
- [18] Heedman P-A, Strang P, Symptom Assessment in Advanced Palliative Home Care for Cancer Patients Using the ESAS: Clinical Aspects, Anticancer Research 21: 4077-4082 (2001)



# **Appendix**

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## Appendix A

Datum

Pat. uppgifter

### ESAS (Edmonton Symptom Assessment Scale)

Markera din skattning av symptomet med ett rakt streck över linjen.

Skattad av:   Patienten             Anhörig             Personal

Ingen smärta \_\_\_\_\_ Värsta tänkbara smärta

Ej orkeslös \_\_\_\_\_ Värsta tänkbara orkeslöshet

Inget illamående \_\_\_\_\_ Värsta tänkbara illamående

Ingen nedstämdhet \_\_\_\_\_ Värsta tänkbara nedstämdhet

Ingen oro/ångest \_\_\_\_\_ Värsta tänkbara oro/ångest

Ingen sömnighet \_\_\_\_\_ Värsta tänkbara sömnighet

Bästa möjliga aptit \_\_\_\_\_ Ingen aptit

Bästa möjliga välbefinnande \_\_\_\_\_ Sämsta tänkbara välbefinnande

Ingen andfåddhet \_\_\_\_\_ Värsta tänkbara andfåddhet

Bästa möjliga livskvalitet \_\_\_\_\_ Sämsta tänkbara livskvalitet

Skicka till LAH



## Appendix B

Datum

Pat. uppgifter

### Smärtanalys

**Var har Du ont? Markera alla ställen där Du har smärtor och använd gärna nedanstående tecken.**

Ritad av:

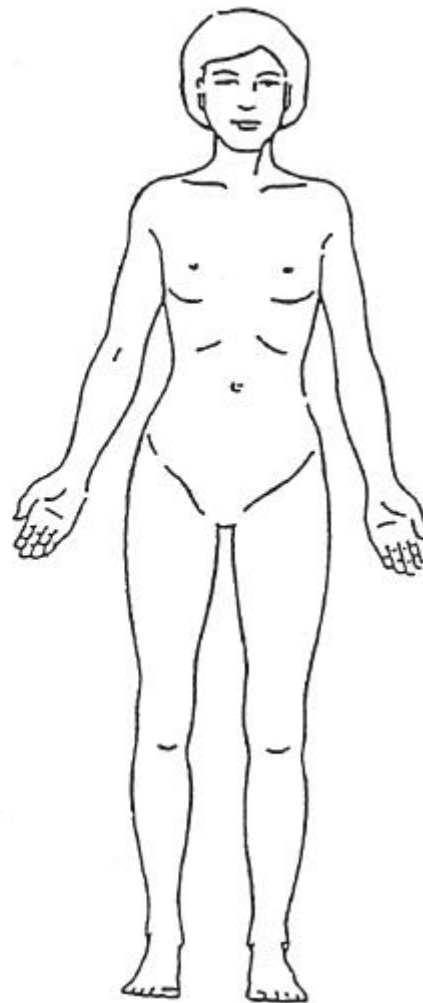
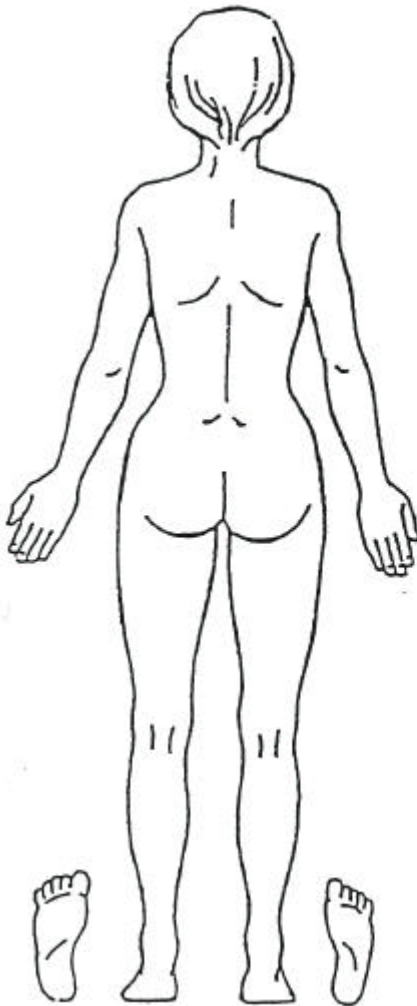
Patienten

Anhörig

Personal

Symboler att använda på figurerna nedan:

Molande Smärta	M M M M M M	Brännande Smärta	X X X X X X	Stickande (sockerdricka)	... .. ... ..
Huggande Skärande	/// /// /// /// /// ///	Domning	= = = = = =	Muskelkramp	S S S S S S



Skicka till LAH



## Appendix C

Datum

Pat. uppgifter

### Kvalitetssäkring symptomkontroll

Markera hur Du idag upplever din smärta och ditt välbefinnande med ett rakt streck över linjen.

Skattad av:    Patienten         Anhörig         Personal

Ingen smärta

---

Värsta tänkbara  
smärta

Bästa möjliga  
välbefinnande

---

Sämsta tänkbara  
välbefinnande

Skicka till LAH



## Appendix D



### Frågor till utvärdering av Anoto pennan och symptomformulären.

<b>Hur patienten upplever formulären.</b>				
	Instämmer <u>inte</u>		Instämmer <u>helt</u>	
<i>Formuläret/formulären är lätta att förstå och använda</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Texten i formuläret/formulären är lätta att läsa (tillräckligt stor text)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Det var lätt att förmedla symptom med hjälp av symptomformulären</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### Kommentarer/kompletteringar till ovanstående frågor

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<b>Hur patienten upplever pennan.</b>				
	Instämmer <u>inte</u>		Instämmer <u>helt</u>	
<i>Pennan är lätt att använda</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Det var lätt att förstå hur pennan fungerade</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Pennans storlek och tyngd kändes tillfredställande</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Pennan hade bra och tydlig visuell feedback (lysdioder)<sup>1</sup></i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Pennan gav bra och förståelig feedback vid aktivering av "MagicBox" (vibration)<sup>2</sup></i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Pennans vibration var tillräcklig stark</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Kommentarer/kompletteringar till ovanstående frågor**

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<sup>1</sup> En bättre förklaring av denna funktion görs innan användandet av pennan.

<sup>2</sup> En bättre förklaring av denna funktion görs innan användandet av pennan.

<b>Hur patienten upplever att fylla i formulären med <i>Anoto</i> pennan</b>				
	Instämmer <u>inte</u>		Instämmer <u>helt</u>	
<i>Jag föredrar att använda <b>Anoto</b> konceptet i jämförelse med Fax</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Jag föredrar att använda <b>Anoto</b> konceptet i jämförelse med PC/dator</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Genomgången innan jag fyllde i formuläret räckte för att snabbt kunna komma igång</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Jag tycker att jag kan lita på att informationen kommer fram till rätt mottagare</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Kommentarer/kompletteringar till ovanstående frågor**

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Patient frågor				
	Man		Kvinna	
<i>Patientens kön</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	20-40	41-55	56-70	71-
<i>Patientens ålder</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Ja		Nej	
<i>Jag använder mig idag av mobiltelefon</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Instämmer <u>inte</u>		Instämmer <u>helt</u>	
<i>Jag är positivt inställd till att använda dagens moderna elektronik (PC/mobil/PDA/etc.)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Jag tycker att <b>Anoto</b> konceptet är bra</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Jag tror att <b>Anoto</b> konceptet skulle kunna vara användbart för mig</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Jag tror att <b>Anoto</b> konceptet skulle kunna ge mig en bättre medicinsk vård</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Jag tror att <b>Anoto</b> konceptet kan komma att kunnat användas i andra sammanhang</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Övriga kommentarer

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**IMT och LAH tackar för Er medverkan i denna undersökning.**