Children’s ability to navigate through a streaming service such as TV4 Play

Barns förmåga att navigera genom en streamingtjänst som TV4 Play

KRISTINA ROMAN
ABSTRACT

Due to the increased use of Internet among children, developers have realized that digital environments need better usability, especially to give children the opportunity to handle digital interfaces on their own. This paper investigates how children handle and navigate the online streaming service TV4 Play. The aim of this study was to understand the children’s moves and actions for further development of a more child-centered site that should make it easier for them to handle.

The study was based upon a Usability Evaluation Method (UEM) called Peer-Tutoring, where pairs of children cooperated and taught each other, one by one, to solve tasks based on navigation through the interface. This method was also combined with a method called Active Intervention, where questions were added to the Peer-Tutoring in order to invite the children to talk and reflect on their actions. The participants were 4-6 year old children from a preschool in Danderyd, Stockholm.

The results show difficulties of navigating and understanding the structure of the site, which is closely related to children’s limited cognitive ability, for instance, adults have superior capacity to handle drag and drop compared to children. These results led to recommendations that the TV4 Play team can take into account when they optimize usability for children. For example, they should implement one-click buttons instead of drag-and-drop functions, and list the available TV shows in a horizontal overview.

SAMMANFATTNING

På grund av den ökade användningen av Internet bland barn, har utvecklarna insett att digitala miljöer behöver bättre användbarhet, särskilt för att ge barnen möjlighet att hantera digitala gränssnitt på egen hand. Denna uppsats undersöker hur barn hanterar och navigerar på streaming tjänsten TV4 Play.

Syftet med denna studie var att förstå barnens rörelser och åtgärder för vidareutveckling av en mer barncentrerade webbplats, som ska göra det lättare för dem att hantera.

Studien baserades på en användbarhets utvärderingsmetod, som kallas Peer-Tutoring, där barnen i par samarbetar och lär varandra, en efter en, för att lösa uppgifter baserade på navigering via gränssnittet. Denna metod kombinerades med en metod som kallas aktivt ingripande (Active Intervention), där frågor ställdes för att bjuda in barnen till att prata och reflektera över sina handlingar. Barnen var 4-6 år gamla från en förskola i Danderyd, Stockholm.

Resultaten visar svårigheterna att navigera och förstå strukturen på webbplatsen, vilket är nära relaterat till barnens begränsade kognitiva förmåga, t ex har vuxna överlägsen kapacitet att hantera dra-och-släpp jämfört med barn. Dessa resultat har lett till rekommendationer som TV4 Play teamet kan ta hänsyn till när de optimera användbarheten för barn. Till exempel bör de implementera klickknappar istället för dra-och-släpp-funktioner och lista tillgängliga TV-program i en horisontell översikt.
Children’s ability to navigate through a streaming service such as TV4 Play

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KEYWORDS
Children Interaction Design; Children’s Cognitive Ability; Peer Tutoring; Active Intervention.

INTRODUCTION
The numbers of digital products and services have increased in Sweden in recent decades, especially in the industry of information and communication technology [1], [2]. The use of streaming services has become increasingly common in everyday life during the shift from analogue to digital transmission [3]. A newly released report shows that tablet use among children has increased remarkably the last few years, especially in younger ages, 0-8 year olds, mainly because they are easy to use and the thorough usability of the interface [3]. Usability is now at the center of development, and therefore web interface used by computers need to match the progress of those used by tablets.

Most children in Sweden today are exposed to computers and tablets from an early age, and they quickly learn how to use these devices [3], [4], some of them even before they are exposed to books [5]. The information available online has increased, and common interfaces are not optimized for children’s interactive ability, like tablets are. Simultaneously, with the increasing development of new services, the majority of interfaces developed are still focused on adults, leaving the children behind and neglecting the needs of children. Even though recent development of interfaces has aimed to be more adapted to young children [6], there are still few studies that involve children or how they perceive their use of computers [7].

Since 2009, the TV4 Group1 provides an online streaming service called TV4 Play, where TV shows are broadcasted online, both live and catch-up. This master thesis is done in collaboration with TV4 Group, in order to investigate how children manage and navigate the interface of TV4 Play. The aim of this study was to understand the children’s ability to interact with the service, like handling icons, searching for their chosen TV show, handling different episodes and ending up by going back to the homepage. The goal was to deliver a list of recommendations to the TV4 Play team for use in their further development of the website.

Designing for children is something that the TV4 Play team has to engage with in relation to their service. By understanding how children interact with digital environments, they can acquire knowledge about their progress its development towards a user-friendly environment. The main problem related to this type of interaction, was whether the children have the capacity or not to navigate to their favorite TV show. I was interested

1 TV4 Group; company that own TV4, Sjuan, TV12, TV4 sport, TV4 Fakta, TV4 Fakta XL, TV4 Film, TV4 Komedi, TV4 Guld and TV4 HD.
in their behavior, whether they understood every icon and if they could handle each part in the design. Hence, my research question is:

*How do preschool children use and navigate TV4 Play?*

Many Video on Demand services aimed at children such as SVT Barnkanalen, Netflix and Viaplay, seemingly try to remediate tablet interface conventions to increase the comprehension of the website layouts. Thus, the sub-questions, which are underlying the research question:

*Do tablets affect the use of laptops among preschool children?*

*How does preschool children's physiological capacity impact the use of functions inside the interface?*

**THEORY**

**Peer-Tutoring and Active Intervention**

This part deals with the methodology used in the evaluation. Research has shown an increased interest in the methodological knowledge of designing evaluation tests for children [8], [9]. Al et al. found that testing pairs of children is a suitable method, because children have difficulties to follow a traditional think-aloud protocol [10].

This method has come to be known as Peer-Tutoring and it encompass each child to participate in two sessions, first to learn from the previous child and then to teach the next child in line to handle the same process. The aim was to open up for comments and questions that would not appear in a test using a single participant.

Some of the challenges when designing Usability Evaluations Methods (UEM) for children are children’s vague ability of verbal expression, which depends on the ability to translate experiences into statements. Abstract and logical thinking abilities, along with the skills of keeping multiple concepts simultaneously in mind, are also difficult and could prove to be problematic when formulating the tasks [9]. Kesteren et al. found that most verbal comments were collected when using Active Intervention - a UEM aiming at eliciting thoughts from users by actively asking them questions during the performing process. This study has used Active Intervention in parallel with Peer-Tutoring, to guide the children forward. Children in pairs could identify more usability problems, and specifically more critical problems, compared to doing it alone [10]. The cognitive burdens of performing the tasks is divided between the tutee and tutor, and are called expert and non-expert child in this thesis [11]. The questions complemented the test and created a conversation between the children and the researcher.

**Children’s Cognitive Ability**

Following section deals with children’s ability to solve problems and receiving information. Children have other cognitive stages compared to adults that are significant in interaction with digital environments. The most developed design processes involving children already from the beginning of the development [12]. Cognitive, physical, social and emotional developments are factors that impact the children’s interactions with digital environments[5]. It is important to create entertaining and learning environments for children, to increase their cognitive capability in interaction with new interfaces. Research on children’s interaction has therefore been meaningful in both theoretical and practical aspects [13].

Martens [12] reports that children are limited in digital environments - due to their underdeveloped skills, such as spelling and understanding hierarchies and classifications that makes it difficult for them to find what they are looking for. She argues that these are some of the main challenges when designing interfaces aimed for children; their cognitive development and their motor skills need to been taken into account, in all digital environments designed for children. Their lack of knowledge about keywords and their low ability to spell make it easier for them to browse compared to search [12]. Children’s limited capability to use drag and drop, point and click that also can be challenging when designing for children, particularly if the graphics and the icons are too small or close to each other[12].

Fang, Luo & Xu [13] argues that interaction between children and computers is a complex process of cognitive activity and it involves the coordination of psychological factors. Consequently, analyzing the children’s psychological characteristics would be beneficial in designing human-computer interaction for children[13]. Druin et al. [6] designed an interface with children in mind, they made it more visual and with limiting use of text as much as possible, which reduced the children’s cognitive load. Other functions that reduce the cognitive load are one-click interfaces with easy interactions.

**Children's Interaction Capacity**

Within an interface where children interact and navigate, it is recommended to have an easy structure with high usability to meet the children’s ability to understand and help them reach their targets[6]. According to Cooper, children use the same cognitive ability to learn reading, as they working in a digital environment. They need to learn how links works, how they move through these links and understand the process and progress of navigating through these links to the other screens [5]. Navigating by clicking on destinations, with easy buttons such as “home” and “back” icons, needs to be easily placed for the children to understand the meaning and purpose [6].

Fang, Luo & Xu [13] concludes that it is easy for children to make errors during an operation when they clicking by use the computer mouse, it is difficult for them to grab the object once again they have dropped it. Another problem is that they drop the object before having dragged it to the intended position. Children have difficulties to accomplish the accurate positioning like selecting and dragging objects. Consequently it is not ideal for children to use a computer
mouse, instead Fang, Luo and Xu [13] suggests that design should use discrete commands instead, to facilitate the interaction.

For children there exists three stages of movements due the navigation and the use of a computer mouse: fast move cursor to the object, slow down to precise position and lastly click and release the button [13]. The number of drop errors will probably decrease when objects have to be dragged over smaller distances [13]. Young children have the capability to use a computer mouse, but it takes significant longer time to fulfill a process [13].

**Children’s Ability to Manage Searching**

According to Druin et al children appear to search very differently depending on gender [6]. Boys tend just search for a specific character they want. Instead the girls tend to be careful and more interested in browsing pictures than finding the exact character in question. Therefore the interface needs to support structured searching and browsing, and an efficient method for accessing information [6].

Earlier studies have shown that children lack in understanding concepts of classifications and hierarchies, which make searching online challenging for them [12]. Since children have difficulties with hierarchies and classification systems, the International Children’s Digital Library team has proposed a way of to flatten these hierarchies, making them concrete instead of abstract, with pages of icons and keywords designed specifically for children [12].

The recognition skills can also be utilized when designing searching systems, by offering a choice of categories that require almost no input - thus minimizing the requirements of spelling skills and substantial vocabulary [15]. Hanna et al. [16] found that usability of a product is closely related to children’s enjoyment of it; therefore a design that is fun and at the same time help to understand the functions, is exclusively important in this development.

**METHOD**

To answer the question of how children use and navigate TV4 Play, the usability evaluation of the website was made with 20 children. They were 4-6 years old from a pre-school in Danderyd, Stockholm, and the ages were distributed as follows: 6 four years old, 12 five years old and 2 six years old. The investigation took place in their preschool, to reduce insecurity and maintain comfort (figure 1). Days before the test would be carried out; the parents took part of a document, which described what the study would be about and to approve consent for the children to attend, as well as video recordings and how these would be handled - more about this in Ethics Statement.

The evaluation used Peer-Tutoring as method and was based on a variety of tasks that include all buttons, links and step through the whole website aimed for children. All the tasks were given verbally right after they had finished the ongoing task. They were ordered to fulfill one task before they could start on another one, and all tasks are summarized in figure A.1 in the appendix. If they did not manage a task, they received help from the expert child, which already had performed the same session, alternatively from the researcher.

In the beginning of the day all children were gathered to get an brief introduction and information of what should happened when they entered the test. The aim of the introduction was to make the children calm and safe, because they performed the test without the teachers.

Before the test started they got instructions to select characters from a paper where all TV shows available at TV4 Play were collected, in order to put the sequence in a realistic scenario and to avoid that the children chose the first show that came up at the screen. The evaluation was performed on a MacBook Pro laptop within the pre selected web browser, Safari. They could chose between using an ordinary computer mouse or the touchpad on the laptop.

**Figure 1 An evaluation session with children in pairs at their preschool.**

The tasks were designed to allow the children manage icons and functions, navigating and searching for the TV show they selected in the beginning of the test. Questions were asked in case some children did not voluntarily speak during the test, this method is called Active Intervention [9]. The whole session was conducted in surveillance of a web camera and screencasts to record the behavior, the dialogue between the children and the clicks on the screen. Additionally, notes were used to register specific behaviors and to facilitate the compilation of the results. In order to prove certain results, a measurement in Google Analytics was conducted to compare features and its use in reality. From this material; specific difficulties and areas in the design, could be individually examined, and data regarding this be collected. After all results had been collected, the videos and the data were analyzed one by one.

**RESULT**

As described above, the test was structured to let the children, on their own navigate through the different steps inside the website. The protocol of the evaluation is
presented in figure A.1 in the appendix. During the test it became apparent that some of the children had an instinct to use their fingers to swipe and click directly on the screen, without using the touchpad. Probably because the majority of those who use digital tools at home uses tablets (table 1). They were given the opportunity to use a computer mouse or use the touchpad on the laptop, almost everyone chose the touchpad, some of them tried to use the computer mouse, but eventually they also chose the touchpad. Three children had difficulties in using the touchpad; when moving the pointer from one area to another, and in knowing how to click. After they had entered the site once, they seemed too learned quickly how it worked. Almost everyone knew what was supposed to happen in the next step and where he or she should click to reach the target. Sometimes the speed with which the task was given, needed to be increased, in order to not lose the children’s attention completely, because the focus was sometimes entirely on what they saw on the screen, and not on what they should do. Fortunately, it is a positive response to TV4 Play, which confirmed that they managed to capture the children’s attention, but it created delays in the implementation of the test.

Table 1 Usage of computers and tablets among the children.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Girls (10)</th>
<th>Boys (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using a computer at home</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Using a tablet at home</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Using most of (Tablets/ Computer)</td>
<td>7/1</td>
<td>2/0</td>
</tr>
<tr>
<td>Manage the device above (Yes/No)</td>
<td>6/2</td>
<td>2/0</td>
</tr>
</tbody>
</table>

Navigating through TV4 Play

One of the sub-questions this paper deals with is how tablets affect the use of laptops among preschool children. This part summarizes how children act in the interaction with a laptop, where the tasks including navigating and searching steps. It is interesting to see how they using a laptop with a hint of how they possibly use a tablet. The following text is presented in the non-expert child perspective, and in the way of how it performed the tasks.

The first task was to find the Internet button icon at the desktop. Every child faced difficulties in their first attempt -although almost everyone found it with help of the expert child, except one that found it by itself. When the non-expert child became expert, this specific step seemed much easier to perform. Eventually they became familiar with it and after a while they manage it comfortably.

When the children had entered the first empty page in the browser in Safari, they were supposed to find TV4 Play’s homepage. All children were helped to type in the browser text field, because no one could write yet. Since Safari recognize the most frequently visited, it registered the use of TV4 Play and a red icon became visual after few visits. This made it easy for these children in line to find the website. This icon was something that everyone remembered after using it once, and became a sign of TV4 Play after a while.

Next task was to find the TV show they had chosen from the paper collage of all children shows available. All TV shows aimed for children were collected in the “child page”, and could be reached by either click on the “child page” icon in the menu bar or by searching for the specific show in the search field, and since they were too young to write, they needed to find the “child page” icon. Since the “child page” is written with letters BARN, which means children, and they are to young to read, no one could find it by itself, not until they got help of the expert child. Once they knew where it was, they remembered it. Accordingly differing two of them, which tried to search for the show in the start page, around pictures of other shows. They did not try buttons or go further into other pages (figure A.2 in the appendix) and after a while they got bored, stopped looking, and asked for help. Eventually they learned where it was placed and when they tried to hit it, they hovered the pointer over the icon and every time they pressed on it, they changed direction of the pointer and missed the target. Fortunately after few attempts, they finally manage to hit it. Two of the children commented concerned:

“”It is little bit tricky to find” and “It is hard to find””

After the children had entered the “child page”, they should find the TV show they had chosen. Most of them found the shows easiest in the top of the page. For those who had to search further down for the show, did not understand that they could scroll down to find more options – the interface can be seen in figure A.3 in the appendix. Most of them just stopped looking and asked if they could change to another show. It was also hard for most of them to use the touchpad to scroll, because they had not used that type of functions before. Once they found the specific show they had chosen, they could easily start it. Intuitively, everyone clicked on the picture of the show to proceed to the video page. Once they entered the specific video page (figure A.4 in the appendix), it started automatically, and everyone knew that they should wait for it to load. One of the children had problem with the picture that symbolized the show in the start page; the child chose one show at the paper collage before the test and the picture inside the layout was another one, which made it difficult for the child to find it. Some of the comments from the children who found it were:

“”There it is!’ ‘I know, there it is!’ and ‘Piece of cake’. One guy yelled out: ‘Hey bigger screen, please!”’

Handling Buttons and Bars

The focus of the second sub-question was on whether the children’s physiological capacity impacts the use of functions inside the layout or not. The following section deals with the difficulties children have regarding buttons and volume/progress bars inside TV4 Play's interface.

After they had found the show and entered the video page, next task was to press play and pause, adjust the volume
and go back and forth in the progress bar. The symbol of play and pause was easy for almost all children to understand, the icon easy to hit and they knew which functions it had. If they did not touch the touchpad for few seconds the menu bar became invisible and hidden, this made them frustrated and confused. The challenge was to grab the button before the bar suddenly disappeared, but the small size of the icon and the few seconds made it difficult for them to manage it. When the menu bar disappears, they did not know how to do to find it and make it visible again. It was disturbing and they became confused and uncertain when they should find the buttons. Unfortunately they did not understand that they should move the mouse over the play screen to make it visible. Some of them just tried to touch the mouse little bit, and since they did not move it over the player, nothing happened.

Figure 2 The pointer’s movements, made by five of the children when they tried to adjust the volume.

The children’s biggest challenge in the evaluation was to adjust the volume and manage the progress bar (figure 2). To adjust these bars, they need to grab the rounded icon and move the pointer at the same time as pressing the touchpad to grab the object. Intuitively, everyone tried to press one time at the volume icon to adjust the volume and not slide the bar that became visible. In general it was hard for them to manage the touchpad, such as pressing it down and at the same time moving the pointer to the target - the difficulty was to manage two actions at the same time. During the test they were too focused on what they should do, and forgot to press at the same time as moving the object. The size of the volume button was too small for them to hit and the rounded small area to grab. When they clicked, they directed all attention on how to click and forgot to focus on the area they suppose to click on, and it caused them to miss. This is also a difficulty that Martens discusses, such as children’s capacity and their limited ability to manage more than one action at once [12]. The results from this study, broadly complies what Martens argues for. In some cases, there was some who did this operation without problems and others start to use the buttons at the laptop instead of searching for the functions inside the layout.

To make the menu bar invisible after using it, the pointer needs to be removed from the bar, and only two of them moved the pointer right after. Another small observation was that some of them understood that increase the volume was upwards, and downwards was decrease. Few of them thought that volume was too low and eventually they tried to increase it by their own. When they were asked to use the progress bar, they first made some protests to not fulfill the task; instead they would like to finish the show until the end. This bar has the same difficulties as the volume bar; they could not grab the button, drag it to the target point and at the same time push the touchpad to move the object to another position. The children commended:

“I really wish it was bigger!” “I know, my mum has taught me.”

An evaluation of the volume button was conducted from the recorded videos, where an analysis was made on the area they clicked on, to see how the children moved the pointer and in what area they mostly tried to click on. The result shows that most of them clicked in the upper left corner of the button, and the reason could be that the children tried to click with the middle area of the pointer and not with the “pointing finger” that became visible when they are moving it above a linked icon (figure 3). A combination of the little hitting area and they sliding when they pressed the touchpad, could be a reason why they missed the area. They also met this challenge when they tried to click further on at the gray progress bar to move forward, even that line was hard to click on. They often missed the bar, clicked upwards on the screen, such as when they pressed the touchpad, the finger moved upwards, which resulted that they missed the line.

Figure 3 Area where the children actually clicked, compared to adults.

Next task was to set the video player in full-screen mode and almost everyone knew that button, it was easy to find and they understood it. In normal mode the button was a bit small to press on, but the icon was significantly easier to press on in the full-screen mode. Few were interested to switch to full-screen, but almost everyone knew how to do it. There were still minor difficulties, such as one child, who tried to enter full screen by zooming like using a tablet, with two fingers pinch-zooming on the touchpad. In turn, there was another child that press that button almost directly when the show started.
Then they should switch to the next episode of the same show. It could be reached by clicking on a button that indicates the next episode (figure 4) or by scroll down to more options of episodes. Most of them did not understand it until they got help from the expert child, but some of them tried and guessed where it was. The hit area of the button, which leads to next episode, was comprised of only an image and a text, and not the entire visual area, which was a difficulty when they thought they pressed, but indeed they missed and nothing happened.

**Figure 4 Button that lead to next episode, and the red area that was not linked.**

Next step in the evaluation was to find other seasons and episodes that belong to the same shows, which were located further down in the layout. Once again almost no one understood that they could scroll down, for more alternatives and options. They looked at the screen, at the picture and moved the mouse around at the screen. It was not until they got instructions to scroll down; they understood that they could do it. Furthermore it seemed hard to learn, because it was not clear, and some of them did not remember it when they should explain for the next child (in figure A.5 in the appendix).

Once they found the area of episodes, one child said it would like to see the last episode of the season and pointed in the end of the page. The chronological order of the episodes is understandable and in the right order for the children, even though not all pointed this out. It was obvious for some of them that the last episode was in the end of the page, one counted at the screen how many episodes there was and what they would love to see.

**Navigating Back to Children Page**

Before ending the evaluation, the children were asked to go back to the page where all TV shows were collected, the “child page”, and to pretend to choose another show. Many of them protested and did not want to go back, because they were busy with the ongoing show. In some of the situations the show needed to be paused, to remove the focus from the screen and then turn it on the actual task. When navigating back to the “child page”, there was two options to choose between; a big grey arrow in the upper left corner or by using the “child page” button again. Most children did not know what the grey arrow meant and asked for help to go back to the child page. The majority used the grey big arrow, because the expert child suggested it. Three of them chose instead to use the “child page” button again. These two buttons were measured in Google Analytics to compare if the majority of all users today use the grey arrow or the child page button to moving backwards, to see if there is any difference between the interpretation buttons. The results show that 34.5 % of the users that proceeded after viewing a video used the grey button and the other (65.5 %) used the children button. Then we can ask if the grey arrow are necessary if the number of buttons in the layout should be reduced?

The last task was to find another show, after they have experienced and became familiar with the website once, it was not a problem for them to perform. They easily navigated to another show like the same process before. They seemed to remember it very well. Good response against the structure in the layout was that they learned how it worked quickly.

**DISCUSSION**

The purpose of this study was to investigate how children in the age of 4-6 years old interact with the streaming service TV4 Play and to learn their capabilities of use and navigate through the layout. The collected data answered the question:

*How do preschool children use and navigate TV4 Play?*

During the study, my perception of children’s use of computers has changed a bit. Their cognitive capacity was a bigger difficulty than expected and resulted in difficulty of use. A usability evaluation method conducted the children’s behavior and actions within the interaction of TV4 Play.

The result show limited ability among children to use icons and bars, as well as understands the structure and the arrangement of the interface. They had difficulties when they used a touchpad on a laptop. The result showed similarities between using a laptop and the use of a tablet, especially in tasks where the children should scroll, make bigger player screen and when they performed movements that were close to an interaction with a tablet.

**Children's main challenges in the interface of TV4 Play**

Fifty percent of the participated children in the evaluation have access to and use a tablet at home, which could be a reason why usage patterns could be seen in their way of navigate on a computer. Difficulties related to the usage of a touchpad confirm the children's preferred use of a tablet. Intuitively they tried to use the screen as a tablet, by swiping and touching on the screen. Moreover, they could not use the touchpad in the same way as an adult; they had problems with pushing the button on the touchpad and change direction of the pointer inside the layout. Another pattern from the tablet usage was when a child tried to go for full-screen and zoomed on the touchpad, with two fingers swiping from each other. To sum up, the tablet seems to influence the way children use and interact with a digital environment at a laptop.
One of the challenges the children faced during the evaluation was to find the “child page”. The icon was not a sufficiently strong marker that they would find the first time. Some of them looked around without using the pointer and they searched among other pictures at the site and no one found it, without help. Usually, children cannot in ages 4-6 years old read, which made it difficult for them to localize the button. The little cloud around the “child page” button or the placement of it could be a reason why they remembered it in the next session. A suggestion would be to have more obvious icons for the children, like a specific area in the layout where some of the characters are gathered. Bergman et al. [15] suggests to utilized recognition skills, by collecting characters to offering the children what they looking for, which minimizing the cognitive load.

The children seemed to also use their recognition ability to find the specific show. They easily opened the video page containing it by clicking on the picture. This was easy for them; they did not ask, just clicked like they have used the site before. The picture of the show was big enough to hit, but some of the children got problems when the picture of the character was another inside the children page than it was on the paper collage it chose from. The pictures of the character may be little difficult to identify if they not symbolizes the main character at the front page.

They did not understand the opportunity to scroll down for more options of TV shows, which was a big challenge. It seemed that the page that appeared was the only thing that existing for them. But as Markopoulos and Bekker (2003) argue for in their text about classification [8], a page of icons which make an overview of the options are a suitable structure for children with limited searching skills. One may ask whether they are aware of more options further down, or is the challenge to scroll down? By placing the icons of the TV shows in a horizontal line could simulate a tablet, which will increase the chance that they know how to navigate.

Children’s undeveloped motor skills limiting their ability to handle more than one thing at a time, which made the disappeared menu bar distracting and confusing. They need to pay full attention when moving the pointer to the button and at the same time focusing to not moving the pointer outside of the menu area. Once they tried to move the pointer and they by mistake touched outside of the area, it became invisible in a second. It would be better to not let the area became invisible or let it be visible for a longer period. That would give the children the opportunity to make small mistakes and the chance of changing direction of the pointer.

Another phenomenon observed in the analysis among the children, was when they moved the mouse to the menu bar to adjust the volume; they made fast movements around the icon and tried to pinpoint the pointer at the area to hit it. These characteristics of moving the pointer was just like Fang, Luo, and Xu [13] discovered in their paper, they said that children have three stages of moving and handle the computer mouse in a digital layout. Indeed, it is interesting when designing for children; they actually moving in another dimensions and directions than adult do and could be an important insight. This can be crucial for the size of icons when they are to be determined. For example the volume bar; it was too small for the children to catch and click on, it was difficult for them to manage drag and drop movements [13] and the bar that became invisible if they were outside of the area was annoying and disruptive. As Druin [6] argues; when designing for children in digital environments, it is important to use one-click interfaces to reduce children’s cognitive overload. It is easier for them to handle one thing at a time. By designing clean and simple interfaces, it could optimize for children’s interaction and understanding of functions.

When the children tried to click on a button, for instance on the volume bar, they did not use the same part of the pointer as adults do. By measuring of movements when they clicked on volume button, it seemed that mostly used the middle part of the pointer. In this case the middle of the hand, while adults use the top of the finger on the icon. This means that they mostly miss the button and click outside of the bar, which results in pause or that the menu disappeared. This is a design problem, where the button needs to be bigger or alternatively use one-click buttons, as also Martens argues for [12].

There are two alternatives to moving back from the video player to the selections of TV shows, either by using the grey arrow in the upper left corner or using the “children” button again (in figure A.4 in the appendix). Most of them selected to go with the grey arrow, but there was only because they got help from the expert child. The result from Google Analytics indicates that 65 % of all users in a month used the child page. This result concludes that it seems that the grey arrow button are not necessary, and should be deleted to minimizing icons inside the layout.

In general, the interface has good structure with limited texts with only icons and pictures. This is what Druin et al [6] recommend when designing for children. All functions should be collected at one page, with easy icons, which symbolize the characters of the shows and limited amount of other buttons, just the most important ones.

**Improving the methods**

The methods used in the evaluation of TV4 Play were Peer-Tutoring and Active Intervention, and they are intended to understand how children use and act in a digital layout, also to create knowledge about how children behave and operate in an evaluation method. This method was chosen specifically to gather the most out of the children as possible, in a creative and comfortable way to avoid misunderstandings, create confidence and fun.
After conducted the tests with this method, there are some details that are valuable to have in mind and that could have been adjusted. First, it was difficult to made the test with children, because of their short attention span; the time is limited and the attention need constantly be on the tasks. Through the test, you need the children’s patience and knowing what they are capable to do in that time.

Another factor that may affect the test in general, could be the time from the child made the test until the next session, where the child became the expert. In this short time span, it may be possible that the expert child remember the steps specifically and do not interact, as it would be in a real situation. Instead of letting the child be an expert right after he/she had made the test, it would be better to have three children in row to be the expert and then the fourth child be the first non-expert and role with second child to be expert to the fifth child and so on.

Initially it was not the intention that the evaluation would measure clicks, but in the end it actually became current. It would have been optimally to use software that measure specific clicks and summarize all clicking marks. That result would generate more validity.

In general, these methods were good and easy to use; because of its elaborated background suitable for children [10]. The research gathered how children think and how they act in those kinds of situations. If these methods could be complemented by the above-suggested improvements, they could prove to provide a clearer and a more structured result.

Nielsen (1994) recommends to make an evaluation with five to ten participators, to receive earnings for a representative level. This test was made with twenty children, and reaches marginally the validity of representative result as recommended [17].

Comparison with other streaming services

This section is presenting a comparison of the recommendations given to TV4 Play in the conclusion and other streaming services, how they handling the structure of the interface adapted for children. This is to summarize any differences in what this study concluded, versus what the other services already use.

Bamkanalen – Swedish Television, public service
Their interface has the horizontal line to present the TV shows, and also got an easy interaction with playful layouts. They use the same video player as the other TV shows aimed for adults, with small buttons and the volume/progress bars[18].

Netflix
Netflix’s website for children is presenting an easy structure, also with a horizontal line where the characters are gathered and cropped, to have the same outline form as a whole. When browsing between the characters in the horizontal line, the arrows scroll the characters from side to side by hover the mouse over the arrow icons [19].

C More
The only part this website could relate to the recommendations, is the video player with the big play button, which is recommended for children’s use [20].

To summarize, these companies use some of the recommendations that TV4 Play was given after finishing this study. Fortunately, they have already seen these problems and implemented the solutions, which also confirm the results this paper gave.

Future Research
The area of children and their usage of computers and digital environments in general, need to be further examined. Studies regarding children’s behavior and how they handle icons and bars in general would also be interesting to look further into, by means of an eye-tracking system? Are there any general symbols that children understand from other experiences like from toys and other things at home, that could be used in digital environments?

CONCLUSION
This study has investigated whether children could navigate TV4 Play’s children pages, if they could handle specific icons and bars, whether they find the TV shows and whether they understood the layout in general. The results underlie the recommendations below, and indicate that children had difficulties when handling the structure and the layout, because of their limited ability to use the pointer and their limited cognitive capacity to drag and drop – three components in one.

Based on the presented result and discussion, TV4 Group is given the following recommendations:

- Put a recognizable symbol for the TV characters at the homepage of TV4 Play, to increase the chance they easily find the children page. Two versions:
  - Structure the icons of the TV shows in a horizontal line, to imitate the swiping in a tablet. That will also increase the possibility that they find more shows.
• Better outline when they have entered the video page, with fewer icons and an overview of the other episodes and seasons. For instance beside the video player, to increase the chance the children find the other episodes and seasons.

• Let the menu bar always be visual or not using it at all, with a bigger play button and skipping the volume bar. The use of volume could be managed at the computer. If default volume is on normal to high level, they can adjust it on the computer.

ETHICS STATEMENT
Then the children were under 18 years old; I needed permission from a parent or guardian to let the children be included in this study. The parents had to read through a document in which the background and the process was described, that the children were completely anonymous and ensured that the material is treated gently and safely from others. Additionally, some question was asked about the children’s usage of computer and tablets. They had to approve this agreement with their signature at the bottom of the document. They also got the chance to voluntarily choose if it was ok that the children were filmed during the study, the material promised not to come out. As thanks, the children received stickers and a small promotional gift to play with.

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Thank to my outsourcer TV4 Group, for an interesting and worthwhile mission and especially thank to my supervisors Andreas Wahlström and Christian Gustavsson, with all help and inspiration. Additionally, thank to my supervisor group for all supports and good comments, and of course Elina Eriksson, my faithful supervisor at KTH.

REFERENCES


APPENDIX

Figure A.1
The protocol that summarizes the tasks that the children did.

<table>
<thead>
<tr>
<th>Uppgift</th>
<th>Beskrivning</th>
<th>Frågor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valj TV-program bland karaktärer</td>
<td>Fråga om de kan skriva</td>
</tr>
<tr>
<td>2</td>
<td>Gå till browsern</td>
<td>Fråga: om det vad barnknappen betyder.</td>
</tr>
<tr>
<td>3</td>
<td>Hitta programmet som de valde i uppg. 1</td>
<td>Använder de sökfältet el. browsrar de?</td>
</tr>
<tr>
<td>4</td>
<td>Pausa</td>
<td>Oj vänta, kan du stanna filmen?</td>
</tr>
<tr>
<td>5</td>
<td>Justera Volymen</td>
<td>Scenario. Oj vart är ljudet?</td>
</tr>
<tr>
<td>6</td>
<td>Spola fram/hoppa fram</td>
<td>Jag såg inte riktigt … kan du gå tillbaka?</td>
</tr>
<tr>
<td>7</td>
<td>Starta Helskärmen/Stäng Helskärmen</td>
<td>Om de inte hittar fråga, Vad tror du händer om du trycker på ”den” symbolen?</td>
</tr>
<tr>
<td>8</td>
<td>Hoppa till nästa avsnitt</td>
<td>Välj sista avsnittet</td>
</tr>
<tr>
<td>9</td>
<td>Välj ett annat avsnitt</td>
<td>Välj ett annat program</td>
</tr>
<tr>
<td>10</td>
<td>Kommer de ihåg vad de gjorde sist?</td>
<td></td>
</tr>
</tbody>
</table>

Figure A.2
This is the homepage of TV4 Play, and the interface in view is where the children suppose to search for the child page.
Figure A.3
The layout the children met when they entered the child page. They did not understand that they could scroll.

Figure A.4
This is the layout of the video page, there the children should manage play, pause and adjust the volume. They should also search for the next episode and other older episodes.
Figure A.5
This view shows where they should choose another episode or other season.