# IDENTIFYING CUSTOMER NEEDS – DISABLED PERSONS AS LEAD USERS

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## ABSTRACT

In product development it is essential to understand what users need. But as current users are functionally fixed, they are not able to provide information that would help develop breakthrough products. Lead users – users that currently experience needs still unknown to the public – are better able to identify and communicate their needs, but identifying lead users is difficult. We show through a case study on mobile phones that extraordinary users, disabled persons in this example, can be seen as lead users. We show how these extraordinary users do experience similar needs as the ordinary users and, in addition, the extraordinary users experience, and are able to communicate, needs that the ordinary users do not yet have, and thus extraordinary users are a valuable resource in customer need identification.

**Keywords:** customer need identification, lead users, disabled persons

## INTRODUCTION

It is broadly acknowledged that when trying to develop successful new products, understanding user needs is essential. Traditionally this means exploring the needs of the targeted customers of the product. Classical research on problem solving shows, however, that current users are strongly constrained by their real-world experience, an effect called functional fixedness [1, 2]. Thus, those who use an object or see it used in a familiar way are blocked from using that object in a novel way. A screwdriver, for example, is a tool for handling screws but as it is long and sharp it could also be used as a crowbar or chisel. Or if a person is asked to perform a task that requires the use of a wire, he is less likely to unbend a paper clip if he is given the clip attached to papers than if he sees the clip loose [2]. A current user of a product is functionally fixed and therefore not able to broaden his perspective on its use – not able to think out of the box. Therefore gathering customer needs in order to develop breakthrough products may be difficult.

Von Hippel's lead user method does not concentrate on current users but on lead users – users that currently experience needs still unknown to the public and who also benefit greatly if they obtain a solution to these needs. Lack of functional fixedness makes lead users very appealing to product development – lead users do not base their views on existing products but on their needs. Users of today's products seem to be poorly positioned to envision novel needs or solutions, as they are familiar with existing product attributes and therefore not necessarily able to think of new attributes and uses. "In contrast, lead users would seem to be better situated in this regard – they 'live in the future' relative to representative target-market users, experiencing today what representative users will experience months or years later." [3] Even more extreme conditions can prevail among lead users found outside the target market. If so, "they may, therefore, be forced to develop solutions that are novel enough to represent 'breakthroughs' when applied to the target market." [3] Developing products to meet the needs of lead users allows a firm to anticipate trends and to leapfrog competitive products [4]. Although the lead user method was first introduced already in 1986 [5] and there are references to demonstrate its performance [6, 7], pinpointing the actual lead users still is difficult.

Traditionally mainstream consumer product design has not explicitly considered the needs of older or disabled people. Instead, their needs have been considered in the design of niche products like disability aids, which provide separate and often stigmatizing solutions for these user groups [8]. Yet in many ordinary circumstances we all suffer from a "situational disability". When there is no light, we cannot use our eyesight, for example. When there is a lot of noise, we are not able to hear. When driving a car, we should not use our hands for anything else than driving nor look away from the road. We argue that if a product design is based on the user needs of the target market, i.e. the majority of consumers that have no disabilities, we end up leaving out everyday situations, where the use eyesight and hearing, or all limbs, is limited or completely prevented. Still it is a significant advantage for a product to work well in all possible situations.

The purpose of this study is to investigate the identification of lead users, specifically, if so called "extraordinary" users could be used as leas users. Extraordinary users experience needs more often and in a larger scale than "ordinary" users – marathon runners vs. casual joggers, for example. In this study the user needs of disabled and "situationally disabled" users were compared. The examined user groups were deaf, blind, and ordinary users, who see and hear well. This study had a two-part goal: (A) to find out if the needs of extraordinary users, disabled users in this example, are in fact the same as those that ordinary users face situationally; and (B) to investigate if the extraordinary users also experience today what the target market may experience later, i.e. if they in fact do "live in the future" and thus are lead users and a valuable resource in customer need identification.

## BACKGROUND

### Lead users

Rogers [9, 10] explains how new ideas diffuse through a society. A considerable time lag exists from the introduction of a new idea to its widespread adoption, but there still is certain inevitability in their diffusion.

The theory of lead users relies on the idea that there is always somebody who has the need first, and that the rest of the marketplace will have the need later. As all new things diffuse through a society over time, there are always users whose present needs foreshadow general demand [11]. Von Hippel [5] defines lead users as users with two characteristics: 1) Lead users face needs that will be general in a marketplace – but face them months or years before the bulk of that marketplace encounters them, and 2) Lead users are positioned to benefit significantly by obtaining a solution to those needs [5].

According to the first lead user characteristic there are users who experience new needs and are prepared to generate innovations that substantially differ from existing market offers. The second characteristic reflects the possibility of the users initiating the development of a new solution if the solution would bring them significant benefit. [12] In other words, lead users are well ahead of market trends and have needs that go far beyond those of the average user. [7]

Rogers [10] divides the adopters of an innovation into five categories: innovators, early adopters, early majority, late majority, and laggards. It is important to distinguish lead users from these categories. "[Lead users] are typically ahead of the entire adoption curve in that they experience needs before any responsive commercial products exist – and therefore often develop their own solutions." [13] See Figure 1.

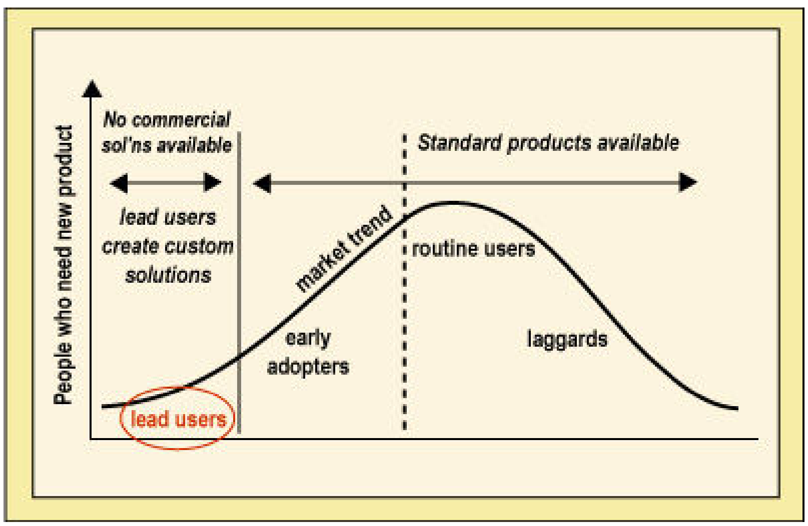


**Figure 1** Lead users' position on a market trend [14]

The main question is *how to find a lead user*. Lead user is often somebody who is trying to improve his way of working rather than consciously trying to invent. Like the developer of World Wide Web Tim Berners-Lee says: "it was something I needed in my work" [15]. Very often lead users will have already invented solutions to meet their needs. This is particularly true among highly technical user communities, such as those in the medical or scientific fields [4]. Developers of open source software are a clear example of lead users. They profit by using the software improvements that they develop.

[13] Lead users can also be found among those who function in harsh conditions: professional athletics, aerospace, or military solutions, for example. For example, innovations such as antilock braking systems (ABS) were first developed by the aerospace industry: military aircraft commands have a very high incentive to stop their vehicles before running out of runway [7]. Shah [6] shows that innovations in skateboarding, snowboarding, and windsurfing have typically been developed by a few early expert participants in those sports, these expert participants being a good example of extraordinary users.

## Related research

Several methods for the assessment of customer needs exist, such as observation, surveying, and interviewing. Traditionally these methods are used to learn about current or targeted users of a product.

Green et al. [16, 17] acknowledge that user needs vary according to product usage context (PUC). PUC is defined as "the usage factors characterizing the application and environment in which a product will be used that may significantly impact customer attribute preferences" [17]. Already in 1975 Belk [18] talked about "situational effects" on consumer behavior and suggested that consumer research needs to take into account situational variables and context.

Newell [19] proposes the concept of "Ordinary and Extra-ordinary human-machine interaction". This draws the parallel between an "ordinary" (able-bodied) person operating in an "extraordinary" environment, e.g. high work load, adverse noise, or lighting conditions, and an "extraordinary" (disabled) person operating in an ordinary environment. He introduces the concept of considering a 'user' as being defined by a point in the multi-dimensional space, which specifies their functionality and the relationship of that functionality to the environment in which the user operates. In other words, otherwise fully functioning people can be seriously handicapped by hostile environments.

Newell & Gregor [20] show situations where people are using standard equipment, but not in standard locations, and are therefore effectively disabled: If a laptop or palmtop computer has to be operated while the user is standing and cannot rest the system on a ledge, then effectively the user is one-handed. In a noisy environment communication systems which are designed for deaf or speech-impaired people may be appropriate. Using technology designed to provide access for people with visual impairments should be considered in darkness or in situations when there is smoke. Many industrial situations require wearing protective clothing which reduces sensory input as well as manual dexterity. Newell & Gregor [20] also note that Norwegian Telecom developed a large-key telephone keyboard specifically for people with poor manual dexterity, but found that it was very useful in outdoor locations where users tended to wear gloves.

VTT Building and Transport department of VTT Technical Research Centre of Finland conducted a research project called NAVITarve that concentrated on user needs for personal navigation services [21]. The information needs of different users of public transportation in different situations were explored. 48 + 85 users were studied through personal diaries, group meetings, and conjoint analysis. Most of the users studied were “typical” users that were interested in information content, not so much in the technology that would provide the information to them. Among other groups, three groups of “critical” users were studied: visually impaired people, people with memory disorders, and mobility impaired people. It was found that these “critical” users would provide essential information about user needs not only for themselves, but also for others in “critical” situations of use: dark or unfamiliar environment, stressful use situation, or moving with luggage, pram, or bicycle. The results from “critical” user groups revealed that “critical” users often need information that is similar to all other users. Approximately 50 % of those information needs expressed by “critical” users were same as those information needs expressed by “typical” users. It was concluded that majority of these information needs can be seen to facilitate traveling for anybody in less than ideal situation. [21]

Newell [19], Newell & Gregor [20], and NAVITarve [21] show several examples on the effects of the environment on user needs, and how the needs of an extraordinary user are in certain situations similar to those of an ordinary user. We want to show that extraordinary users can be lead users and therefore beneficial in identification of latent customer needs when trying develop breakthrough products.

## METHODOLOGY

In this study we explored the user needs of disabled users as an example of extraordinary users. Three members of three different groups of mobile phone users were studied and compared: deaf, blind, and ordinary users who see and hear well. Deaf and blind groups were selected to represent disabled persons, because of the clear definition of these groups, and the fact that it was rather easy to access these groups. Blind and deaf persons were contacted through several associations and societies, such as Finnish Federation of the Visually Impaired and Finnish Association of the Deaf, and through personal contacts. The three deaf persons were deaf since birth. Two of the blind participants were congenitally blind, and one had lost his eyesight in his adulthood.

According to World Health Organization (WHO), globally in 2002 more than 161 million people were visually impaired, of whom 124 million people had low vision and 37 million were blind [22]. WHO estimates that in 2002 there were 250 million people in the world that had disabling hearing impairment [23]. Finnish Association of the Deaf believes the penetration of mobile phones among the deaf to be at least as high as among the general population. It can be assumed that the penetration of mobile phones among the blind correlates to the general population respectively.

The methods used were photo diary based on a theme and contextual inquiry along with an open-ended discussion. Contextual inquiry was used for learning about users needs. Photo diary and open-ended discussion provided information both on user needs but also on the leading edge behaviour of the disabled persons. Photo diary and self-photography have been used in various disciplines. Gaver et al. [24] included a disposable camera in the cultural probes package when studying the elderly and Brown et al. [25] used photo diary followed by semi-structured interviews to capture information in working life. Contextual inquiry is a field data-gathering technique developed by Beyer and Holtzblatt [26].

There were two meetings with every participant. The first meeting was a short 30-minute meeting where participants were given the photo diary assignment. Approximately two weeks later in the second meeting the contextual inquiry and the open-ended discussion were carried out. In the same meeting the photo diary results were talked through and used as inspiration in the discussion. An outside interpreter took part in the meetings with the deaf participants.

In addition to the nine participants presented above, three other people were interviewed. Two of them had progressively lost a major part of the eyesight in their adulthood, and one had a similar visual disability but he also suffered from a severe hearing impairment. The purpose of interviewing these three people was to gain a wider perspective on disability in general, since these persons had literally seen both worlds. Besides, all three had tried out a variety of mobile communication devices. All participants are listed in Table 1.

**Table 1** List of participants and their mobile phones

| user | sex | age | mobile phones |
|---|---|---|---|
| blind 1 | female | 34 | Nokia 8310 (personal), Nokia 1100 (personal) |
| blind 2 | female | 58 | Nokia 3660 (personal) |
| blind 3[1] | male | 36 | Nokia 6600 (personal) |
| deaf 1 | male | 25 | Nokia 6100 (personal), SonyEricsson Z1010 (personal), Nokia 6600 (work) |
| deaf 2 | male | 33 | Nokia 9110 (personal), SonyEricsson Z1010 (personal), Nokia 6310i (personal), Nokia 9110 |
| deaf 3 | female | 28 | Nokia 6820 (personal) |
| ordinary 1 | male | 29 | Siemens ST60 (personal) |
| ordinary 2 | female | 30 | Nokia 6600 (personal) |
| ordinary 3 | male | 60 | Nokia 9210i (personal, work), Nokia 6230 (personal, work) |
| severe visual impairment | male | 43 | Nokia 6600 (personal, work) |
| severe visual impairment | male | 37 | Nokia 6600 (personal, work) |
| severe visual and hearing impairment | male | 57 | Nokia 9300 (personal) + Nokia LPS-4 inductive loop set |

[1] Not congenitally blind. Not able to read braille.

The photo diary assignment consisted of a disposable camera and a stamped return envelope. The participants were instructed to use the camera for one day and to take a picture of "everything you use for communication, or use for receiving and transmitting information", i.e. newspaper, alarm clock, radio, mobile phone, signboards, etc. (see Figure 2). The blind participants were advised in practice on how to use the disposable camera. No additional equipment was required – just the disposable camera.

In the second meeting the pictures taken in the photo diary assignment were discussed one-by-one. The participant explained the meaning of each picture in the order they were taken. Each object in the pictures was discussed in detail: how many times it was used during the day, why, and for which purposes. The use of mobile phone was discussed and observed according to the principles of contextual inquiry. What have you done with your mobile phone today? Show me how you do it. What devices have you used this week? For which purposes? Why? Show me.

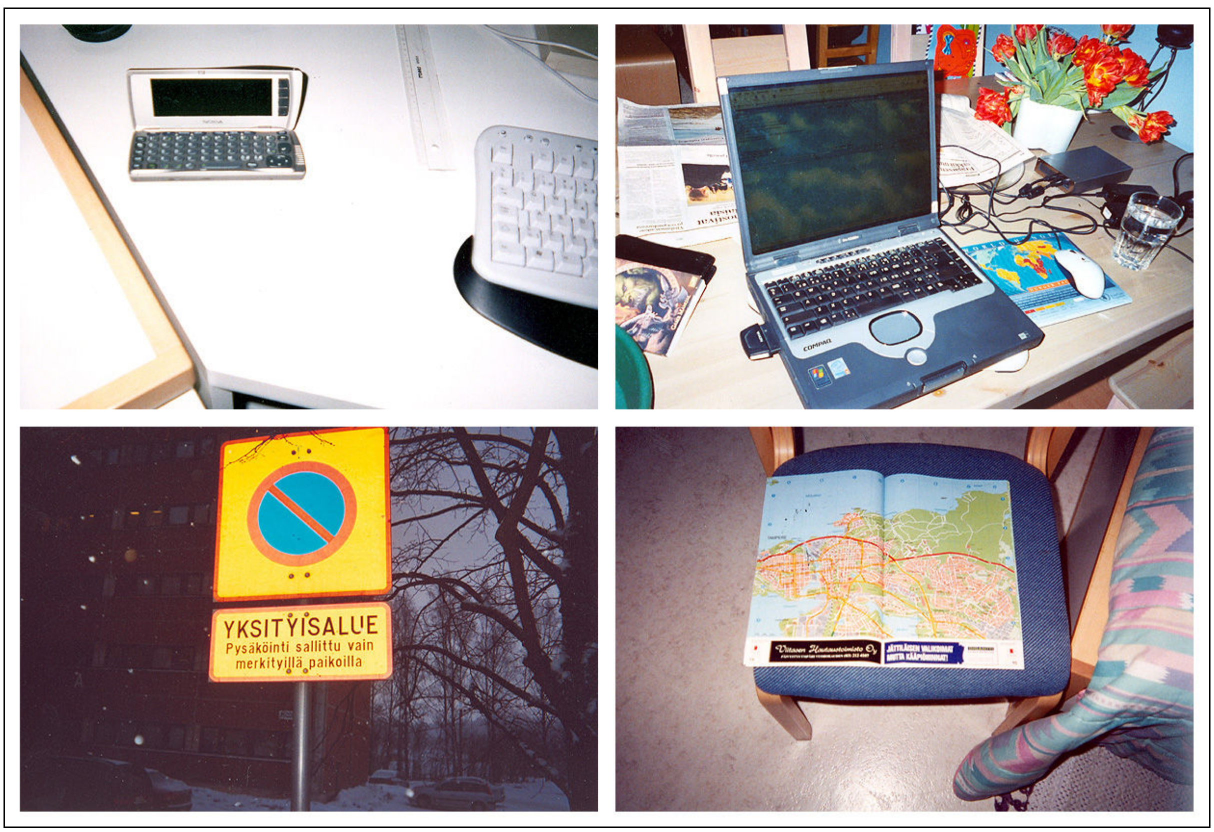


**Figure 2** Photo diary pictures

The disabled users were observed when using their mobile phones in their ordinary environment, such as home or work environment. The ordinary users were observed when using their mobile phones in special situations that included complete darkness, and noisy environment. These special situations were created in the participant's home. Complete darkness was achieved in a walk-in closet or in a windowless bathroom. Noisy environment was created by using disposable foam ear plugs and an industrial hearing protector headset that included total noise-canceling and an FM radio. All sounds from surrounding environment were blocked out and replaced with music.

The special situations were chosen to be such that they really simulate a possible everyday disability situation. Therefore the "situational blindness" was not simulated by concealing user's eyes but by taking the user into a dark room. It is highly unlikely that a person ends up in a situation where his eyes are concealed but there is a strong possibility that his eyesight is limited by lack of light.

In these special situations the ordinary users were asked to perform basic tasks, such as calling, receiving a call, sending a text message and receiving one. The starting point of the tasks varied: the mobile phone was to be found in the pocket, in the bag, or in the surroundings in proximity of the user. The use of mobile devices was studied also in the ordinary environment in the same manner as was done with the disabled users.

After going through the pictures of the photo diary, and the contextual inquiry, the participants expressed their views on their current mobile devices, their expectations, and desires. They told about problems they have faced, and shared their visions on what kind of devices they would like to use and how.

## RESULTS AND ANALYSIS

In this section we will first present the results for the comparison of user needs of the extraordinary users (disabled users) vs. the ordinary users (situationally disabled users). We will then show examples of the leading edge behavior of the extraordinary, and how they indeed face needs that the ordinary public may encounter later.

## User needs of extraordinary users vs. ordinary users

Photo diaries documented the course of the participant's day, and the objects and devices that had been used during the day. The photographs taken by the blind participants turned out well. Only aiming at the target was slightly inaccurate, but it did not impede recognizing the photographed object (see Figure 3). The contextual inquiry and open-ended discussion were able to widen the understanding of the actual user needs of each participant.

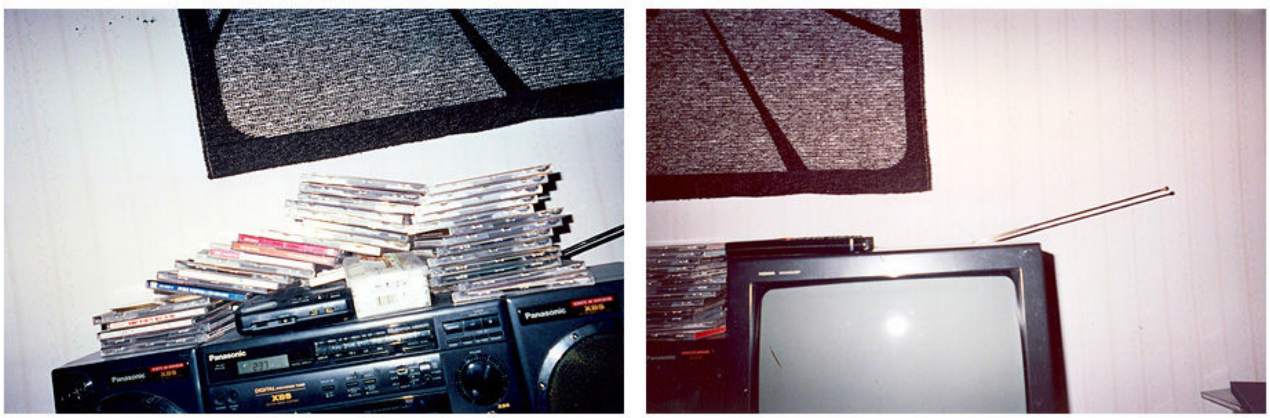


**Figure 3** Photographs taken by a blind person

All ordinary users articulated situations, when use of mobile phone is difficult because of not being able to hear well: urban noise, rock festival, library (when the phone should be silent and no speaking is allowed). Speaking on the phone when walking in the city centre was found difficult and uncomfortable since it is not possibly to clearly hear the voice on the other end. It was said to be "a rule, not exception" to lose your friends at a rock festival and then not being able to contact them because of the noise: You cannot talk on the phone and you cannot hear the phone ring. When trying to contact someone through a text message, it takes a lot of time until the other person even realizes he has received one.

Both disabled and ordinary users actively use the same three devices for communication and handling information: mobile phone, television, and computer (see Table 2).

**Table 2** Devices actively used by the participants

| | Deaf 1 | Deaf 2 | Deaf 3 | Blind 1 | Blind 2 | Blind 3 | Ordinary 1 | Ordinary 2 | Ordinary 3 |
|---|---|---|---|---|---|---|---|---|---|
| Mobile phone | 3 | 4 | 1 | 2 | 1[a] | 1[a] | 1 | 1 | 2 |
| Television | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Computer | 1 | 1 | | | 1[b] | 1 | 1 | | 1 |
| Laptop computer | | | 1 | 1[b] | | | | 1 | |
| Webcam | 1 | 1 | 1 | | | | | | |
| MP3 player | | | | | | | 1 | | |
| Text phone | | 1 | | | | | | | |
| Electronic magnifier | | | | | | 1 | | | |
| Memona Plus | | | | | 1 | | | | |

[a] with TALKS
[b] with Braille display

Blind 2 and Blind 3 have TALKS[1] speech output software on their mobile phones. It speaks out the words and letters that are shown on the screen. Blind 1 is not a TALKS user, but uses the mobile phone just by touch. Blind 1 has a limited access to mobile phone functions since she has to memorize the menu structure. Blind 1 and Blind 2 read Braille and therefore have a Braille display attached to the computer. It transforms the text on the PC screen into Braille, displaying 40 of 80 tactile cells on a line.

Both blind and situationally blind users performed equally in given tasks (see Table 3). Neither situationally blind nor blind users were able to find a silent phone if it was placed in an unknown location. If the phone was ringing, both situationally blind and blind users found it easily guided by the sound. Situationally blind users also noticed the blinking screen and were able to locate the phone by the help of the blinking light.

**Table 3** Ability to perform given tasks (situationally blind vs. blind)

| Task | Situationally blind (complete darkness) | | | Blind | | |
|---|---|---|---|---|---|---|
| | Ordinary 1 | Ordinary 2 | Ordinary 3 | Blind 1 (no TALKS) | Blind 2 (TALKS) | Blind 3 (TALKS) |
| Can he find the silent phone, when not holding it, and make a call? | no | no | no | no | no | no |
| Can he find the ringing phone, when not holding it, and answer the call? | yes | yes | yes | yes | yes | yes |
| Keypad locked, can he unlock it and make a call? | yes[1] | yes[2] | no[3] | yes[2] | yes[4] | yes[4] |
| Keypad unlocked, can he make a call? | yes[5] | yes[5] | yes[5] | yes[6] | yes | yes |
| Keypad unlocked, can he send a text message? | yes[5] | yes[5] | yes[5] | yes[6] | yes | yes |

[1] Pressing one determinate key lights the screen and makes the instructions to unlock the screen visible. *User knows the determinate key by heart.*

[2] Pressing two determinate keys is needed to unlock the keypad. The screen is not lit until unlocked, i.e. the instructions to unlock the screen not visible. *User knows the determinate keys by heart.*

[3] Pressing two determinate keys is needed to unlock the keypad. The screen is not lit until unlocked, i.e. the instructions to unlock the screen not visible. *User does not know the determinate keys by heart.*

[4] TALKS speaks out the instructions to unlock the screen.

[5] The screen is lit.

[6] *User knows the menu structure and keys by heart.*

Some phones require pressing two determinate keys to unlock the keypad. The screen of the phones will not be lit until the keypad is unlocked, i.e. the instructions to unlock the keypad that are shown on the screen cannot be seen. In order to unlock the keypad without instructions, one must remember the correct key combination by heart. One situationally blind and two blind users did not remember the combination. These two blind users were, however, able to listen to the instructions on the screen through TALKS and then able to successfully unlock the keypad, where as the situationally blind

[1] SpeechPAK TALKS™ converts the display text of a cellular handset into highly intelligible speech, making the device completely accessible for blind and visually impaired people. SpeechPAK TALKS runs on Symbian-powered mobile phones to speech-enable contact names, callerID, text messages, help files, and other screen content. (http://www.scansoft.com/speechworks/talks/)

user was not. In other words, the blind users had found a solution to their need by installing TALKS on the mobile phone.

One ordinary user drives a lot and uses a hands-free holder for the mobile phone in the car. He finds it very difficult drive and simultaneously hit the right buttons when phone is placed in the holder. This problem is very similar to the one of unlocking the keypad in the dark.

Also deaf and situationally deaf users performed equally in given tasks (see Table 4). Only one situationally deaf (Ordinary 2) was able to find a ringing phone when not holding it. She noticed the blinking lit screen in the corner of her eye. Other users did not notice the ringing phone.

**Table 4** Ability to perform given tasks (situationally deaf vs. deaf)

| | **Situationally deaf (noisy environment)** | | | **Deaf** | | |
|---|---|---|---|---|---|---|
| **Task** | Ordinary 1 | Ordinary 2 | Ordinary 3 | Deaf 1 | Deaf 2 | Deaf 3 |
| Can he find the ringing phone, if not holding it? | no | yes[1] | no | no | no | no |
| Incoming call, can he find the phone, if the phone placed in a pocket or a handbag? (phone vibrating) | no | yes | yes | yes | yes | yes |
| Incoming text message, can he find the phone, if the phone in pocket or handbag? (phone vibrating) | no | yes | yes | yes | yes | yes |
| Can he make a call… | yes | yes | yes | yes | yes | yes |
| ...and communicate the message? | yes[2] | no[3] | no[3] | no | no | no |
| Can he send a text message? | yes | yes | yes | yes | yes | yes |

[1] *User notices the blinking light on the screen.*

[2] *User notices when the call is answered, and then speaks out the message on the phone.*

[3] *User does not notice when the call is answered. User speaks out the message on the unanswered phone.*

All users were able to select a number and make a call, but only Ordinary 1 was able to communicate a message. Deaf users were naturally not able to speak. Ordinary 2 and Ordinary 3 could speak the message on the phone, even thought they could not hear the person in the other end, but neither user was able to realize if the call had been answered or not. The symbol that indicates calling changes on the screen, when there is a ring tone. Both users were mistaken by this symbol change and interpreted it to indicate that the call had been answered.

All users talked about the importance of a good keypad. None of the ordinary users were satisfied with their current keypad. One ordinary user hoped for a keypad with good tactility that would enable the use of it without watching. She also wanted to wear a protective cover on the mobile phone but found using the keypad difficult through the cover. She uses the protective cover on the phone not only in order to protect the phone but also in order to get a better grip when digging out the phone from a bag without watching. Two blind users had found a solution to their tactility need: They had modified the keypad by adding a small "lump" on the 5-key or all keys in order to make the keypad more tactile.

What is found is that the needs that ordinary (situationally disabled) users face in special situations are similar to those of extraordinary (disabled) users in ordinary situations.

## Leading edge behavior of extraordinary users

We found that disabled persons experience needs that ordinary users may experience later, and that in many cases they already have obtained solutions to those needs. There are examples of solutions the disabled users have found, but which have later become general among ordinary users. We also found several examples of solutions currently used by disabled users that may become common in the future.

Deaf users rely heavily on text messages, and in Europe they, in fact, adopted text messaging much earlier than the ordinary public. This, however, requires writing in a language other than native, which for the deaf is sign language. One deaf user sends her husband photos of products from stores, in order to avoid time consuming text messaging. For ordinary users this would in many cases be more efficient than trying to describe something using words.

**Figure 4** Memona Plus

One blind participant still actively uses Memona Plus (see Figure 4) for making notes. Memona Plus is a pocket size electronic, portable Braille note taker that weighs 180 g and can be connected to a PC or to a mobile phone. Memona Plus enables both 6- or 8-dot Braille. The storing capacity is 30 A4 pages. The written texts can be checked sign by sign through the inbuilt digitized speech output. The notes can be stored as different files and they can easily be transferred to a PC. The keyboard can also be used as a PC keyboard. Through the inbuilt microphone short voice messages can be recorded. Memona Plus also tells the time and date. The predecessor of Memona Plus was Memona (introduced in 1992) which had a smaller storing capacity and no voice message recording. The first personal digital assistants (PDAs) had practically the same functions. One of the firsts was Palm Pilot that came to market in 1996 – 4 years later than Memona.

One blind user actively uses Navicore Personal[2] navigation software through TALKS, as he is not able to see the map on the phone screen. Although Navicore was designed to be used when driving, he uses it for personal navigation when walking. Separate navigation systems especially designed for car-use tend to have a speech output option for exactly the same reason, i.e. not being able to look at the map when driving.

[2] Navicore Personal is a software application for navigation that is installed on the mobile phone by memory card, and used together with an external Bluetooth GPS-receiver (http://www.navicore.fi/).

To compensate the missing possibility to make calls, all deaf users have been using MSN messenger[3] service on the internet for years. Nowadays MSN messenger and the like have also been adopted by the general public. All three used MSN messenger both through webcam and through regular text-based chat. Webcam is always preferred to chat, since use of webcam enables communication in sign language. The only negative side of communication through webcam was seen to be its intrusive nature. Sometimes a customer does not want to be seen in relaxed clothing at home, for example. In this kind of cases text-based chat is applied, even though both parties share sign language as their native language, and are sitting in front of a webcam.

The next step from using the messenger service with a webcam is making two-way video calls, which two deaf users already do on their SonyEricsson Z1010. This phone is a clamshell phone and has two cameras: one on the outer side (see Figure 5) and one on the same as the screen (inner side) (see Figure 6). They found it good that when making a two-way video call, i.e. when making "a call in sign language", the phone can be placed on a table, in order to make signs with both hands. But when holding the phone on the other hand and making signs with the other, a thumb can accidentally be placed on the camera. When sending a one-way video message, i.e. when sending "a text message in sign language", you are forced to use the outer side camera. This works fine when you are recording other things than yourself. But when you are recording yourself making signs, you are not able to see your own picture.

[3] Internet messaging service by Microsoft (http://messenger.msn.com/).


**Figure 5** SonyEricsson Z1010 mobile phone (pointing to camera used in one-way video messages)

**Figure 6** SonyEricsson Z1010 (pointing to camera used in two-way video calls)

The majority of current mobile phone users have not yet started using two-way video calls or even sending one-way video messages. There are several reasons though why video calls and messages may become popular among all users. In a modern world we live in, families and friends often live geographically far away from each other. By making two-way video calls instead of phone calls, grand-parents could stay in tighter contact with their grand-children, for example. A parent could be able to show the other parent the first steps of their child as he or she is taking them. Instead of sending a holiday text message stating it is sunny and the beach is beautiful, one could send a one-way video message actually showing it. Also working life has become more dispersed over the years and people spend more and more time on business trips. Video conferencing is used but it requires special equipment, which makes organizing such a conference complicated. Two-way video call could be established right then and there, whenever needed.

The deaf users also indicated that there should be a small light source integrated in the phone. Otherwise it is not possible to make two-way video calls or send one-way video messages in the dark. That naturally would apply for all users.

Two blind users had installed TALKS on their mobile phones, but all users would clearly benefit from the possibility of switching to speech output when in the dark or driving a car, for example.

One visually impaired participant described a problem considering routing when outdoors. He is able to notice signboards but not able to see what is written on them. He suggested image recognition as a solution to this problem: User would take a photo of the signboard and have TALKS read out the text. This would be a handy tool for anybody visiting a foreign country. Before departing for a trip, one would just download a suitable dictionary on the mobile phone.

An everyday problem blind persons face is trying to locate objects. One blind user suggested that in order to stop worrying about keys, the mobile phone could be used to lock and unlock the home door. That would clearly help everybody, as we all seem to be carrying more and more objects everyday.

These multiple examples show that the extraordinary users, disabled in this case, do indeed exhibit leading edge behaviour in adapting and developing new communication aids. While some of the needs of the disabled do not match with the needs a situationally disabled person might face, many do, as described above.

## DISCUSSION AND CONCLUSIONS

We found that the user needs of ordinary users in special situations correspond well to the needs of the extraordinary users. In our example, the user needs of situationally disabled users, i.e. ordinary users in special situations, overlap with the needs of disabled users in ordinary situations. We were also able to show several examples of leading edge behavior of extraordinary users. It seems that if extraordinary users were seen as lead users, it would greatly benefit the identification of latent customer needs and therefore help develop breakthrough products.

When we look at the data gathered through this study in reference to von Hippel's definition, we find that the second lead user characteristic clearly applies to disabled users: Disabled users surely benefit significantly by obtaining a solution to their needs. What comes to the first characteristic, there are examples that show that the extraordinary users driven by their extraordinary needs have found solutions like text messages that have later become common among all users. There seems to be a similar trend in two-way video calling. This suggests, that in order to accelerate the adaptation of the new application, companies could investigate the needs of extraordinary users who already use various mobile two-way video communicating applications, and use the information to develop the new mobile phones (or other devices) to better match the (latent) needs of the public.

Lead users, or extraordinary users, are often considered high-performance users, such as marathon runners vs. casual joggers, or aerospace vs. car industry. We were able to show that also low-performance users, disabled users in this example, can be seen as lead users and highly beneficial in customer need identification. Innovations made by extraordinary users regardless of their performance-level benefit ordinary users that build the bulk of the market place.

It should be noted, however, that disabled users also face specific needs that are unlikely to become current among the general public. Blind users, for example, hoped for a 10-cell Braille display to be included in the mobile phone, which an ordinary user will not need, as she does not read Braille. This however does not diminish the valuable other usage data that can be obtained.

We recommend that extraordinary users would be included in customer need identification in product design. At times, all users suffer from situations, when they are not able to use all senses. Users of any devices should not be divided into able-bodied and disabled, since ability level is not a dichotomy but a continuum. Turning to people with disabilities in usability testing of products could also highlight problems that would not be obvious to those without such disabilities.

In addition to the fact that users who do see and hear undergo moments of situational disability, it should not be forgotten that up to 25 % of population in industrialized countries are older people or people with a disability [8]. The target market of mobile phones being virtually all consumers, means that the aging population should not be shrugged aside, as it continues to fill an ever-increasing part of the target market.

As a possible limitation concerning this study could be seen that only hearing and visually impaired users were studied. These user groups were selected to represent disabled users because of the clear definition of these groups. It was not difficult to construct corresponding situational disability environments. Another limitation could be the low number of participants. Examining more users of each examined group would possibly have given a wider understanding on the user needs. Future research should include examining other extraordinary users like persons with a physical disability, as it is not difficult to find corresponding situational disability circumstances in everyday life, where use of limbs is not preferred or is completely excluded.

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