

# Unexploited Resources in Interaction Design for Universal Access: People with Impairments as a Resource for Interaction Designers

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**Abstract.** A challenge to HCI-designers is to create simple, usable, and useful applications. The current paper addresses this problem and presents an innovative possibility to extract useful information from users rarely represented in contemporary participatory design approaches. The study was conducted from a Universal Access point of view.

The primary result of the study is that people with well defined intellectual (e.g. understanding and logical reasoning) difficulties provided the designers of web-pages with more valuable and elaborated answers to bottlenecks in the interaction than a more representative group of web-users.

With this result in mind Universal Access should not be an unreachable goal. This implies that people with intellectual difficulties can be regarded as an unexploited resource in HCI when using a participatory approach.

**Keywords:** Universal access, Design methods, Design for all, Universal Design.

## 1 Introduction

The aim of this study has been to develop a more effective design method enabling better understanding and an easy to use interface for net-based services, improving universal access.

Our emphasis is design support in early design phases. In traditional participatory design approaches users' diversity is not an issue in selection of participants.

An attempt to use a participatory design approach with the ambition to achieve universal access to net-based services has frequently been considered to be expensive as well as time consuming. However, is it possible to reach this goal with scarce resources? Participatory design has usually been applied for development of innovative services, whereas universal access has been more focused on finding problem areas and circumvention of these. In addition we strived to utilize opinions and experiences from a group of people with intellectual difficulties that usually is disregarded in design contexts.

The point of departure for the current study was the phase between the designer proposed paper prototype and before programming.

## 2 Background

### 2.1 Strategies in Design

Is it possible to design “easy to use” interactive applications? Well, it should be, but where do we start? One strategy is to start with the most difficult part [1]. But, which one is the most difficult?

We have to define what we mean by “Easy to use”. Is it just easy to navigate physically or is it easy to understand and easy to read? A simple and effective navigation system in interactive applications is one of the most important things when making it user-friendly.

We can approach the question in several ways. The one we have chosen is to involve the target users in the design process. This has been successful in User-Centered-Design (UCD) [2] and in co-operative [3] design processes. In general UCD projects, the end user is not usually taking part as participant in the very design process, but the knowledge of the user is leading the design on the right track. On the other hand in Co-operative design processes the end user is participating in the process. One example is the project “KidStory” [4] where kids were equal partners in the workgroups. The objective of these workgroups was to build low-tech prototypes with an obvious focus on usability issues close to the participants.

### 2.2 Users in Design

The main issue in this paper is our critical attitude towards the use of “common user” or “representative user” and also the thinking that usability testing have to involve large groups of representative users to be valid.

One solution is to hold down the amount of individuals participating in the evaluation as Nielsen [5], suggests to use as few as 8 -10 experts in a “discount” usability test to get hold of up to 80% of the usability problems.

Most of the design approaches in order to make easy to use products for all people is to choose representative participants [6] [5] [7] (common users) to provide ample input to the design process.

The group “common users” consists of 'all users'. 'All users' include people with all possible variations of states and conditions [8]. There are very few efforts to explore alternative ways of choosing participants in design processes, despite the fact that individual's functioning is something that can change over time [9] or are tied to a certain situation.

Ohlsson, Persson & Östlin [1] advocate that individuals with limitations in their functioning could be a valuable asset in the design process to indicate difficult areas of the usage.

To use the concept 'functional difficulties' [10] instead of disabilities might give us another view on the design of products and services for all people that not always have to result in special solutions for certain kinds of groups. Special solution in itself can sometimes be considered as discrimination, while “broad” solutions, that are good for all, are experienced as natural solutions that fit the broader group as depicted in the TED – model [1].

The TED- model is compliant to ISO-standard 13407 [2], asserting four user centred design activities that need to start at the earliest stages of a project.

Most conventional models of usability testing in a user centred design approach, does not consider users with specific difficulties, is not sufficient for designing accessible, usable and use-worthy [11] services for a broad majority of users due to its focus on the main user.

The main difference compared to a conventional usability model to the TED-model is the introduction of a group comprising people with specific and defined difficulties. This group of people with defined difficulties are thought of as problem identifiers in the evaluation process, and a creative solution asset in the design process of new products and services.

### 3 Aim

The aim of this study is to determine how people with limitations in their functioning contribute to the design process in conjunction to other groups. The focus is to make the usability issue simpler to deploy in the design process of creating interactive-services.

The main research question in this study was:

*How does the use of a group of persons with limitations in their functioning influence the design process of interactive services?*

The secondary and more precise question is derived from the first question:

*In which way do individuals with development disability enrich the development of easy to use interactive applications?*

### 4 Method

This study was made in two phases; first phase used “Think aloud” protocols [12], where the user verbally describes the interactive sessions and their perception around them and the second phase was a group activity.<sup>1</sup>

A paper based prototype (sketches) of the interactive applications was used. The usability area of this study was primarily targeting the “Ease of understanding”. Real navigation in the interactive applications was not possible due to the design phase (only paper based sketches was at hand), where not all information was available during testing. This was the first step in the development process, to give the designer some input on the layout and how understandable some of the conceivable/imagable functions were.

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<sup>1</sup> In cases number one and five there was an additional iteration. The designer was present in the background in these two cases. A new paper based prototypes was presented to the participants based on the result of the previous iteration. The participants were then asked to “Think aloud” about both prototypes and asked for preferences and why, as the first step.

**First phase;** The method is based on “Think aloud” protocols [13] [14]. The method’s main purpose is to let a user describe how to do a specific task. The user is also expected to verbally express his/her thoughts. The procedure allows the participants to express themselves as freely as possible and to let them talk as much as possible from their own point of view.

We asked the participants to “Think aloud”, while he/she was looking at paper prototypes in solitude. Each participant was asked to describe how he/she navigates through the system and to describe his/her thoughts about what would happen when navigating through the system as the first part of the test.

**Second phase;** the group activity was made in two steps, A: one focus group discussion of their personal experience of the prototype, and B: the group made a simple prototype together.

Five different design cases were studied (Table 1). In all cases except one the intent was to use keyboard and mouse as input devices. In case number four a handheld control was used for potential navigation in the proposed main TV-media. Ethnographical data of presumptive users was collected by the designer prior to this study. The ethnographical data collection was not a part of this study.

**Table 1.** Descriptions of the five cases

Case 1	A web application aimed to promote a conference. The target for this site is politicians, organizations, companies and all other interested in the area. Target users for this site are all citizens in the county for the conference.
Case 2	A web application aimed to make pressure on manufacturers for certain consumer products. The target group is manufacturers and the entire group of consumers. The driving force behind this site is to increase the influence of consumers with a specific limitation of their hand function on the design of products.
Case 3	A web application targeting public information from a specific municipality. The target users are all citizens in the municipality. The municipality strives towards a site developed in a “Design for all” perspective.
Case 4	A interactive television (ITV) application intended to bring easy and understandable information to the guest of municipality driven elderly care centre and the guests’ next of kin. This ITV-application should work both on a computer and on set top boxes for TV.
Case 5	A web application aimed for a small web shop with a limited number of products. Target group is all consumers that have access to Internet

The cases in the current study are aiming towards all as in “design for all”. In case four the target users are elderly people and their next of kin, where the elderly are subjected to elderly care. This implicates that the first target group has severe difficulties due to the system of elderly care in Sweden, where elderly people live in their own homes as long as possible. The difficulties can be both of psychological and physiological nature.

#### 4.1 Analyse Method of the Material

All activities was recorded and transcribed with Linell’s second level of transcription [15]. The content from the transcribed material was analysed [16] [17] and categorized through the areas of remarks. The categorized material was compared between the tree groups of participants. Material from the first (individual) part was then compared to the second (group activity) part and the result was analysed both for each case and between the cases.

#### 4.2 Participants

The study was conducted on one group persons with defined difficulties; In this case intellectually impaired, and one group with elderly and another group with school employees. All participants were recruited by referrals [18].

**Table 2.** Participants in the study

Participants	Case 1	Case 2	Case 3	Case 4	Case 5	Total all cases	
							Unique individuals
Defined difficulties(D)	9	6	6	6	7	34	31
Elderly (E)	6	6	0	6	8	26	20
School employees( S)	4	0	2	3	4	13	13
Total	19	12	8	15	19	73	64

In total 64 different persons participated in the study (Table 2). The group of people with defined difficulties (D) were 31<sup>2</sup> and they all have mild to moderate intellectual impairments. One group of elderly comprising 20<sup>3</sup> persons (over 63 years) and 13 school employees participated in the study.

People in the groups with defined difficulties (D) were in the ages between 17 and 20 years old. 60% of the participants in this group were female. All the participants were familiar with mobile phones, Internet and chat. None of the participants indicated that they were technique novices. At each site there were between 6 and 9 participants in the D group. Three persons participated in two different case studies. The total number of participants in the D groups was 31 individuals.

<sup>2</sup> Three of the persons participated in two different case studies. One person participated in case one and four and two persons in case one and five.

<sup>3</sup> The same group participated in case one and four.

In the groups comprising elderly persons the participants' ages were between 63 and 86. In this group there were 55% female and 25% of the participants indicated that they were technique novices. One of the groups of 6 elderly participated in two cases. The total number of participants, in the groups of elderly (E), was 14.

Another group with adults working in a school participated in the studies. Nine of the participants worked as teachers and the others worked as teaching assistants, without academic education. Of this group there were seven females. In this group two persons indicated that they were technique novices.

### 4.3 Ethics

All participants were informed that the participation of this study was strictly voluntary and that they could terminate the participation whenever they choose. They were also informed how the material should be used. The information allowed the participants to decide by themselves to participate or not. [19]

## 5 Results

The result of this study is described in two parts. The first part constitutes some examples of the design outcome of the two steps in the study. The second part consists of a comparison of the result between the groups in both steps of the study.

### 5.1 Examples of Design Result from the Different Cases

In the first case (Web application aimed to promote a conference), the D (defined difficulties) group stated that it should be easier to understand chosen menu items. This did not come up in the other groups. The D group came up with a design suggestion implemented in the second version that all groups considered as an improvement.

All individuals in the D group had trouble with the pictures in case two (Web application aimed to make pressure on manufacturers); they tried to give them some functionality. Half of the group in the E (elderly) group did the same thing. The designers' thought the pictures in the prototype were something that should emphasize the message of the site rather than being connected to any function.

In case number three (Web application targeting public information); the participants in the D group reacted to the menu text and the menu background colour. The S (school employed) group did not mention this at all.

Another thing that came up during step one in case three, for all participants in the D group, but not for all the participants in the S group, was a question about which of the menus that was the main menu.

In case four (ITV application); All participants in both the D group and the other groups could explain how to navigate by pointing at areas in the prototype. This differed, unfortunately from the designer's idea of how to navigate. Even the use of the handheld control: Two out of three in the S group and all in the D group explained how to use it in another way than the designer's way.

All participants reflected in case five (Web application aimed for a small web shop) step one (the individual part) that the menu system was easy to find. That the

menu text was too small in relation to other text was also pointed out by all participants in the D group, in the S group and four out of eight in E group.

All the individuals in the D group, seven in the E group and two of the S group indicated problems with some of the words used in the menu. The understanding of the words constituted difficulties for the members of the D group.

## 5.2 Study Result

The first question about how a group with people with limitation in their functioning influences the design process is illustrated by the following.

The method of using simple paper prototypes and to let the participant individually talk about what they are thinking and feeling seems to be very efficient. Especially the individuals with development disability were very focused during the “think aloud” activity. The E and S groups did not have the same focus in the individual parts and they seemed to have some form of psychological/social barrier to speak out loudly what they were thinking.

- It seems as the D group easily think aloud around the paper prototypes. For people in the S and E groups it took some time to get started.
- It was noticed that it takes significant longer time per individual in S and E groups than in the D group for both the individual part as well as the group activity.
- In the group activity the differences between the three groups were small. It seems to depend more on the group members’ way of interacting with each other than which group they were in.

The second question outlined in the objective was in what way people with development disabilities could enrich the development of easy to use interfaces?

- The members of the D group came up with a wide range of suggestions, mainly through the group activity, to improvements that were of the kind that all individuals, with or without disability, could take advantage of.
- Even smaller areas of difficulties were noticed by the D group, but not in the other groups.

## 6 Discussion

One result that might come as a surprise to designers was the ease of which the D group talked about how they perceived the tested prototype sites. The method of “think aloud” around paper prototypes seems to be very effective for the D group. The S and E groups did not seem to have the same immediate easiness to talk about what they perceived about the prototype pages.

The comments from people in the D groups were more homogenous than comments from people in the E and S groups. In almost every question, the D group was describing the same difficulties, but in a more instant way. The E groups had more life experience, which resulted in some unique points of view regarding the interpretation of some menu items.

Using only the D group had resulted in the same result as the other control groups together in this study. This could be something that makes the UCD-process easier and shorter with fewer participants.

Also in the S control group the participants varied more in the individual part in their comments and reflections compared to the D group but still, all important comments also appeared in the D group. The S groups' diversity in reflection could depend on the fact that the participants in the former group varied in educational level and in life experiences. What is surprising is that the same reflection came up in the D group.

The D group's impact on the usability issues were actually mostly around the area pointed out in advance; the area of understanding the sites. The understanding of the text was one of the areas that the D group had a lot of comments about, probably because it is something that is important in their lives.

The method "Think aloud" was probably a very good way of receiving direct indication on the logic of the menu system. The members of the D group have a lack of logical thinking within their defined difficulties, which is probably the answer to why they so effectively point out the difficult parts of the menu system. They pointed this out without trying to describe what the menu item should mean. The members of the E and S groups tried to describe all the menu items even if they knew it was more or less a guess. This could be one of the things that make the use of D groups more effective.

With a "design for all" perspective in mind the result indicates that, having people with difficulties participating in the test/design groups, problems within the area of accessibility is automatically included in the process without having to include it separately. This was very obvious when a second prototype were presented to the participants built from the result from the design activity.

In the phase of designing the interactive services the approach using the method with people with defined difficulties in their functioning seems to be very effective.

In a Human Centred Design process the user is one of the main objectives. How do we describe a normal user in a normal environment? In design we often try to design with a representative user group in mind. Are these questions relevant? The result in this study points in the direction of rethinking how to select users that participates in design processes. We might end up with choosing participants according to the limitation in their functioning instead of a representative selection of participants. There can be contextual difficulties where specific knowledge is necessary. Maybe this result is more useful and efficient in applications meant to be used for the general public.

Universal Access should by this result not be an unreachable goal, but rather considering people with intellectual difficulties as an unexploited resource in HCI when using a participatory approach.

## 6.1 Future Areas of Research

Only a minor part of the design process has been covered in the present paper. Further research should focus on the whole design process from idea generation to product or service implementation and follow ups. The main group of the present study had cognitive impairments, whereas further studies will be augmented to embrace people with other impairments as well. Further studies should aim to provide designers and developers with practical knowledge about accessible design tools, and about the specific contribution from diverse user groups, and simultaneously enquire designers' further needs of how to utilize this knowledge.



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