Linping - Linqueueping
without queue
- A case study in developing navigable and readable web applications that are perceived as trustworthy by their users

Linping - Linköping utan kö
- En fallstudie i att utveckla navigerbara och läsbara webbapplikationer som anses trovärdiga av dess användare

Markus BIAMONT,
Alexander DANIELSSON,
Anton FRÖLANDER,
Gustav JOHANSSON,
Philip MELBI,
Eric PETERSSON,
Joakim STRANDBERG,
Anna WIKSTRÖM,
Johannes ÅLANDER

Supervisor : Johanna Ek
Examiner : Aseel Berglund
Upphovsrätt


Copyright

The publishers will keep this document online on the Internet – or its possible replacement – for a period of 25 years starting from the date of publication barring exceptional circumstances. The online availability of the document implies permanent permission for anyone to read, to download, or to print out single copies for his/hers own use and to use it unchanged for non-commercial research and educational purpose. Subsequent transfers of copyright cannot revoke this permission. All other uses of the document are conditional upon the consent of the copyright owner. The publisher has taken technical and administrative measures to assure authenticity, security and accessibility. According to intellectual property law the author has the right to be mentioned when his/her work is accessed as described above and to be protected against infringement. For additional information about the Linköping University Electronic Press and its procedures for publication and for assurance of document integrity, please refer to its www home page: [http://www.ep.liu.se/](http://www.ep.liu.se/)

Markus BIAMONT,
Alexander DANIELSSON,
Anton FROLANDER,
Gustav JOHANSSON,
© Philip MELBI,
Eric PETERSSON,
Joakim STRANDBERG,
Anna WIKSTROM,
Johannes ÅLANDER
Abstract

The purpose of this study was to attempt to create a usable and trustable web application for selling event tickets capable of better satisfying the needs of students and event arrangers at Linköping University than contemporary methods. At the moment of writing all such tickets are sold physically and students are required to queue to acquire tickets. Throughout the study the application was user-tested and metrics regarding readability, navigability, and perceived trustability were tracked. The tests made use of the Concurrent Think Aloud method, the Retrospective Probing method, Smith’s Lostness formula, contrast checking tests, and the LIX readability formula. The test results improved throughout the development process and finally showed that the application could indeed be considered readable, navigable, and in several ways perceived as trusted by its users. The study resulted in an application that with a few modifications, including but not limited to student union discounts and stability concerns, could successfully simplify the vending process for event tickets at Linköping University, or lay a theoretical foundation necessary for future developers to make an application capable of fulfilling either this or similar needs.
# Contents

Abstract iii

Contents iv

List of Figures vii

List of Tables viii

1 Introduction 1

1.1 Aim . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
1.2 Research Questions . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
1.3 Delimitations . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2

2 Theory 3

2.1 E-commerce . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3
2.2 Usability . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3
2.2.1 Navigability . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 4
2.2.2 Readability . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5
2.3 Online Trust . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 6
2.4 Usability- and User Testing . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 7
2.4.1 Concurrent Think Aloud Procedure . . . . . . . . . . . . . . . . . . . . . . 8
2.4.2 Retrospective Probing . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 8
2.4.3 Developing a Plan for a Usability Test . . . . . . . . . . . . . . . . . . . . 9
2.4.4 Test Participants . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9
2.5 Development . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 9
2.6 Testing the Web Application . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10
2.6.1 Concurrent Think Aloud Testing Method . . . . . . . . . . . . . . . . . . 10
2.6.2 Navigability Testing . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10
2.6.3 Retrospective Probing Testing Method and Testing of Perceived Trust . 11
2.6.4 Readability Testing . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 12

3 Method 13

3.1 Sprint 0 - Market Analysis and Decision Making . . . . . . . . . . . . . . . . . 13
3.1.1 Market Analysis . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 13
# List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Overview of development and testing</td>
<td>13</td>
</tr>
<tr>
<td>4.1</td>
<td>Start page after the first developing sprint</td>
<td>23</td>
</tr>
<tr>
<td>4.2</td>
<td>Start page second developing sprint</td>
<td>28</td>
</tr>
<tr>
<td>4.3</td>
<td>How easy it was for event arrangers to understand the web application, Test 2</td>
<td>34</td>
</tr>
<tr>
<td>4.4</td>
<td>How easy it was for regular users to understand the web application, Test 2</td>
<td>34</td>
</tr>
<tr>
<td>4.5</td>
<td>Start page</td>
<td>36</td>
</tr>
<tr>
<td>4.6</td>
<td>Drop down login</td>
<td>37</td>
</tr>
<tr>
<td>4.7</td>
<td>Countdown clock</td>
<td>37</td>
</tr>
<tr>
<td>4.8</td>
<td>Shopping cart using breadcrumbs</td>
<td>38</td>
</tr>
<tr>
<td>4.9</td>
<td>Stripe payment window</td>
<td>38</td>
</tr>
<tr>
<td>4.10</td>
<td>Page shown when purchase is in process</td>
<td>39</td>
</tr>
<tr>
<td>4.11</td>
<td>My page</td>
<td>40</td>
</tr>
<tr>
<td>4.12</td>
<td>My Party Committee Starting Page</td>
<td>40</td>
</tr>
<tr>
<td>4.13</td>
<td>My Party Committee Starting Page showing events</td>
<td>41</td>
</tr>
<tr>
<td>4.14</td>
<td>Create event form with datepicker</td>
<td>41</td>
</tr>
<tr>
<td>4.15</td>
<td>Create patch form</td>
<td>42</td>
</tr>
<tr>
<td>4.16</td>
<td>How easy it was for event arrangers to understand the web application, Test 3</td>
<td>46</td>
</tr>
<tr>
<td>4.17</td>
<td>How easy it was for regular users to understand the web application, Test 3</td>
<td>47</td>
</tr>
</tbody>
</table>
## List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Lostness for users, test 1</td>
<td>26</td>
</tr>
<tr>
<td>4.2</td>
<td>Lostness for arrangers, test 2</td>
<td>35</td>
</tr>
<tr>
<td>4.3</td>
<td>Lostness for regular users, test 2</td>
<td>35</td>
</tr>
<tr>
<td>4.4</td>
<td>LIX for the web application pages</td>
<td>43</td>
</tr>
<tr>
<td>4.5</td>
<td>Contrasts for web application components, where colors are stated in hexadecimal with a description of the perceived color</td>
<td>43</td>
</tr>
<tr>
<td>4.6</td>
<td>Lostness for arrangers, Test 3</td>
<td>47</td>
</tr>
<tr>
<td>4.7</td>
<td>Lostness for regular users, test 3</td>
<td>47</td>
</tr>
</tbody>
</table>
Students at Linköping University need to go through a time consuming and strenuous process to buy event tickets. In the current system the tickets are often released for sale early in the morning, and the students need to be there forming a physical queue. This means standing in line during inconvenient hours. It is a process that affects students as well as the event arrangers, for whom it means a lot of work to oversee the queue. The arrangers in question are voluntary students responsible for campus based events.

An introductory study was performed that provided proof of the hypothesis that the current system is not well considered among students nor event arrangers at Linköping University. The study found that 89% of the student respondents have waived buying a ticket because of long queue times and that 91% would prefer buying their tickets online (see Appendix A). It was also found that 76% of the event arranger respondents would prefer an online sale system (see Appendix B).

A competitor to the current process that is worth mentioning has yet to be introduced. This gives a prime opportunity to realize the idea and evaluate the results in this article. The vision is to create a web application that sells event tickets, together with accessories, that is simple, fair, and unanimously used by event arrangers and students at Linköping University. As convenience is a prominent positive factor of e-commerce for consumers [1], a web-based sales system seems appropriate.

This study also aims to realize the vision through development of a web application based on usability (in terms of readability and navigability) and perceived trustability as these factors have shown to have importance to the user experience [2], [3], and willingness to purchase from web sites [4], [5].

1.1 Aim

This study will research if and how a usable web application that sells event tickets can be created to better satisfy the needs of students and event arrangers at Linköping University.

1.2 Research Questions

How can a web application that sells student event tickets be constructed so that it is usable regarding navigability and readability, as well as being trusted by its users?
1.3 Delimitations

Measurement and evaluation of the usability factors and perceived trustability will primarily be performed through user testing.

Interesting factors that this study does not consider are the facts that a web application like this must be safe from hackers, be able to handle a considerable amount of stress during short intervals of time (i.e. ticket release), nor does the study take the important economic factor of creating a web application into account - including these factors would enlarge the study outside of its set timeframe and are not directly relevant to the research questions. The products would most likely have no problem selling, as the same products are sold today. However there would be development costs as well as service costs that could pose an issue to the nonprofit event committees and arrangers.
2 Theory

This section will cover the underlying theory for the development of the web application. First general points regarding e-commerce are presented. Navigability, readability, and perceived trustability of an online application will be defined, and the respective importance of these factors will be highlighted. Furthermore the issue of testing these factors will be elaborated by discussing usability testing, Retrospective Probing, how to develop test plans, and recruitment of subjects for usability tests. Lastly the specific development methods of this case study are to be briefly reviewed, followed by the concrete testing methods applied for this study.

2.1 E-commerce

In recent time e-commerce has been growing steadily. In 2016 the US Census Bureau of the Department of Commerce estimated that e-commerce increased by 14.3% over the last year in the US, compared to the total retail sales increase of 4.1% [6]. In Sweden, where this study is performed, about 60% of the adult population shop online - corresponding to over four and a half million people [7]. Furthermore, studies have shown that online shopping provides convenience for the customer [1], [8], and that younger people are more likely to shop online [9]. Since a simple solution is sought after and the target demography is students, the results of these studies indicate that a web application of this nature could be an appropriate solution to the case problem. For further evaluation of the market, surveys can be employed. In performing internet surveys representativeness and high response rate are of great importance, the latter associated with number of contacts - particularly personalized correspondence [10].

2.2 Usability

Usability has been defined by the International Organization for Standardization as the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" [11]. In other words the term implies how accurately a user can complete tasks by spending a minimal amount of resources (cognitive effort), while keeping a positive attitude towards the usage process of the product. In their respective sections the impact on usability of readability and navigability is specified.
2.2 Navigability

Navigability has in previous studies been defined in several ways, commonly focusing on the ease of use in finding information [12]–[14]. A more formal definition is provided by Castro et al.: "The navigability of a Web application in use, understood as the efficiency, effectiveness and satisfaction with which users can move around in the application to satisfy specific goals under specific conditions" [15]. This definition specifies the importance of the ability to achieve certain tasks, which is important as it is the essence of why web applications are commonly used. In research done by Wojdynski and Kalyanaraman existing definitions of navigability were examined in order to further clarify the concept. They mentioned that the common factor between many definitions of navigability has been described as “the idea of a construct that defines the quality of navigational support provided by a system interface” [13]. Here the focus is not on how easy it is to use the web application, but a measurement of how good the application is at supporting the end user in their navigation of the application. In this study these definitions are used complementary, as one highlights the motive of use and the other a tangible way of enabling measurement.

As navigability has shown to be a crucial factor regarding site usability [3], [14], [16]–[18], it is of importance that the web application is navigable. Further mentioned by Younghwa and Kozar [2], navigability has a positive effect on the level of satisfaction the user gets by using a website, as well as increasing the probability for a user to return to the site. Navigability also has a correlation with the trustworthiness of a web application, as problems with navigation hurts the credibility of a website [19], [20]. Furthermore a study has also shown that improved navigation in e-commerce sites promotes sales [21].

An experiment examining website design elements related to navigability [13] showed that websites designed with descriptive menu bars, with a clear connection between the pages they contain and the pages’ contents, were shown to create positive feelings when used and at the same time were perceived as navigable. Websites containing breadcrumbs and a site map showing the site structure, reachable from all pages via a hyperlink, were perceived as navigable. Many other studies have been conducted regarding navigability in websites and web applications, from which these imperative factors that impact navigability positively have been derived [14], [22]–[25]:

• Obvious and simple navigation through clear ways to move between all sections of the application
• Clear navigation design with the ability for users to identify current, past, and future positions
• Completeness and clearness of navigational links, all links should be active and self-explanatory
• Avoid horizontal scrolling through matching page-width with width of the browser window
• Limited number of levels in the application, usage of breadcrumbs for ease in navigation between the levels

However the implementation of theoretical research should be done with care as practical design often differs from guidelines and research [26], and heuristics used commonly lack validation [27].

Evaluation of navigability with quantitative measurements can be done with Smith’s L formula for lostness [28]. The formula shows how lost a user is when performing a specific task in an online scenario. The higher the value of lostness, the more lost the user is expected to be. Krahmer and Ummelen also made sure that when subjects failed with completing a task, they would be considered lost with the formula [29].
2.2.2 Readability

Readability is commonly used to define the difficulty level of reading a text \[30\]. Edgar Dale and Jeanne Chall defined readability as: “The sum total (including all the interactions) of all those elements within a given piece of printed material that affect the success a group of readers have with it. The success is the extent to which they understand it, read it at an optimal speed, and find it interesting” \[31\]. It is a comprehensive definition of a text’s readability in general, although when it comes to reading text in a web application, viewed on a monitor instead of on paper, there are more factors to take into consideration such as the colors and structure \[2\].

A web application should aim to be readable, as readability is proven to be a factor that contributes to a web application’s usability \[3\], which directly contributes to the user’s perception of the web application. This further affects the user’s buying intention, loyalty, preference, and likelihood to return \[2\].

When it comes to understanding a text and reading it at an optimal speed, it is important that the wording is clear and easy to understand. In Standards for Online Communication (1997) JoAnn Hackos and Dawn Stephens \[32\] summarized research done by many experts regarding this subject and came up with a number of golden rules of writing. These are:

- Use short, simple, familiar words.
- Avoid jargon.
- Use culture-and-gender-neutral language.
- Use correct grammar, punctuation, and spelling.
- Use simple sentences, active voice, and present tense.
- Begin instructions in the imperative mode by starting sentences with an action verb.
- Use simple graphic elements such as bulleted lists and numbered steps to make information visually accessible.

One of the most used and known tests that uses readability formulas is the Flesch-Kincaid readability test which consists of two tests, the Flesch Reading Ease and the Flesch-Kincaid grade level \[30\].

The Flesch Reading Ease formula was published by Rudolf Flesch \[33\] and it gives a score from 1 to 100 which indicates the level of difficulty, from very difficult to very easy. The formula uses the average sentence length and average number of syllables per words to calculate the score \[30\].

Flesch-Kincaid grade level is a modification of the Reading Ease formula \[34\]. It was modified by converting the result of the Flesch Reading Ease formula to U.S. grade levels and goes from grade 1 to 10. The formula for calculating the grade level uses the same variables as the Flesch Reading Ease formula \[30\].

LIX, “läsbarhetsindex” in Swedish, is the most used formula to measure readability when it comes to the Swedish language. The formula was published by Carl-Hugo Björnsson \[35\] and it takes the amount of words, sentences, and long words into consideration (according to Björnsson long words are those with more than 6 letters in them). The formula gives scores from zero and up but only provides defined definitions of readability from 25 to 75, where 25 is considered very easy and 75 very difficult \[36\].

Fonts and the length of line spacing are two factors that affect readability in terms of reading efficiency. They are significant in terms of that they are what makes it possible to distinguish and understand letters that make up the words and sentences in a text, therefore it is important that the font is simple and clear. Without the right amount of spacing it would be hard to distinguish individual letters from each other and therefore it is important to have
2.3 Online Trust

As of today, there exist many different definitions of online trust, but generally these have four different and important parts in common [40]:

1. There is a trustor and a trustee. The trustor is typically a consumer who is browsing an e-commerce web application, and the trustee is the e-commerce web application, or more specifically, the vendor that the web application represents.

2. There is vulnerability, meaning that there are present risks that the consumer may lose money and/or privacy when using the application at question.

3. There are produced actions. The actions on the consumer side being to make a purchase online from the vendor, which could mean providing credit card and personal information, and “window-shopping”. Both of these actions bring positive outcomes to online vendors, but the consumers must be confident that they have more to gain than to lose when using the web application.

4. There is a subjective matter. The level of trust considered sufficient to make transactions online is different for each individual. The attitude toward machines and technology is also different from person to person.

An example of this would be the definition of trust supplied by Jarvenpaa et al. [41]: “a consumer’s willingness to rely on the seller and take action in circumstances where such action makes the consumer vulnerable to the seller”. This definition incorporates a trustor and trustee in the form of customer and seller, as well as focusing on the factors of vulnerability and action. Another similar definition of online trust that fulfills all of these criteria is that of Kim et al. [42]: “a consumer’s subjective belief that the selling party or entity will fulfill its transactional obligations as the consumer understands them”. Their definition focuses more on the psychological belief of currently available information than produced actions. In this
study these definitions are seen as complementary and hence they are together used to define trust in this study.

A web application needs to be trusted by its visitors since trust between customer and seller and willingness for the customer to purchase from the seller are highly correlated, the visitors will not purchase as many products from the application if it is not trusted by them [4], [5].

A trusted web application can be built by using several tested approaches to increase the overall trust of the application. According to T.Oliveira et al. [4], the online vendor should relate to the consumers’ perceived competence, integrity and benevolence to increase the overall trust a consumer has in an e-commerce business. This means firstly that the consumer should believe that the online vendor has the ability, gained from expertise in doing business, to handle sales transactions. Secondly it means that the consumer should believe that the online vendor is honest, keeps to commitments and promises made, and is genuine. Lastly, the consumer should believe that the online vendor acts in the consumer’s best interest, and that, if needed, the vendor would do their best to help the consumer. To achieve this, there are at least three factors that are positively correlated to a customer’s trust towards a web application. These are perceived online vendor reputation, the perceived quality of the application, and consumer perceptions of the safety of the web environment. The higher or better any of these factors are, the higher the trust in the web application. However the strongest correlation among these three last mentioned factors and a customer’s trust towards a web application is the perceived quality [5].

In the previous paragraph it was stated that to build a trusted web application it is necessary that the consumer believes: That the online vendor has the ability to handle sales transactions, is honest and genuine, and acts in the consumer’s best interest. According to the Stanford Guidelines for Web Credibility [43] there are ten specific guidelines on how to boost a website’s credibility and thus, make the consumer believe in these factors as they are stated in the web application. These are:

1. Make it easy to verify the accuracy of the information on the web application.
2. Show that there is a real organization behind the application.
3. Highlight the expertise in the organization and in the content and services provided.
4. Show that honest and trustworthy people stand behind the application.
5. Make it easy to contact the web application’s accountable(s).
6. Design the application so it looks professional (or is appropriate for the purpose).
7. Make the application easy to use – and useful.
8. Update the application’s content often.
9. Use restraint with any promotional content (e.g., ads, offers).
10. Avoid all types of errors.

2.4 Usability- and User Testing

The goal of every web application is to be usable in one way or another (in our case regarding navigability and readability) and thinking about this is a key component in every step of web development. Usability testing is a process involving users designed to evaluate how well a system meets usability criteria [44]. The goal of such a test is primarily to improve the usability of a product, and therefore the participants in a usability test should represent real users doing real tasks [44]. The researchers observe and record what the participants do and
say and then analyze the collected data. Based on this, problems are diagnosed and changes can be recommended.

UEMs, Usability Evaluation Methods, are used by web developers in order to assess the usability of their web applications. In a mapping study [45] with the goal of summarizing the current knowledge available about UEMs used by researchers to evaluate web applications for the last 14 years, the following conclusions were made:

- UEMs come in many different shapes and sizes and it is common practice to apply more than one UEM with the goal of addressing a broad range of usability problems.
- The majority of tests are conducted at the implementation stage, when the product has been deployed or when a prototype is ready.
- There is an indication that there is a need to focus on more testing during the early stages of the development life-cycle, allowing for earlier and cheaper changes.
- It is very common to combine inquiry methods with user testing.
- 82% of UEMs employed an ad-hoc method where each test case was specifically tailored to the application being tested.

2.4.1 Concurrent Think Aloud Procedure

One such UEM is the Concurrent Think Aloud Procedure. Users verbalize their thought process while attempting to complete a given set of tasks. They explain their actions, perceptions and expectations of the application’s functionality and interface [46]. There are different schools regarding how to run a Concurrent Think Aloud Procedure (CTA). Using the Ericsson and Simon method the researchers should avoid interfering with the user’s thought process and only provide simple reminders to “keep talking” if the user ever falls silent for an extended period of time. Users should also be trained in advance in the thinking aloud method [29].

This method is relevant for finding evidence for models and theories of cognitive processes. However, most researchers deviate from this very strict definition proposed by Ericsson and Simon which compromises the theoretical grounds the method lies upon. Boren and Ramey argue that this must not necessarily render the tests useless [47], but the results should be treated differently and in accordance to the procedure used. If the purpose of the test is to test and troubleshoot application functionality with the goal of supporting or challenging design decisions, then it might be better to use the framework for speech-communication proposed by Boren and Ramey. Using this framework, the researchers are allowed to communicate with the test participants in a controlled manner in order to extract relevant information. This allows for a more natural interaction, but the user performance is impacted. The participant may have an easier time completing tasks because of the interactions, which is a downside if a metric like navigability is of interest, especially when using a usability measurement like lostness [29].

2.4.2 Retrospective Probing

When employing Retrospective Probing, users get asked questions about their experience immediately after completing a set or subset of tasks. These questions can be aimed towards evaluating specific elements of the application relevant to the researchers, or more broadly to evaluate the user’s overall likes/dislikes [46]. Since all users are asked to answer the same questions, the results of different users are easily comparable. The user feedback gained by Retrospective Probing is a measure of the user’s perception of the application. A weakness with this method is that users rely on their memory of their experiences, which might not be accurate.
2.4.3 Developing a Plan for a Usability Test

According to Jeff Rubin and Dana Chisnell [48], a test plan serves as a blueprint for the testing and defines or implies the required resources. A test plan usually includes the following sections [48]:

- **Purpose, goals, and objectives of the test**: Clarify and describe the reasons for the test, the key point.
- **Research questions**: Formulate the questions that you want the test to answer. These need to be specific and measurable.
- **Participant characteristics**: Determine the size of the participant group, and the overall characteristics of the participants.
- **Method (test design)**: Describe how the research is going to be done.
- **Task list**: Make up a complete list of what tasks are to be done by the participants.
- **Test environment, equipment, and logistics**: Describe what environment will be stimulated and what equipment will be needed.
- **Test moderator role**: Describe the moderator’s responsibilities and tasks.
- **Data to be collected and evaluation measures**: Explain what data will be collected and what research questions it will answer.
- **Report contents and presentation**: Summarize how the results will be reported by explaining the sections that will be included.

2.4.4 Test Participants

Test participants should represent real users that are expected to use the application [46]. A study has shown that there is little correlation between the number of test participants and the number of usability findings during a test and that five users almost always is enough to reach the maximum benefit-cost ratio [49]. However there are exceptions to this assumption as highlighted by Faulkner [50]. In her study she demonstrated the importance of larger test groups in certain scenarios in order to emphasize that the issue is not how many test users you have, but how representative they are of the target population. As long as the user research is performed with representative users and is aimed at giving insight to and driving forward the design, a minimum of five test participants should be sufficient.

2.5 Development

Agile methods are widely adopted in modern software development processes [51], and companies using agile methods generally produce better results than those applying document-driven approaches [52]. Development of a web application can be performed through iterative sprint cycles following the agile scrum methodology [53]. The system architecture of an application can be based upon the widely accepted MVC model [54]. Furthermore development can proceed with the guidelines [43], influential factors [14], [22]–[25], and readability concerns [32], [37], [38] highlighted in the following sections in mind. Evaluation of the concurrent state of the application, regarding the question at issue, can be performed through user testing.
2.6 Testing the Web Application

User testing was performed at completion of each development sprint cycle. Focus lay on testing the deliverables added in the specific cycle while still testing the complete product in its current state of development. Testing was done using a combination of Concurrent Think Aloud (CTA) method and Retrospective Probing (RP). Combining the two methods is an effective way to understand the test participants’ user experience [46]. The combination of spontaneous thoughts and retrospective thoughts gave a more complete view of their experience with the application. Both methods were incorporated at conclusion of a sprint cycle. CTA testing helped uncover problems previously not thought of while RP was instrumental in answering predefined questions.

Each test was performed on a laptop prepared with only a browser opened to a blank page. The subject would as part of their task be asked to navigate to a specified address to begin interacting with the web application.

2.6.1 Concurrent Think Aloud Testing Method

The core of CTA testing is to get at what test participants really think of the design being tested. Although it might seem trivial thinking aloud while working on a task, a lot of test subjects find it hard to keep the mental stream going. To combat this, the test subjects were given the opportunity to practice on the technique while playing a simple mathematical game, the Tower of Hanoi. Once the subject was considered comfortable with the CTA method the introductory part of the test was put to an end. Further in the actual test facilitators were appointed whose sole purpose was to encourage test participants to keep talking. Facilitators were limited to open ended questions posed in a manner of queries, such as “what are you working on now?” and “how do you feel about this part of the application?”, to not affect the behavior of the subject’s interaction with the application whilst still encouraging the CTA method. CTA served as a view of what initial expectations test subjects had about feature location and structure of the application [46]. Information regarding discrepancies between preconceived notion of the application’s structure and present structure was paid extra attention to by note takers. Such discrepancies play a key role in how users perceive the application as a whole [13], therefore capturing the information in its true nuance was seen as essential for future revisions. To ensure a complete collection of data the user’s voice was recorded during the entire test.

2.6.2 Navigability Testing

During the CTA testing the navigability of the web application was evaluated with Smith’s L formula [28]:

\[ L = \sqrt{\left( \frac{N}{S} - 1 \right)^2 + \left( \frac{R}{N} - 1 \right)^2} \]  

- N is the number of unique nodes visited during the task
- S is the total number of nodes visited during the task
- R is the minimum number of nodes required to visit to complete the task

Where each specific location of the web application is considered a node. The total number of nodes visited and the number of unique nodes visited were observed for each test subject by a note taker. The optimal number of nodes needed to complete a task was calculated with as a simple shortest path problem, and the lostness was then calculated using the formula in equation 2.1. Values of lostness exceeding 0.42 indicated that the subject was lost. If test
subjects failed to complete a task S was allowed to range to infinity, thereby exceeding the indicating value - and considering the subjects as lost [29]. If test subjects became lost the application was not navigable enough and needed changes to clarify it further. The changes made aimed at implementing the concepts from the theory section better and improving the application with help from the CTA.

2.6.3 Retrospective Probing Testing Method and Testing of Perceived Trust

Before and during each testing round two sets of questions were formulated:

1. Direct questions to point focus towards changes and new features.
2. Open ended questions to get test subjects to talk freely about the application. Giving focus towards what was most noticeably good/bad about their experience.

Firstly, the following questions were asked to all test subjects (can be found in Swedish in Appendix C):

- Did anything in the web application work differently from how you expected it to work?
- Were you ever unsure about how to navigate in the web application?
- On a scale from one to five, how easy was it to understand the web application?

Secondly, to continuously test whether or not the visitors trusted the web application, the test subjects were faced with a scenario adapted to if the test subject was an event arranger or a regular user. The event arrangers were faced with the following scenario and questions (in Swedish in Appendix C):

You have used this web application in the exact same way, but in a non-test environment at home. The web application is live and used by students to buy event tickets and patches.

- Do you believe that Linping would handle the selling of the event tickets/accessories in a reasonable way? Why/Why not?
- Do you believe that Linping’s handling of the information regarding parties and the financial parts is done in a secure and correct way? Why/Why not?
- Do you believe that Linping would help you solve your problem if for example there would arise a problem with your tickets or accessories? Why/Why not?

The test subjects that were regular users were instead faced with the following scenario and questions:

You have used this web application in the exact same way, but in a non-test environment at home. The web application is live and used by event arrangers to sell event tickets and patches.

- Do you believe that Linping would provide you with a valid ticket/accessory at a reasonable time and price? Why/Why not?
- Do you believe that Linping would keep your personal information safe minimizing the risk of theft of money or private information? Why/Why not?
- Do you believe that Linping would help you solve your problem if for example there would arise a problem with your ticket or accessory? Why/Why not?
2.6. Testing the Web Application

This was done to conclude if the participants believed that the web application’s administrators had the ability to handle sales transactions, were honest, and that the administrators would act in the participants’ best interests, which, as has been concluded in theory section 2.3, shows that the application is trusted by its users. If all questions were responded with a "yes", the application was perceived as trusted by its users. If one, or more, of the questions were answered negatively, the follow-up questions’ answers were used as guidelines when improving the application in the next sprint cycle.

Lastly, the following questions were asked after ending the scenario (in Swedish in Appendix C):

- How did you perceive the web application in its entirety?
- Can you think of any functionality to this web application that you would wish to see in a future version?
- Is there anything that you would like to add about the test?

All answers were noted by a note taker and concluded in a document to find trends and ideas among the answers given by the test subjects. From these documents, changes were agreed upon as to what needed changing in the web application to make it more navigable, readable and trusted by its users.

2.6.4 Readability Testing

The web application’s readability was tested in multiple ways. Before implementing text that consisted of more than one word it was tested with LIX, equation 2.2, as the text was in Swedish (for English texts similar methods would be the Flesch-Kincaid test and the Flesch Reading Ease formula which were discussed in the previous chapter). LIX was used by inserting the written text into an algorithm that calculated a score which indicated the level of readability with the following formula:

\[
LIX = \left( \frac{\text{number of words}}{\text{number of sentences}} \right) + \left( \frac{\text{number of words > 6 characters}}{\text{number of words}} \right)
\]  

(2.2)

These scores could then be compared with the appropriate grading table to determine an objective measurement of the readability of the text. An easily readable application was sought after meaning that the LIX-value was allowed to vary between zero and 30. If the tested text was not in between the accepted values the text was subject to change to better satisfy the restrictions made. This could be done by shortening the sentences in the text and using simpler words.

Tests were also made for the color of the text and the background color when designing the web application to make sure that the contrast was high enough. A minimum contrast ratio recommended by the Web Content Accessibility Guidelines [39] is 4.5:1 when the contrast ratio is calculated with the equation in 2.3.

\[
\text{Contrast ratio} = \frac{(L1 + 0.05)}{(L2 + 0.05)}
\]  

(2.3)

L1 and L2 range from zero to one and correspond to the relative luminance of the two colors compared. L1 is always the lighter color. WebAIMs Color Contrast Checker software was used to check the contrast between all text and its respective background to make sure that no contrast would be lower than 4.5:1 [55]. If a contrast was below 4.5:1 the colors of either text or background were changed until the resulting contrast was satisfactory to the guidelines.

Besides these tests, the guidelines in the theory were used when designing the web application in terms of readability, as well as feedback from the user tests.
3 Method

The web application was built through four sprint cycles, the first being a pre-study and market research, and the following sprints focusing on development. After each developing sprint tests were performed, see Figure 3.1. This chapter describes the specifics of these steps and the method of constructing the web application.

3.1 Sprint 0 - Market Analysis and Decision Making

This sprint set the theoretical and practical framework for the development of the web application. A market analysis was conducted, and extent of development was limited to simple paper prototypes.

3.1.1 Market Analysis

To determine if there is a market for an application of this nature, two separate surveys were conducted. The surveys were conducted online to reach the potential customers and event planners as quickly as possible. One targeted the potential customer base that would use the application to acquire tickets and the other was aimed at those who plan the events and sell tickets. The customer survey was constructed to primarily gauge interest in the application and to evaluate if adoption of the application for tickets sales would affect the demand for tickets. The survey aimed at event planners focused on discerning if there was interest in adopting the new sales system and to get the event planners’ view of positive and negative side effects of adopting to such an application. The surveys were created using Google forms. Distribution of the customer survey was done both as a link through social media groups for students at Linköping University as well as by walking around campus prompting students...
to fill in the survey on a laptop supplied by the project group, and distribution of the arranger survey was done as a link sent to the social media pages of the different groups of event arrangers at Linköping University (links were accompanied by messages personalized in greatest extent possible depending on group) [10]. The response rate for the surveys were 210 individuals for the customer survey and 23 individuals for the arranger survey. Full surveys can be found in Appendix A and B.

3.1.2 Making Decisions

In the beginning of the project there was a lot of brainstorming taking place in order to find out what functionality could and should be considered for the application. The different functions were then ranked from most important to least important to get an overview of what to prioritize. The prioritization was in this stage based on what functionality would be most important in an initial prototype where the user’s ability to find products and make a purchase could be tested, since this had been deemed as the core function of the application.

3.2 Sprint 1 - The Base of the Web Application

This section describes the methods used for the initial development of the application and details of the first user test.

3.2.1 Development Sprint 1

In the first sprint results from the surveys and decisions from sprint 0 were used as a basis for the development. A shell for the web application was created and basic functions were implemented. The server side of the application was created with Python using the web framework Flask while the client side was developed using HTML, CSS, and the Bootstrap framework.

A database was developed to allow the web application to retrieve and store information which was done using SQLAlchemy.

Throughout the development several steps were taken to ensure navigability, readability, and perceived trustability of the application. This included the development of tools to ensure clear navigation between different sections of the web application as well as choosing appropriate colors and fonts to ensure the readability of the application.

3.2.2 Test 1

At the end of the first sprint, the first user test was conducted. The project group mainly wanted to get feedback on what had been done so far, and get information about which functions should be implemented next or if something existing should be changed. Tests for lostness and the perceived trustability for the website were also planned, to obtain results and to practice for future tests. Focus laid on what to do next, since the web application was in a very early stage of the development process. An operational plan for the test was developed a few days before the test day. The plan for executing the test included the following steps:

1. Welcome the test participants.
2. Explain the agenda for the test and how it will be executed.
3. Let the test participant practice the CTA (Concurrent Think Aloud) method.
4. Let the test participant perform a set of tasks using the web application while using CTA. Here observers take notes on how the test participants move around on the page to measure lostness.
5. Perform Retrospective Probing.
6. Thank the test participant for their participation and offer a pastry.

For this test there were two separate rooms for the test which was divided into two parts. In the first part the participant performed the first three items on the agenda in the first room, and in the second part the last three items in the other room. Before the real tests were initiated, a practice test was conducted where a group member acted as a test participant and the rest of the group acted as facilitators or observers. When this had been done, the real test participants were invited in one at a time and the test plan was followed.

The test had six participants, two of whom were friends of a group member and four that were randomly picked from the campus. None of the participating users were studying computer science as bachelor. This was done in order not to taint the result considering that they would have insight in the development process.

To practice the CTA-method the users were invited to play a simple mathematical game, the Tower of Hanoi. The objective of the game is to create an identical stack of the disks to the starting position on any other rod than the one they are originally on, while obeying certain rules. An unlimited amount of moves were allowed and no focus was laid on how fast the test participant could finish the game. The priority was on how well they could practice the Concurrent Think Aloud method.

Before a participant would start the game it was explained that the only thing cared about was to what extent and how well they could perform the Concurrent Think Aloud method, and that they did not have to feel any pressure on completing the game fast or in the best possible way. Keywords mentioned for exercising CTA were “why you do something rather than what you do”. If the participant forgot to use the CTA-method they were reminded to use it, and if the participant showed signs of nervousness they were assured that it was okay to fail and to do moves that did not lead to the final objective, the only important thing was to use the CTA-method. After the game was finished the test participant was encouraged to use the CTA method while testing the web application, and was after that escorted to the other room for part two of the test.

In order to achieve an optimal test environment a test facilitator was appointed. This role involved the responsibility of helping the test subject perform the test in a correct way by giving initial instructions and then quietly observing the user whilst them performing the test. The final task for the facilitator was to conduct a concluding query.

The role as test facilitator first came into action after the initial CTA-introduction was completed. Once the subject completed the first phase of the test they were moved into a new room to continue with the next and main part of the test. There they were welcomed by the facilitator that once again emphasized the importance of the CTA-method. Finally before the subject was permitted to interact with the application the facilitator referred to further instructions written on a whiteboard as follows:

1. Go to 127.0.0.1:5001 (This was the local host IP address pointing to the application)
2. Buy a ticket.
3. Upon completion inform the facilitator.

The subject then proceeded to attempt the tasks that were put in front of them whilst conducting the CTA-method. For this part of the test the facilitator observed the subject while they attempted their tasks and if necessary reminded them to motivate why they made their choices - although at the same time trying not to interact with the subject, only for the purpose of making them think out loud. This was done in order to have as little influence as possible on the test subject and avoid tainting the result. Once all tasks were completed the facilitator encouraged the subject to freely navigate the application and gain a better overview while
3.3 Sprint 2 - Implementing Important Functions

This section describes the methods used for the ongoing development of the application and details of the second user test.

3.3.1 Development Sprint 2

The second developing sprint focused on expanding existing functions and implementing key functions for the application. Decisions made during sprint 1 served as a foundation with functions that had to be implemented and the progressions with the web application were further made by following the guidelines found in the theory section in this report.

The database was expanded to hold information about purchases and event tickets. Flask Admin was used to create an administration page making it possible to give extra permissions to the application administrators. To strengthen the brand and thereby also make the application more trusted by its visitors a logotype was created using Paint. Simple icons were implemented using Bootstrap’s Glyphicons to improve the navigability in the application and some were made interactive using CSS.

An event calendar was made using HTMLCalendar class from Python calendar library and Javascript. Throughout the application flash messages were used to prompt the filling in of fields that had not yet been filled in before submission. Flask Mail was used to send emails directly from the server and QR-codes were created using the Python package PyQRCode as a substitute for physical tickets. Furthermore, Stripe was implemented in the checkout process to allow the customers to be able to make purchases in the application in a secure manner.

3.3.2 Test 2

By the end of the second sprint, a second user test was conducted. Navigability, readability and perceived trustability of the web application were tested with the use of the CTA-method, RP, and Smith’s L formula.

A couple of days before the test an operational plan was developed. This plan included the existing questions and tasks from test 1 where students were tested, with an additional task of completing a purchase of both an event ticket and a patch. A new task and questions specific for the event arrangers that were going to test the application were also developed.
This new task consisted of navigating to the page made for event arrangers, and from there create a new event.

The day before the test, a practice run of the test was conducted where a group member acted as a test participant and the rest of the group as facilitators or observers. During this day group members also reached out to friends to find students and event arrangers that would be willing to participate in the test, this search resulted in 6 event arrangers and 3 students. During the day of the test, 2 student participants were recruited randomly at the university, also according to the set requirements. The requirements were that a participant had to be either a student or an event arranger studying at Linköping University and whom was not currently writing a bachelor thesis in computer science or had done so in the past.

During the test there were three different roles among the group members:

- One member practiced CTA with the participant.
- Two members took notes of how the participant navigated around the application.
- One member conducted the Retrospective Probing after the tasks were completed.

The execution of the tests followed the following steps:

- Welcome the test participants.
- Explain the agenda for the test and how it will be executed.
- Let the test participant practice the CTA method.
- Let the test participant perform a set of tasks using the web application while using CTA.
- Let the test participant continue to review the application.
- Perform Retrospective Probing.
- Thank the test participant for their participation and offer a pastry.

After the test, the notes regarding the participant’s navigation and their answers were summarized and evaluated by the group. This information was then used as a basis for evaluating the research questions of this study and examining possible changes or new implementations in the application for the next developing sprint.

### 3.4 Sprint 3 - Finalizing the Web Application

This section describes the methods used for the final developing sprint of the application and details of the third user test.

#### 3.4.1 Development Sprint 3

The third developing sprint focused on expanding the functionalities for event arrangers, fixing issues, and improving the readability of the application. Decisions made during Sprint 2 served as a basis for what changes would be implemented.

The application and database were improved to handle password hashing, this functionality was implemented with the Flask extension Flask-Bcrypt. The Python utility library Werkzeug (also the base of the Flask framework) was used when image uploading was added for the purpose of replacing image links in event and patch creation/editing pages. To better handle different inputs for dates and time on the event creation/editing pages the module dateutil offered generic parsing. Other minor functions were mainly implemented through Javascript.
3.4. Sprint 3 - Finalizing the Web Application

Tooltips were added to the elements in the navigation bar to clarify for the user where they would end up if a link was clicked. Breadcrumbs were added to the process from shopping cart to payment, for ease in navigation between the three steps. The responsiveness of the application was improved to among other things avoid the use of scrolling for the user if possible.

To improve the aesthetic appeal the font of the application was updated, the sans serif font family Avenir was selected as a means of improving the look while retaining readability. Several buttons and links where updated in color after their respective contrasts had been measured with WebAIMs Color Contrast Checker, in line with the formerly described methodology of the subsection Readability Testing of section 3.1.

3.4.2 Test 3

By the end of the third sprint, a third user test was conducted. Navigability, readability, and perceived trustability of the web application were tested with the use of CTA, RP, and Smith’s L formula.

Two days before the test a new operational plan for test 3 was developed. This plan included the existing questions and tasks from test 2, where both students and event arrangers participated, with additional tasks for both groups. For students the following task was added:

- Buy one ticket for a specific future event, the associated patch for that event, and another specified patch (In the test the event and patch were specified by name in the task).

For event arrangers the following tasks were added:

- Edit an event
- Upload a patch
- Remove an event

The day before the test, a practice run was conducted, to prevent problems from occurring during the real test. In the practice run a group member acted as a test participant and the rest of the group were either facilitators or observers. During the days before the test group members also reached out to friends and acquaintances to find students or event arrangers that would be willing to participate in the test, this search resulted in 6 event arrangers and 5 students. The same requirements for participants used during Test 1 and Test 2 were also used for this test, and these were that the participant had to be either a student or event arranger studying at Linköping University and whom was not currently writing a bachelor thesis in computer science or had done so in the past.

During the test there were three different roles, which were assigned prior the test, among the group members:

- One member practiced CTA with the participant.
- Two members took notes of how the participant navigated around the application.
- One member conducted the Retrospective Probing after the tasks were completed.

The execution of the test followed the following steps:

- Welcome the test participants.
- Explain the agenda for the test and how it will be executed.
- Let the test participant practice the CTA method.
3.4. Sprint 3 - Finalizing the Web Application

- Let the test participant perform a set of tasks using the web application while using CTA.
- Let the test participant continue to review the application.
- Perform Retrospective Probing.
- Thank the test participant for their participation and offer a pastry.

After the test, the notes regarding the participant’s navigation, what they said during the use of CTA and their answers from RP, were summarized and evaluated by the group. This information was then used as basis for evaluating the research questions of this study and for what changes or new implementations that could be done in the web application if the project was to continue.
4 Results

This chapter describes the results of the four sprints in their respective sections. The initial surveys and developing decisions are presented in section 4.1. Sections 4.2 and 4.3 follow the same structure with a description of the concurrent state of the application, summarized results of respective user tests, and lastly important decisions and considerations of the sprint. Finally section 4.4 in addition to these subjects presents the results of concluded readability testing.

4.1 Sprint 0 - Market Analysis and Decision Making

Two surveys were conducted, one for regular students and one for event arrangers. The survey for regular students had 210 respondents while the survey for event arrangers had 23. The goal of the surveys was to examine the possible need of the web application among students and event arrangers. In the surveys the local term “kravall” was used, which stands for a party event arranged by and for students at Linköping University.

4.1.1 Survey for Regular Students

The age of the respondents ranged from 19-32 and among those 45% were women and 55% men. The respondents came from 24 different study programs at the university and their habits of going to "kravaller" were as follows:

- 0 times per semester: 6%
- 1-2 times per semester: 28%
- 3-5 times per semester: 39%
- 5-10 times per semester: 20%
- 10+ times per semester: 7%

After establishing their background, 6 more questions were asked:

- Have you ever queued for a “kravall”-ticket?
4.1. Sprint 0 - Market Analysis and Decision Making

- 74% answered yes.
- 26% answered no.

- Have you ever experienced that the queuing time was too long?
  - 96% answered yes.
  - 4% answered no.

- Have you ever refrained from buying tickets to avoid queuing?
  - 89% answered yes.
  - 11% answered no.

- Would you prefer to have an e-ticket instead of a physical ticket?
  - 84% answered yes.
  - 16% answered no.

- Would you prefer to buy the ticket online before buying it physically?
  - 91% answered yes.
  - 9% answered no.

- Today, you can ensure a “kravall”-ticket by queuing enough time. Would you be willing to forgo that possibility, if instead the tickets were awarded at random among all interested? (In case of high demand, you are not guaranteed a ticket)
  - 54% answered yes.
  - 46% answered no.

4.1.2 Survey for Event Arrangers

Among the 23 respondents 91% were active event planners, 96% had already planned an event, and together they represented 8 different study programs at the university.

- Would you prefer a sales system online?
  - 74% answered yes.
  - 26% answered no.

- What do you think about the queuing system for “kravaller”? Good, bad?
  Some think that the current system is good as it is and some think it is bad. But most seem to agree that there are pros and cons.

  - Pros
    * People can ensure tickets by queuing for a long time.
    * Enables that people want to work during “kravaller” in exchange for purchase in advance of tickets to avoid queuing.

  - Cons
    * Mentality of the students.
    * Arrangers have to work several hours, mostly during uncomfortable hours, to sell the tickets.
    * Time consuming for both students and arrangers.
4.1.3 Decisions Made During Sprint 0

Once the surveys were conducted, it was clear that there was a demand for an online application for selling event tickets. A marketing plan was developed to better understand and structure the marketing possibilities for such a product (this marketing plan can be found in Appendix D). The next step was to decide on what functions were essential to have in a first prototype. Namely what functions were needed to create a test scenario that could yield meaningful user feedback for future development. The following attributes were deemed as essential and given priority for implementation in the web application in Sprint 1:

- Creating an account
- Logging in
- Viewing upcoming event
- Viewing patches available for sale
- Purchase an event ticket
- Purchase any available patch

4.2 Sprint 1 - The Base of the Web Application

In this section the resulting application after the first developing sprint is described in the subsection Development Sprint 1. The results of the first user test are presented under Test 1, and lastly important decisions made regarding the application during the sprint are highlighted under Decisions Made During Sprint 1.

4.2.1 Development Sprint 1

This section covers the development made in the web application during Sprint 1.

Content included in the first build

The first front-end build of the web application consisted of eight pages where the number of levels on a page was limited to three. It included a navigation bar present at the top of all pages to ensure clear navigation between different sections, from which the user could get to the pages of events, patches (event accessories), calendar, about, registration, and login. The two last elements were pulled to the right of the navbar, and if a user was logged in the last two options were exchanged for a shopping cart and logout option. The right-pulled elements all had explanatory glyphicons. All pages further included a footer on the bottom of the page, reading year and name of the project group, as can be seen in Figure 4.1. Other pages accessible from within the application included a page for deciding on payment method and a confirmation page for purchase.

Creating the Database

A database was created with SQLAlchemy using the extension Flask-SQLAlchemy that provides an easy to use Object Relational Mapper (ORM). The extension provides useful defaults when using the Flask framework, which made it easier to accomplish the tasks needed to set up the database for the web application. A database with tables for users, events and patches was created. These tables could then be altered and used through functions implemented in the application using queries provided by SQLAlchemy.
4.2. Sprint 1 - The Base of the Web Application

The Events Page

At the events page the upcoming party event was showcased with a small title and image below the page title "Upcoming event:“. A button below the image allowed for direct purchase of a ticket. This button redirected the user to the payment method page if the user was logged in, otherwise the user was redirected to the login page with a flashed message prompting them to log in for access of this feature. Below the button there was a link to the homepage of the event. If a user clicked on the image showcasing the event, the contents of the page would be replaced by a smaller image accompanied by a description of the event as well as two buttons, one for purchasing a ticket (the same as above) and the other for closing the new content and going back to the former page.

The Patches Page

The page for patches had a similar structure to the events page. Different products were all fetched from the database and showcased in an in-line list, all with an image and a button for purchase. The images for the patches were clickable as well, in the same way as the event providing new content in the form of a smaller image, more detailed information, and two buttons (purchase and close).

Unfinished Pages

Both the calendar and about pages contained nothing more than a short text, explaining that the current page/feature was currently in development. This was also true for the shopping cart, which was only accessible if the user was logged in.

The Registration Page

The registration page contained two text fields, prompting the user to select a username and provide their student id to create an account. Below these text fields was some informative text, explaining that when an account was created a password would be generated and shown automatically on the next page, and that the user should remember this password. A submit button labeled "Create user" was located beneath this text. Submitting the page redirected
the user to the login page, where the selected username, student id, and generated password was flashed. This information was also stored in the database.

The Login Page
To handle the functions login, logout and remembering a session’s user Flask-Login was used. It is an API within the Flask framework that provides user session management. It was used to store active users’ ID in sessions and to restrict views to logged-in users only.

At the login page a title prompting the user to "Log in" was followed by two text fields; one for username and one for password. Below these fields a submit button labeled "Log in" was located, and below that a button labeled "Register new account" - which redirected the user to the registration page if clicked. Both text fields where required to be filled in, if the page was submitted without this requirement fulfilled the user was returned to the page and prompted to fill in the required fields missed. If either submitted username or password were incorrect (no such user in database or incorrect password for submitted username) an appropriate error message was flashed as the user was returned to the login page. On a successful login the user was redirected to the main page (events) where a flashed message confirmed the successful login attempt.

The Payment Method Page
When a user clicked on a button labeled "Purchase now" (either from events or patches), they were redirected to the payment method page. The title of this page prompted the user to choose the desired payment method. Below this an explanatory text was located, stating that more options of payment would be added in future builds. A lone button represented the only available option, labeled "PayEx". If this button was clicked the user was redirected to the confirmation page.

The Confirmation Page
At first when redirected to the confirmation page, the only content was a title stating that the purchase was underway. After 2,5 seconds this was replaced with a new title, text, and button. This title exclaimed that a transaction had been performed, and the smaller text explained that a confirmation e-mail had been sent to the users educational e-mail address (however no such e-mail was sent at this time). The button was simply labeled "Back", and redirected the user to the events page when clicked.

Aesthetics
In general all text in the application was black (#000000) and backgrounds white (#FFFFFF). For fonts in the application Bootstrap’s native font stack was used, meaning all fonts were sans serif which is appropriate for readability on screens. The background of the navbar was white/light gray (#F8F8F8), the border gray (#E7E7E7) and the text black (#000000). When an element was hovered the text changed color to a darker gray (#A9A9A9). The active page was shown in the navbar, as the background of that section was changed to a darker gray (#E7E7E7). Standard buttons were used for the registration and login page, while Bootstrap’s success button was used for purchase and payment buttons, Bootstrap’s primary button for the confirmation page, and Bootstrap’s default button for close buttons. Throughout development version 3.3.7 of Bootstrap was used. Initial color scheme of the application was in place to ensure readability, as contrast is important, and black text with a white background is the best in terms of pure readability. To further ensure readability text consisted of words familiar to this kind of online environment, and instructions were written in imperative mode.
4.2.2 Test 1

Six users participated in this test. In this section the results of importance have been divided into sections based on what they affected or helped evaluate, for a complete overview of the results see Appendix E.

**Difficulties with Account Creation and Login**

During the CTA process four users did not understand why both student ID and username were required for registration. One user further voiced a wish during the RP process to have student ID as the sole username.

After account creation two users did not see the displayed text with username and password right away. Furthermore two users had problems with the displayed text disappearing when the login page was reloaded - losing their passwords. These problems were also mentioned in the RP process, one user pointing out that they did not expect the password to disappear when pressing a button, and another user thought it was easy to miss that an account had actually been created. One user would have preferred for the account information to be presented clearly on a different page than the login page. Related to these subjects, three users failed to log in on their first try during the CTA process.

**Superfluous and Hidden Product Information**

During the CTA process two users did not understand that the product images were clickable for more information, one of these users voicing a wish to be able to access more information about the products during RP and the other realizing shortly after the conclusion of the CTA process that it was possible to click the images. One user thought that information for patches was superfluous in its current state, suggesting the use of only a few words as a sufficient description.

**Unclear Buying Process**

Two users were confused during the CTA process when they only could buy one product at a time. One user wanted a pop-up or some sort of intermediate step before purchase, this was also voiced during the RP process as one user expected and would have preferred an intermediate shopping cart step.

One user found it unclear what ticket had been bought upon completing a ticket purchase during the test, and also brought this up during the RP. An intermediate shopping cart step could possibly solve this problem as well.

**Other Missing Features**

During the RP process four users said they would have liked a "My page", from where the user could change their password, edit their billing information, and view their order history. Two users wanted some sort of delivery information available, and another function also desired by two users was a calendar with the events closest in time. Other noteworthy features that the users suggested were a contact or help page, tooltips, amount of tickets sold for an event, resale of tickets, more events displayed on the main page, and more information on the about page.

**Perceived Usability**

Three users answered they thought the application to be user-friendly, although pointing out some improvements to the graphical design were necessary. A fourth user thought the application was easy to use once you were logged in.
During the Retrospective Probing, three users answered no when asked if the application worked differently from their expectations, and four users answered no when asked if they ever were unsure about how to navigate the application. When asked to rate how easy it was to understand the application on a scale from one to five the mean and median values were 4.0 and 4.2 respectively.

Perceived Trust

The users were asked if they believed Linping (the name of the application) would provide them with a ticket/accessory after a reasonable time and at a reasonable price. Regarding the price, two users believed the price would remain the same and another two users thought a small service fee would be added to the price. The remaining two users had differing views, one believing that the price would depend on the ownership of the application, and the other believing the price would be unreasonable due to current lack of information. However, if event arrangers would support the application they would change their mind. This user also believed the same would apply for delivery time, another user believing there would be problems with delivery due to the early development stage of the application, and the remaining four users believed the delivery time would be either fair or instant.

Another question during the Retrospective Probing managed whether the user believed that Linping would keep the personal information of the user safe. Four users answered that they would trust the safety of the application, as they trusted student driven projects in general or because they had not submitted any sensitive information. One user believed their information would not be safe due to the current development state of the application. The last user was unsure, stating that it would depend mainly on how the payment process would be handled.

When asked if they believed that Linping would help the users solve eventual problems that could arise, only one user would trust the application in its current state. Another two believed they would get the required assistance if the application was well established, and a third if there was a way to contact the group responsible for the application. One user believed they would not get the help they would need if technical problems affecting all users would arise, and the last user did not believe Linping would take responsibility for any problems that would occur.

4.2.3 Lostness

As one can see in Table 4.1 the mean value of lostness for all users was 0.46 with a standard deviation of 0.10. This indicates that a majority of the test subjects were lost, as the theory states that values above 0.42 indicates that a test subject is lost.

<table>
<thead>
<tr>
<th>User</th>
<th>Lostness (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.39</td>
</tr>
<tr>
<td>2</td>
<td>0.63</td>
</tr>
<tr>
<td>3</td>
<td>0.33</td>
</tr>
<tr>
<td>4</td>
<td>0.39</td>
</tr>
<tr>
<td>5</td>
<td>0.48</td>
</tr>
<tr>
<td>6</td>
<td>0.55</td>
</tr>
<tr>
<td>Mean</td>
<td>0.46</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Table 4.1: Lostness for users, test 1
4.2.4 Important Measures and Decisions

During Sprint 1 several measures and decisions were made in order to move development forward. They are split up into two sections based upon their influencing factors.

Measures Taken on Account of Test Results

- To make the process of creating a new user clearer the need for a username was eliminated by using the student’s ID as login identifier. This simplifies the user experience by not making them learn yet another username, while utilizing that each student already has a unique identifier.

- To make sure new users could get their account information in a clear and persistent way it was decided the information would be sent to their student mail instead of presented in the application itself.

- Clicking patch images to access a descriptive text about the patch was deemed superfluous and it was decided to present this information directly below the image instead. It was however recognized that links needed to have a graphical indication when moused over to make users aware they were actual links.

- To ensure a transparent and clear buying process an easy to overview shopping cart should be implemented. This serves to simplify buying multiples of products as well as having a last step in the process where it is easy to see what will be purchased.

Measures Taken not on Account of Test Results

- Developing a suitable database for a live system would not be prioritized, the work would be limited regarding the database to the bare minimum required to run the application and its growing functions.

- Future tests would involve both regular students in a consumer role as well as current or past event arrangers in an event publishing role.

- The upcoming sprint would be heavily focused on functions and pure aesthetic design would be postponed to later development stages.

4.3 Sprint 2 - Implementing Important Functions

In this section the resulting application after the second developing sprint is described in subsection Development Sprint 2. The results of the second user test are presented in Test 2, and lastly important decisions made regarding the application during the sprint are highlighted in Decisions Made During Sprint 2.

4.3.1 Development Sprint 2

During the second developing sprint the navigation bar was expanded and now enabled navigation to the pages contact and FAQ (Frequently Asked Questions) in addition to the previous pages. If logged in, all users now had access to "My page", and some users (event arrangers) were also granted special access to an extra page called "My Party Committee" if logged in. A logo for the project was created and included at the far left of the navbar, if clicked it redirected the user to the main page. New pages accessible from within the application included a page for deciding on delivery methods, a form to request a new password, an event creation page and unique event pages for each separate event in the database. An administrator page from where the database could be manipulated was accessible from outside of the application.
The Main and Event Page

The main and event pages showcased the same content, but the layout of the page was changed in this sprint. Directly below the page title was now the event name and description and to the right of this the event image. Below the image there was again the name but also the price for the event and further below that two hyperlinks accompanied by shopping cart glyphicons - "Buy now" and "Add to shopping cart" as can be seen in Figure 4.2.

If a user chose to buy directly they were redirected to the shopping cart page with one instance of the product added to their cart. If the choice was to only add the product to the cart, this was saved in the session and shown to the user in the form of an incrementing number in the navigation bar next to the shopping cart. The event image was clickable, and this action added an instance of the item to the shopping cart. When hovered, a shopping cart icon appeared over the image to inform of the possibility of this action. As before, if attempts were made to buy a product (or add it to the cart) if a user was not logged in, they would be redirected to the login page and prompted to log in.

The Patches Page

The page for patches underwent a similar change, the products still aligned in an in-line list, but having the same buttons and hover-function as the event page product. Between an individual product and its buttons a small descriptive text of the item was situated.

The Calendar Page

The calendar page now properly displayed a classic calendar month format. At the top the current month was stated and arrows allowed for traversing over the year. Name of events from the database were inlaid on the correct dates corresponding to the information in the database. These names were hyperlinks redirecting to event-specific pages.

The Event Specific Pages

Event-specific pages had the same layout as the main page, however if the event was not the next event in time tickets were unavailable. In this case there were no buttons for purchase, and the event image was no longer clickable.
The FAQ Page

At the page for frequently asked questions (FAQ), questions regarding delivery methods and the organization behind the application were answered in a Question:-Answer: format. Beneath these questions and answers a line of text prompted users to click a hyperlink if they had further questions. This hyperlink redirected the user to the contact page.

The Contact Page

The contact page consisted of four text fields; name, email, subject, and message - and below these a submit button labeled "Send". All fields were required, if at least one had not been filled in the user was prompted to fill in all fields. If submitted correctly a message thanked the user for the question and assured that an answer would be provided as soon as possible. The submitted information was composed into an email by the application and sent to the contact address of the project.

The About Page

Below the title "About" on the about page, a large image of the entire project group in a relaxed and slightly comical situation was situated. Beneath this a short description of the group and project followed, ending with a hyperlink to the contact page where users were prompted to go if they had any questions. Below this text each group member was represented with a smaller image, name, and descriptive text.

The Registration Page

The registration page now only contained one text field, student id was now the only information required to create an account. The information below the text field was updated, now stating that a password would be generated and sent to the user’s student mail. If a student ID linked to an existing account was submitted an error message was flashed stating that a user with that student ID already existed. Otherwise the user was redirected to the login page where information explaining that a new user had been created and that the password had been sent to their student mail was flashed. Student ID, password, and student mail were stored in the database as the mail was sent.

The Login Page

Some changes were made to the login page. Above the submit button two hyperlinks were situated, one named "Forgot your password?" and the other replacing the button "Register account". If clicked, the user was redirected to the reset password form and registration page respectively. Otherwise the functionality of the login page remained as was.

Forgotten Password

The page for resetting a forgotten password was a copy of the registration page with some key differences. A different page title and explanatory text described that a new password would be generated and sent by mail. If the submitted student ID did not exist in the database the user was informed of this, and no change was made. Otherwise a new password was generated, sent by mail, and overwrote the former password in the database. The user was then redirected to the login page.

The Shopping Cart Page

The shopping cart was structured with four subtitles; product, price, quantity, and subtotal. For each kind of product in the shopping cart a small image and description was shown in
the product column, price in the price column, quantity and plus/minus-signs for increasing/decreasing the quantity of the product in the quantity column, the subtotal of that kind of product in the next column, and to the right of this a trash button to discard all items of that kind from your cart. Below these tuples a button to the left labeled "Keep on shopping" redirected the user to the event page, and below all the subtotal the grand total was situated. If at least one product was in the shopping cart a button labeled "To checkout" was enabled to the far right. This button redirected the user to the delivery method page.

**Delivery Method**

Depending on the products in the current session’s shopping cart, different elements were enabled to the user at the delivery method page. If at least one event ticket was in the shopping cart a text describing the delivery method for tickets was visible, along with a ticked in radio button for that option. The ticket would be sent in an email to the user attached as a QR-code. If at least one patch was in the shopping cart a text describing the delivery method options for patches was visible, along with two radio buttons for the different options. The choices were either free or by traditional mail - the latter option adding an additional cost to the grand total visible in the shopping cart if ticked in. Always below all text and radio buttons were two buttons allowing the user to either go back to the shopping cart or continue to checkout.

**Payment Method**

The payment method page was similar to the shopping cart in style and structure. Product images, description, quantity, and price were displayed here in the same way - although no options to alter any quantities were present at this page. Below the products a button allowed the user to go back to choosing delivery methods, and below this button the grand total and a buy button were placed. If this latter button was clicked an interface to pay with credit card through implementation of Stripe APIs was shown. When payment was completed all order information was saved in the database as well as QR-codes generated for tickets purchased. Order confirmation was sent by mail together with QR-codes for purchased tickets to the user. After this the user was redirected to the confirmation page.

**The Confirmation Page**

When redirected to the confirmation page the title, text, and button from the former build now loaded immediately, without the precursory page and delay.

**My Page**

At "My page" the student ID, mail, and address of the user was stated. Below this two buttons allowed the user to either change their user information or their password. If clicked the page content was replaced with text fields for filling in the new information and a text field for providing the user’s password for authentication. Below these fields two buttons allowed the user to save their changes or go back to the previous page. If the user chose to save their changes with the wrong password submitted no changes were made and an error message was flashed to the user. When changes where submitted correctly the previous content was loaded with an extra text prompting the user to refresh the page to see changes made. Below the two original buttons the order history of the user was presented, visually similar to the shopping cart. Subtitles here included order number, products, quantity, total, and date of purchase. Products were presented with name and unit price, and format for date of purchase was YYYY-MM-DD HH:MM:SS.
My Party Committee

A user could be granted access to the page "My party committee" by administrators, and such access rights were saved in the database. The title of this page was the name of the event committee the user was a member of, and below this were the planned events for the committee. For each event name, place, number of tickets available in total, and two buttons were displayed. These buttons allowed the user to either go to that event's unique page or edit the event (the latter function not yet implemented). Beneath all events a button labeled "Create event" allowed the user to load the create event page.

The Create Event Page

The page for creating events consisted of seven text fields and two buttons. Text fields were required to be filled in, if a user failed to have done so when submitting an error message would be flashed prompting the user to fill in all fields. The information required to create an event was a name, date, place, number of tickets available in total, price, picture link, and description. When filling in the text field for the date a small calendar appeared where the user could instead click on the desired date and it would be written into the field automatically. The buttons beneath the text fields allowed the user to either create the event or go back to the party committee page.

The Admin Page

A user could attempt to access the administrator page by typing in the local host address followed by /admin in the address field. Before rendering the page a pop-up prompted the user to log in, otherwise the page was inaccessible. The administrator page allowed easy access to the database and was not meant to be used by any test subjects. Administrator functionality was implemented with Flask Admin.

Aesthetics

The colors of text and background had been reversed in this build of the website, text being white (#FFFFFF) and backgrounds black (#000000), this being done to make the application more visually pleasing while still ensuring good contrast and readability. When hovered, text in the navbar changed color to a dark gray (#A9A9A9), and the active page was shown through a change in background to a lighter black (#303030). In general buttons were of Bootstrap’s primary type, however back buttons were of the warning type. All buttons on the shopping cart pages and following pages in the payment process were of the primary type. A background image was added to improve the look of the application, as the appearance affects the perceived credibility of a web application.

4.3.2 Test 2

Eleven users participated in this test, out of which six were event arrangers and five were regular users. In this section the results of importance have been divided into sections based on what they affected or helped evaluate, for a complete overview of the results see Appendix F.

Event Creation Process Flaws

The event creation process received a lot of feedback from arrangers through both the CTA and RP parts of the test which helped further develop the usability of the process.

During the RP, two arrangers pointed out that the edit event button did not work and that they would like to be able to edit events. Furthermore one arranger wanted to have a delete button for events. Two arrangers also reacted to the non-functioning edit event button during
the CTA. One arranger voiced a request during the RP for the possibility to add a ticket release date when creating an event. Also during the RP, one arranger requested a bigger textbox for the event description when creating an event as the, at the time, small textbox made it appear as if the description should be short.

During the CTA, three arrangers were confused by what information to put into the image link field when creating an event. One arranger was confused by the created event’s image, as no valid image link was added and the placeholder text was found confusing.

Event Page Layout and Functionality Flaws

Important input for the event page was received from both the CTA and RP parts of the test that pointed at flaws and missing but wanted functionality.

During the CTA, one arranger recommended to change "festeri" to something else, as not all arrangers identify as a "festeri" (note that this was mainly a problem in Swedish, "festeri" translates to party committee). Two arrangers voiced that they wanted a presentation of the arrangers at the event site. In addition one arranger wanted the event ticket release date to be clearly shown and two arrangers wanted the event date to be shown.

During the RP, one user said they would like some sort of function to remind users of the ticket release. One user was surprised they could not buy tickets to events other than to the next event. One arranger thought the patch would be sold next to the associated event and two arrangers made clear that they wanted patches to be available for sale on the event page.

General Layout and Design Problems

Input regarding the general layout and design of the application was gathered during both the CTA and RP parts of the test. The majority of it relates to the navbar’s content and design in some way.

During the CTA, one arranger and one user thought it was confusing that the event page and main page were identical. One user said they had problems seeing everything in the navbar. Additionally one arranger thought the login failed although it was successful, probably due to the color of the login flash being red.

During the RP, one arranger said they wanted the main links in the navbar to be bigger, and one user thought there should be a unique start page. Two users said that they thought the design looked good.

Other Problems

Some input that cannot be categorized as the above but that still has affected the development of the application was received during the CTA part of the test.

One arranger thought it would be nice to be able to see the amount of sold tickets under the "My party committee" page. A bug was found when one user had the page turn black when clicking a patch image. Moreover one arranger wanted more information about the patch delivery, such as how they were delivered or where they could be picked up.

Perceived Trust Evaluation

Several questions regarding perceived trust was asked during the RP, and the results are shown below. In general the regular users showed more perceived trust than the arrangers.

When the arrangers were asked if they believed Linping would handle the selling of the party tickets/accessories in a reasonable way, three answered yes and three answered no. The following reasons why they did not believe it would be handled correctly was each voiced by a single arranger, but one arranger may have voiced several reasons.

- One thought the application would collapse.
• One thought it would be hard to authenticate student IDs so that one user would not be able to buy more than the maximum number of allowed tickets per person.

• One thought that some sort of queue system was needed.

• One was worried about when the money would reach the arranger.

• One was worried about the security.

When the regular users in turn were asked if they believed Linping would provide them with a valid ticket/accessory at a reasonable time and price, all five users answered yes.

When the arrangers were asked if they believed Linping would handle the information regarding parties and the financial parts in a secure and correct way, five answered yes and one no as they did not feel secure about Linping having access to their information. When the regular users in turn were asked if they believed that Linping would keep their personal information safe, minimizing the risk of theft of money or private information, three answered yes, one was unsure and one answered that they did not think so in the application’s current state. The unsure user was worried about how second hand tickets would be handled.

Both arrangers and users were asked if they believed that Linping would help them solve their problem if for example a problem would arise with their ticket or accessory. Five arrangers answered yes and one answered no, not in the web application’s current state. Four regular users answered yes and one answered no, as they were afraid the web application would be congested. One user clarified that they trust the event committees and thus they trust Linping in extension.

During the CTA one arranger said that they thought the “about” page made the application more trustworthy due to seeing who was behind the application.

Perceived Navigability Evaluation

Relevant results regarding navigability of the web application was collected during the RP part of the test. Overall the test participants had little to no problems navigating the web application.

When the test participants were asked if they were ever unsure about how to navigate the web application, five arrangers and four users answered no. One arranger said they were unsure how to navigate the application right after logging in. One user did at first not know where to buy a patch.

During the RP, one user voiced a thought about the web application being easy to navigate.

Perceived Usability Evaluation

During the RP part of the test, information regarding the application’s perceived usability was obtained.

When the participants were asked how they perceived the web application in its entirety, the following feedback was received.

• Four arrangers thought the application was clear and simple to use.

• One arranger thought the functionality was good.

• One user thought the application worked well.

• One arranger appreciated the calendar view of events.

• One user voiced appreciation for the calendar and the about page.

When the participants were asked how easy is was to understand the web application on a scale from one to five, the answers in figures 4.3 and 4.4 were received, where one is very hard to understand and five is very easy to understand.
4.3. Sprint 2 - Implementing Important Functions

![Bar chart for event arrangers understanding](image1.png)

Figure 4.3: How easy it was for event arrangers to understand the web application, Test 2

![Bar chart for regular users understanding](image2.png)

Figure 4.4: How easy it was for regular users to understand the web application, Test 2

### 4.3.3 Lostness

The mean and standard deviation lostness values for arrangers and regular users were calculated and are shown in tables 4.2 and 4.3 respectively. The results show a 15% improvement for the regular users mean-value which puts the value below 0.42 and thus indicates that the majority of them were not lost. The mean-value for event arrangers is also below 0.42 which indicates that the majority of them were not lost.

### 4.3.4 Important Measures and Decisions

During Sprint 2 several measures and decisions were made in order to move development forward. They are split up into two sections based upon their influencing factors.
4.4 Sprint 3 - Finalizing the Web Application

<table>
<thead>
<tr>
<th>User, arranger</th>
<th>Lostness (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.29</td>
</tr>
<tr>
<td>2</td>
<td>0.51</td>
</tr>
<tr>
<td>3</td>
<td>0.37</td>
</tr>
<tr>
<td>4</td>
<td>0.38</td>
</tr>
<tr>
<td>5</td>
<td>0.30</td>
</tr>
<tr>
<td>6</td>
<td>0.50</td>
</tr>
<tr>
<td>Mean</td>
<td>0.39</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Table 4.2: Lostness for arrangers, test 2

<table>
<thead>
<tr>
<th>User, regular</th>
<th>Lostness (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.31</td>
</tr>
<tr>
<td>2</td>
<td>0.38</td>
</tr>
<tr>
<td>3</td>
<td>0.41</td>
</tr>
<tr>
<td>4</td>
<td>0.42</td>
</tr>
<tr>
<td>5</td>
<td>0.24</td>
</tr>
<tr>
<td>Mean</td>
<td>0.35</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table 4.3: Lostness for regular users, test 2

Measures Taken on Account of Test Results

- To make it easy to differentiate between available events and future events a countdown clock was to be put in place showing the time remaining until ticket release.

- Patches directly linked to an event should be available from the event’s own page in addition to being available from the patch page.

- Implementing a function to edit and/or delete created events needed to be completed prior to the next coming test.

- Adding images to patches, events and future product categories should, from an event arranger perspective, be done using a simple file chooser.

- The navigational bar needed to be made clearer, this should be done in conjunction with making it more responsive.

- Each event page should clearly show what date the event will or did take place.

Measures Taken not on Account of Test Results

- The choice to have purchased patches sent to the buyer by post should be removed. Determining how physical products will be delivered should be up to the arrangers making the patch.

4.4 Sprint 3 - Finalizing the Web Application

In this section the resulting application after the third developing sprint is described in subsection Development Sprint 3, and after this the subsection Readability Test presents the results of those tests. The results of the third user test are presented in Test 3, and lastly important decisions made regarding the application during the sprint are highlighted in Decisions Made During Sprint 3.
4.4. Development Sprint 3

The third developing sprint focused on expanding the functionalities for event arrangers, fixing issues, and improving the readability of the application.

Content Included

In this build the navigation bar was further modified, see Figure 4.5, the link to the events page was removed, being replaced by the link to the calendar (this change was done after the third user test). However the logo in the navbar still redirected to the main page. The link to the calendar was renamed to "Event calendar", and was along with "Patches" increased in size to telegraph to the end user that these pages contained the main purposes of the application. Explanatory tooltips were added to the navbar.

![Figure 4.5: Start page](image)

New pages accessible from within the application included an event editing page, a patch creation page, and a patch editing page (the last one added after the third user test). Titles of all pages were now centered and separated from the content by a horizontal line.

The Login and Registration Pages

The login and registration pages were now replaced with drop-downs from the navigation bar, see Figure 4.6. Most of the content was retained, the link to register a new account formerly situated on the login page was however removed. When logging in the user was no longer redirected to the main page, but stayed on the current page. All flash messages regarding login and registration were changed to be alerts instead (this change was implemented after the third user test). The registration process, login process, and database were updated to handle hashing of passwords, providing a more secure application.

The Event Page

Layout of main and event pages were altered further during this sprint. Title of the page would be the name of the event, except on the main page where the event name was a subtitle and "Upcoming event" was the title. Below the event description more information was added regarding the time of the event and ticket release, as well as name and description of the event committee for the event. Beneath the two hyperlinks connected to the purchase.
of a ticket, products linked to the event were displayed below a small title; "Patches (and accessories)". Associated products were displayed with a small image, title, and price. All of these changes can be seen in Figure 4.5. When hovered upon, a tooltip informed the user that clicking the product would add it to the cart. If the ticket release of an event had not yet happened all links regarding purchase or adding products to the cart were disabled, indicated by using gray colored text. Furthermore a countdown clock for the ticket release with an exciting message would be displayed centered below the rest of the content, see Figure 4.7.

Always displayed on the bottom of the content were a short text with a hyperlink to the calendar, see Figure 4.7, prompting the user to click to see more events (this was added after the third user test).
Payment Process

Breadcrumbs were implemented in the payment process to improve navigability. These were situated below the title of each page and displayed the three steps in the process as well as highlighting the current position for the user in said process, see Figure 4.8.

The delivery method page was altered, the choice of delivery of patches by traditional mail was removed - leaving the free option of picking up the products yourself. As such there was no longer any possibilities for shipping costs to be added to the total.

Event tickets and patches could be put in the shopping cart from the event pages and the patch page. The button labeled "To checkout" in the shopping cart redirected the user to the page containing information about the delivery method. To get here, the user had to be logged in. From this page, by clicking on the button labeled "Proceed with payment" the user proceeded to a page showing all the items the user was about to buy, their prices and the total price. Clicking the button labeled "Pay" caused a window to show up where credit card information could be filled in, see Figure 4.9. Payment was implemented using Stripe.

![Figure 4.8: Shopping cart using breadcrumbs](image)

![Figure 4.9: Stripe payment window](image)
4.4. Sprint 3 - Finalizing the Web Application

When confirming the purchase, an email was sent to the user containing information about the purchase order. If event tickets were bought, one email for every ticket was sent to the user containing a unique QR-code.

While the emails were being sent, the application displayed a page consisting of a loading GIF with a short sentence stating that the user should wait while their purchase was being processed, see Figure 4.10. This was followed by a confirmation after processing was complete.

![Figure 4.10: Page shown when purchase is in process](image)

**My Page**

Removing delivery by traditional mail as a delivery option meant there was no longer any use for the address the user could provide. The addresses were removed entirely from the database and could therefore no longer be displayed or changed from "My page". My page can be seen in Figure 4.11.

![My Page](image)

**My Party Committee**

On the "My party committee" page the events of the user’s committee were no longer initially displayed, now all initial content was four buttons; "Show events", "Create event", "Show patches", and "Create patches", as seen in Figure 4.12.

When clicking "Show events" the button was replaced with a new button labeled "Hide events" and the old view of all the events belonging to the committee was displayed. The edit button now redirected to a new edit event page and beyond the old information regarding tickets sold was a new button labeled "Remove Event". These were displayed for each event, see Figure 4.13. Clicking this new button triggered a modal asking the user if they were sure as this action could not be undone. Buttons allowed the user to either go back to the previous page or delete the event. If the latter was chosen the event was removed from the database and a message was flashed to the user informing them on the removal of the event. All these functions worked the same for patches, only for each patch there were no button linking to a page for the patch, and information about each patch was limited to total number of patches and patches sold.
The Create Event Page

The "Create event" page was expanded with fields for maximum number of tickets per customer and ticket release date and time. Another date picker was used for the ticket release field similar to the event date field, and both date pickers disabled past dates, see Figure 4.14. If the user typed letters into a number field (like price or total available tickets) the field’s edges would turn red and the field could not be submitted until the error had been corrected. The image link text field was replaced with an image uploading function, and uploaded images were saved in the database. Above the submit button a checkbox allowed the user to choose if they wanted to create a patch linked to the event after submitting.
4.4. Sprint 3 - Finalizing the Web Application

Figure 4.13: My Party Committee Starting Page showing events

Figure 4.14: Create event form with datepicker

Edit Event Page

When a user wanted to edit an event they were redirected to the “Edit event” page. This page had the same look and functions as those of the create event page, however the values of the fields were preloaded with information about the event from the database. The differences lie in the title (here “Edit [event name]”), labels on buttons (“Save changes” instead of “Create”), and lack of checkbox for creating a patch linked to the event.

Create Patch Page

The page “Create patch” was similar to the create event page, though consisting of fewer fields. These were name, location for pickup, total amount of patches, price, description, and an image upload function for selecting an image for the product. Beneath these required fields a checkbox was located, where the user could decide if they wanted to link their new
patch to an event or not. If the former was the case and the checkbox was ticked in, radio buttons for all events belonging to the party committee were displayed and the user could make their choice, see Figure 4.15. Below this were two buttons, one for submitting the data and the other for going back to the “My party committee” page. Flashed error messages and strict number fields were implemented the same way for this page as for that of event creation.

![Create patch form](image)

**Figure 4.15: Create patch form**

**Edit Patch Page**

When a user wanted to edit a patch they were redirected to the “Edit patch” page. This page functioned exactly like the create patch page, with the exception of information about the patch being preloaded into the fields from the database. The title of the page and label of the submit button also differed from the create patch page in the same way as those for the event pages.

**Aesthetics**

The standard font for the application was updated to the sans serif font family Avenir to further uphold the readability of the application while being more aesthetically appealing. Responsiveness of all elements of the application was improved, adjusting to screen sizes more properly. The navigation bar was collapsible, meaning when the screen size was too small all links were hidden and replaced by a single button, which in turn toggled a drop-down containing all previously hidden elements now arranged vertically. Changes were made to buttons and links in the application to improve readability; darker backgrounds when hovering over buttons instead of darker text, blue hyperlinks adjusted to lighter blues to contrast better against the black background, and the background of warning type buttons were darkened. As before the standard for buttons in the application were Bootstrap’s primary type, back buttons used the warning type, and the new remove buttons were of Bootstrap’s danger type.
4.4.2 Readability Test

During the third developing sprint the application underwent tests to ensure readability. In this section the results of these tests are presented.

LIX

A readability test using the LIX formula was performed for all texts considered not to be simply lone words. As shown in Table 4.4 all measured final texts had a LIX value less than 30 which shows that they were easily readable. The text for Delivery method - Patch (old) was at first not readable with a LIX value at 64, but the text was modified to become more readable which can be seen as the LIX value for Delivery method - Patch (new) is 29.[35]

<table>
<thead>
<tr>
<th>Page</th>
<th>LIX value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>25</td>
</tr>
<tr>
<td>About</td>
<td>23</td>
</tr>
<tr>
<td>FAQ</td>
<td>24</td>
</tr>
<tr>
<td>Delivery method - Ticket</td>
<td>29</td>
</tr>
<tr>
<td>Delivery method - Patch (old)</td>
<td>64</td>
</tr>
<tr>
<td>Delivery method - Patch (new)</td>
<td>29</td>
</tr>
</tbody>
</table>

Table 4.4: LIX for the web application pages

Contrasts

The contrast checking was performed on all text and buttons which deviated from the simple contrast black on white or vice versa. All contrasts in the web application were categorized as AA, above 4.5:1, see Table 4.5 and can thus be considered readable[55]. Note that shadowing and uneven backgrounds, which have not been accounted for, might have affected the actual perceived contrast.

<table>
<thead>
<tr>
<th>Component</th>
<th>Foreground color</th>
<th>Background color</th>
<th>Contrast ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Links (not navbar or calendar related)</td>
<td>#7DAF59 (light blue)</td>
<td>#000000 (black)</td>
<td>9:02:1</td>
</tr>
<tr>
<td>Calendar links</td>
<td>#7DAF59 (light blue)</td>
<td>#322D2D (light black)</td>
<td>5:82:1</td>
</tr>
<tr>
<td>Blue buttons</td>
<td>#FFFFFF (white)</td>
<td>#337AB7 (blue)</td>
<td>4:56:1</td>
</tr>
<tr>
<td>Edit buttons</td>
<td>#FFFFFF (white)</td>
<td>#8E642D (brown)</td>
<td>5:24:1</td>
</tr>
<tr>
<td>Delete buttons</td>
<td>#FFFFFF (white)</td>
<td>#D33A35 (red)</td>
<td>4:74:1</td>
</tr>
</tbody>
</table>

Table 4.5: Contrasts for web application components, where colors are stated in hexadecimal with a description of the perceived color.

4.4.3 Test 3

Eleven users participated in the test, out of which six were event arrangers and five were regular users. In this section the results of importance have been divided into sections based on what they affected or helped evaluate, for a complete overview of the results see appendix G.

Confusion and Requested Functions Regarding the "Event" page

During the RP five users and one arranger said that they were either confused or disturbed because of the fact that there was only information about one event on the event page and not several. This was also noticed during the CTA, since two regular users and one arranger...
expressed their confusion verbally. During RP two of these regular users expressed a wish to be able to scroll through upcoming events on the event page.

Three regular users also thought it was unclear that the calendar was the only way to access events further away in time.

One regular user wished there would be a way to see how many tickets for an event that had been sold and how many remained.

One arranger wanted a way to add events from the event page and not only from the my party committee page.

During the CTA two regular users were confused that the start and event page were the same. One of these two also had trouble seeing the ticket price on the event page.

**Flaws and Improvement Possibilities for the "Create Event" page**

During the RP one arranger thought it was confusing that when creating an event the ticket release date was directly followed by where the event would be held which easily could be interpreted as the location for ticket release. This was also expressed during the CTA by the same arranger.

Another arranger answered during RP that they wanted to be able to choose, when creating an event, what time it would be visible for everyone else.

One arranger wanted a way to edit events from the event page, my page and calendar. This arranger also wanted to be able to create events that take place during longer periods of time, rather than just one day events.

One arranger also thought it was hard to initially find where to edit an event. This was also noticed during the CTA. Two arrangers were initially confused as to from where an event could be created. This confusion was resolved in one case once the subject saw the link for "My party committee", however the other arranger was unsure whether "My party committee" or "Event" was the right choice.

During the CTA one arranger had problems finishing the create event form, as they entered time for ticket release in the wrong format.

Another thing noticed during the CTA was that one arranger edited the image of an event, even though this was not his or her initial goal, because they thought it was necessary to finish that task.

One arranger found the “Create event” page was easy to understand and commented several times that it was clear what to do. However, when choosing the number of tickets there should be for an event, the buttons in the number field which changed the amount by one felt unnecessary.

**Flaws Concerning the Create Patch Process**

During RP three arrangers thought it was strange that patches were not viewed and edited in the same way as events from the “My Party Committee” page. This was also expressed by one arranger during the CTA. One arranger also wanted to be able to edit patches from the “patches” page, which they expressed during the RP.

During the CTA process two arrangers said that they would like to set maximum patches per person to “unlimited”.

Two arrangers tried to leave the field for patch description empty, and when they got prompted to fill it in they saw that the just selected image had disappeared. After reselecting the image the arranger successfully uploaded a patch.

One arranger misinterpreted the “description” of the patch during creation, and described the look of the patch instead of providing a more general text concerning the patch.

Another arranger was unsure if “creating” a patch meant ordering a patch to be manufactured or if it simply was making the sales information available.

One arranger said that the “create patch” page was very easy to understand.
Perceived Trust Evaluation

In the same way as in earlier tests three questions were asked regarding the web application’s perceived trust.

When arrangers were asked if they believed Linping would handle the selling of event tickets/accessories in a reasonable way, five answered “yes” and one arranger answered that they wanted more information regarding the QR-code.

Regular users got the question “Do you believe that Linping would provide you with a valid ticket/accessory at a reasonable time and price? Why/why not?” Four users answered yes and one did not answer.

The second question for arrangers was “Do you believe that Linpings handling of the information regarding parties and the financial parts is done in a secure and correct way? Why/why not?” Five out of six arrangers felt that the handling of personal information was done in a secure manner. Some arrangers proposed that an agreement between the site-holders and the arrangers would further ensure the feeling of security. One arranger suggested that HTTPS would make the application feel more secure. He also pointed out that the use of familiar payment methods such as Klarna or Payex would make him feel more secure.

The second question for regular users was “Do you believe that Linping would keep your personal information safe?” Three users believed that their information would be handled in a secure way. The other two were not sure about the handling of their personal information and pointed out that they would feel more secure if HTTPS and Bank-ID were used in the application.

The third and final question, for the arrangers, in this section of the RP was “Do you believe that Linping would help you solve your problem if for example a problem would arise with your ticket or accessory? Why/why/why” Three users answered “yes”. To believe that Linping would help one of the other two wanted it to be stated somewhere that Linping will help to solve problems and the other wanted more contact information.

The third and final question, for the regular users, in this section of the RP was “Do you believe that Linping would help you solve your problem if for example a problem would arise with your ticket or accessory? Why/why not?” Four users answered “yes” and the last person was not sure because they wanted a repurchase function.

Other Problems and Interesting Comments

Other interesting comments during the RP process or things noticed during the CTA process that does not belong to one of the above specified topics are the following:

- Two arrangers wanted discounts for student union members to be implemented.
- Two regular users wanted a place on the application where tickets could be sold second hand. One of them thought a queue-system would be good to have for that.
- One arranger wanted more information about the different event committees.
- One arranger wanted more functions for the party committee page.
- One arranger did not understand that he or she had been logged in, because there was no flash message or pop-up with information that the login attempt had been successful.
- One regular user desired clarification regarding pickup sites for patches.
- One arranger clicked on a picture of a patch on the “Patches” page and expected to see a larger image. Instead, the patch was put in the shopping cart. This was not what they expected.
Perceived Navigability and Usability Evaluation

During the RP process one arranger and three regular users answered that they were never unsure on how to navigate in the web application and one said “it was very easy to navigate.” The other regular users and arrangers also thought it was easy to navigate, but were at some point a bit unsure where to press next. Where and why they were unsure has already been covered in the sections above.

The web application as a whole was perceived as clear and simple to use by the majority of the test participants. All six arrangers thought the application was clear and simple to use and/or straight forward in functions. One arranger did not think the design was good enough, while two said it was very good. All five regular users thought the application as a whole gave a good impression and said it was clear and simple to use and/or they were impressed by the design. One regular user also said that it was easy to navigate and that the functions were straight forward.

When the participants were asked how easy it was to understand the web application, feedback shown in figures 4.16 and 4.17 was received, where one means very hard to understand and five means very easy to understand.

Figure 4.16: How easy it was for event arrangers to understand the web application, Test 3

4.4.4 Lostness

The mean and standard deviation lostness values for arrangers and regular users were calculated and are shown in tables 4.6 and 4.7 respectively. The results indicates that the majority of both regular users and event arrangers were not lost while performing the same tasks that were done during test 1 and test 2. Other the other hand, the results indicates that arrangers were lost while performing the new tasks in test 3 while the regular users were not lost while performing their new task.
4.4. Sprint 3 - Finalizing the Web Application

Figure 4.17: How easy it was for regular users to understand the web application, Test 3

<table>
<thead>
<tr>
<th>User, arranger</th>
<th>Task 1 (L)</th>
<th>Task 2 (L)</th>
<th>Task 3 (L)</th>
<th>Task 4 (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.33</td>
<td>0.60</td>
<td>0.25</td>
<td>0.42</td>
</tr>
<tr>
<td>2</td>
<td>0.55</td>
<td>0.60</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>3</td>
<td>0.33</td>
<td>0.60</td>
<td>0.32</td>
<td>0.60</td>
</tr>
<tr>
<td>4</td>
<td>0.42</td>
<td>0.60</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>5</td>
<td>0.35</td>
<td>0.25</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>6</td>
<td>0.19</td>
<td>0.60</td>
<td>0.25</td>
<td>0.60</td>
</tr>
<tr>
<td>Mean</td>
<td>0.36</td>
<td>0.54</td>
<td>0.44</td>
<td>0.57</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.11</td>
<td>0.13</td>
<td>0.17</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table 4.6: Lostness for arrangers, Test 3

<table>
<thead>
<tr>
<th>User, regular</th>
<th>Task 1 (L)</th>
<th>Task 2 (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.40</td>
<td>0.23</td>
</tr>
<tr>
<td>2</td>
<td>0.33</td>
<td>0.23</td>
</tr>
<tr>
<td>3</td>
<td>0.58</td>
<td>0.18</td>
</tr>
<tr>
<td>4</td>
<td>0.33</td>
<td>0.29</td>
</tr>
<tr>
<td>5</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Mean</td>
<td>0.39</td>
<td>0.24</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.11</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Table 4.7: Lostness for regular users, Test 3

4.4.5 Important Measures and Decisions

During Sprint 3 several measures and decisions were made in order to move development forward. They are split up into two sections based upon their influencing factors.

Measures Taken on Account of Test Results

- Additional functions should be added to extend the options for arrangers. This included the options to edit and remove patches as well as being able to overview every event committee’s patches in the same way as its events. This was decided in order to deliver a fulfilling experience to event arrangers letting them have total control of their products.
4.4. Sprint 3 - Finalizing the Web Application

- Since the event page caused some confusion for many users it was decided that it needed to undergo several changes. To increase user navigability a link to the calendar and the option to buy the patch connected to the event should be added to the event page. Since two tabs (home and event) both lead to the event page it was decided that the event tab was to be removed in order to increase navigability.

- If a user failed to create an event at first try, he or she noticed that the just selected image was not selected anymore and thereby felt forced to choose the picture again. This happened in both the create event and the create patch process. It was decided that the problem should be fixed, but due to lack of time it was not and thereby remains as an issue that should be dealt with in development that may happen in the future.

- It was clear from user feedback that two important functionalities needed to be implemented for future undertakings. Firstly discounts for student union members are a requirement as to preserve the perks that are to be expected with membership. Secondly and lastly the application needs to have an English version as well. This is to ensure that non-Swedish speaking students are not excluded. This would increase the possibility that students and event arrangers unanimously use the application. These two functionalities were not implemented due to lack of time, but are important if the web application would be developed further.

Measures Taken not on Account of Test Results

- A decision was made to remove home delivery of patches with the reason being that it is not a function of much use to the customer. As the customers are students at Linköping University they might as well collect ordered patches at the university and thereby avoid the cost of traditional mail.

- In order to speed up the process of logging in and creating an account these functionalities should be changed from separate pages to drop downs from the header.
5 Discussion

This chapter first discusses the Results of this study, followed by the Methods used to achieve those results. Finally, a closer look is given to the ethical and societal aspects of the study in the section The Work in a Wider Context.

5.1 Results

In this section the results of the development process and user tests are discussed. Looking at the result from the final test it can be concluded that the application lives up to the standards set for it being regarded as navigable, readable and trusted by its users.

5.1.1 Decisions made during Sprint 0

The decisions regarding the application from sprint 0 were derived both from a technical view of essential functions, as well as to ensure the prospect of meaningful user tests. Therefore we consider the initial choices regarding the application as absolutely necessary and non-negotiable. The selected functions laid the groundwork for all future functionality of the application, and as such had a great impact on the coming development and testing.

5.1.2 Navigability

Substantial information regarding perceived navigability from the users was mainly received from RP during the user tests. Users were asked one direct question related to navigability and two that indirectly gave indications of changes to be done in the application in order to improve the navigability.

Promising results were already showed in the first test where four out of six users felt comfortable while navigating the web application and all of the participants gave good scores when asked if the site was easy to understand. These results may be due to that several steps were taken to make the application navigable already during the development in Sprint 1, such as implementing a navigation bar and making all links active and self-explanatory, which according to previous studies [14], [22]–[25] is imperative factors that impact navigability positively. The results from Test 1 may also have been affected by the fact that the
5.1. Results

The application was very simple and still lacked many functions, which did not give the users many choices when navigating the application.

The second test continued to show promising results, as well as the third, and is well within the boundaries of it being considered navigable by its users. This may be due to the continuous relationship between developers and users that has lasted during the entire developing process. Taking users’ input into account has made the developing team constantly aware of potential misunderstandings and thereby avoided pitfalls. This can be seen between the different iterations of the application where the amount of functionality and options increased without compromising user navigability. On the other hand, input on changes gained from user tests regarding navigability could be highly personal, and if implemented possibly reduce the overall navigability. The reason that this did not happen, which the results show, may be due to the fact that development of new implementations was based on theory from previous studies.

Information regarding navigability was also gained from measuring lostness during the user tests. According to the lostness-formula over half of the users were considered lost while performing the task given in Test 1 which contradicts the RP results. This may be due to that the application, as earlier mentioned, was very simple and lacked several functions. This made the optimal way to solve the task short and one button clicked in the wrong order heavily impacted the result. One could therefore argue that the task was not thought through when developed and thus does not reflect an image of the navigability as a whole. The result was improved in Test 2 where the the mean showed good results in line with the perceived navigability, which could be an result of that more functions were implemented after Sprint 2 making the optimal way longer to complete a task and making the lostness-formula more reliable. The same performed tasks in Test 3 that were executed in Test 1 and Test 2, showed further promising results. The mean lostness values continued to lower even though more implementations had been done in Sprint 3 making the application more complex, thus further supporting that the application can be considered navigable. In Test 3 we also asked the participant to complete new tasks in addition to the old ones. These tasks were mainly developed to test new small implementations which made the optimal way to complete them short, and the starting point for these tasks depended on where the participants were located after the previous task. This could be the reason that results for several of these tasks showed that participants were lost while performing them while the results from RP showed good results in terms of navigability.

5.1.3 Readability

All pages in the application have a LIX score below 30 meaning that they are very easy to read. Taking all pages into account one could argue that the LIX test does not give the full picture since most pages do not contain that much text. Seeing that most of the templates do not have more than a couple of sentences they will not have a great amount of effect on user experience. The fact of the matter is that the arrangers themselves control the bulk of text in the application. It is only in the description of their products that you find a larger mass of text. Seeing that this cannot be affected by developers focus must rather rely on structural aspects such as the placing of text and colors.

Considering the understanding of the text the aim was to live up to the rules set by Standards for Online Communication (1997) [32]. Seeing that these rules are not measurable they were solely used as guidelines during development whereas the LIX score served as the result that came out of them. It was found that some rules stood out to be more relevant than others regarding the application. Although the application is aimed to be used primarily by students at Linköping University users not initiated in student life may have difficulties with jargons that come with it. Certain phrasings have thereby been changed into more general terms with an example being “kravall” being changed to event.
As seen in table 4.5 all buttons and links have a sufficient contrast ratio to be considered readable. Their colors have no transparency which means that the ratio can be considered fair with no misleading results. With a background image containing several different colors the contrast between text and background needs to be addressed in some way. This is achieved by placing a shaded black box between text and background image. By doing so the contrast criteria of 4.5:1 mentioned in Web Content Accessibility Guidelines 2.0 [39] is achieved. The result does not however provide the full picture being that it does not take the transparency factor into account. Seeing that the black colored area provided for text has different degrees of transparency colors from the background image still impacts readability. This does not necessarily mean that the test is useless but as earlier mentioned does not provide the full picture. Thereby it is up to the developer, relying on user feedback, to weigh readability contra the design aspect to provide an optimal solution for users.

5.1.4 Trust

The most substantial information regarding the evaluation of the web application’s perceived trust was received during the scenario part of the user tests, where the participants were asked three questions that all relate to trust. There was an interesting development of the answers to these questions during the project’s three user tests. In essence the users’ perceived trust of the application has increased test after test, which is in line with what the purpose of the tests were and also goes hand in hand with the theory about increased quality generating higher trust [5].

The first user test results showed uncertainty in whether the users trusted the application or not, only one user thought Linping would help them solve eventual problems. Nevertheless most users thought they would receive the promised product at a reasonable price and time, and additionally they trusted the security of the application, which shows that the application was in some ways trusted but not as a whole. Some of the users said the reason for their trust was that they trusted student driven projects, which is interesting as it implies that there was bias that worked in favor of the application’s trustability. This implies trust has been gained by external factors. The reasons for the trust issues seem to be based in the fact that the application was in very early development stages, with little information of who stood behind the page and no clear contact possibilities. These factors are important to establish trust, as described in the theory using the Stanford Guidelines for Web Credibility [43].

The perceived trust increased in time for the second user test. This time around all arrangers except one and all regular users except one thought Linping would help them solve eventual problems. The further development of the application seems to have increased the perceived trust, and it is likely the extensive “about us” page played a part in this as one arranger clearly stated the “about us” page made the application more trustworthy due to seeing who was behind the application. This is further strengthened by the fact that one user voiced appreciation for the “about us” page. Overall the application had come a long way regarding desired functionality, design, and correcting errors. This does help in increasing perceived trust, as professional design, usefulness, easy contact options, and avoiding errors are all important factors to building trust [43].

However some issues with the perceived trust is still present as only half of the arrangers thought Linping would handle sales of event tickets and accessories in a reasonable way. This is due to several reasons, for example thoughts about the application collapsing under pressure and a non-existing queue system. These problems were however not rectified during the next sprint cycle because of focus on other functionality.

The results from the last test show further increased perceived trust, especially from arrangers. Only one arranger did not believe Linping would handle sales of event tickets and accessories in a reasonable way, and this was because they wanted more information about the QR-codes. This further increased trust can be partly explained by the improved quality
of the application during the last sprint cycle. A lot of focus was put on bug-fixing and im-
plementing a better event creation process with for example an image selector function and a
release date option, which were both deemed as wanted by arrangers from the test 2 results.
Increased quality is strongly correlated to increased trust, as discussed in the theory, and thus
it is likely this played an important part in increasing the perceived trust. \[5\]. However there
were some concerns about security, as one arranger and one user wanted the application to
use HTTPS in order to feel secure about Linping’s handling of their information. This reason
was not further addressed as it is outside the technical boundaries of this project.

The method to evaluate the perceived trust was described as if all three scenario questions
were answered with only positive answers, the application was deemed trusted. Using this
method of evaluation the application cannot be perceived as trusted. However there is a great
flaw with this way of evaluation, as trust is clearly subjective, for example in the definition
by Kim et al \[42\]: "a consumer’s subjective belief that the selling party or entity will fulfill
its transactional obligations as the consumer understands them". There is a high probability
that at least one user test participant will not answer yes to all questions, especially when
the number of test participants increase. This makes it hard to conclude if the application is
perceived as completely trusted, but we can at least see that there are ways to increase the
users’ perceived trust.

5.2 Method

In every user test both test groups, arrangers and regular users, contained at least five par-
ticipants. This is sufficient as long as they are representative enough \[49\], \[50\]. In the tests
conducted in this study, the test users could be considered representative with the motiva-
tion that all users trying out the event arranger view were current or former event arrangers,
and the regular user view was tested exclusively by current students at Linköping Univer-
sity. To get even more representative test groups, no participants identified as regular users
with the intention that never attend an event should be included in the test group as their com-
ments and ideas might not be relevant. Since this information about the test subjects was not
documented in our user tests, it is possible that people from this segment participated and
therefore made our test groups less representative and lowered the number of usability find-
ings. With larger and well-defined test groups representing the target population, relevant
usability findings would probably increase. Also, the probability of getting similar results
when using CTA, RP, and measuring lostness would increase, making the reliability of the
methods higher.

When going through the results from the CTA-procedure and the Retrospective Probing
from each test, no specific strategy on what features to implement was used. Our goal was
to satisfy the target population and features was implemented based on what was popular
opinions by the users during the tests, and what we believed was needed. Therefore, this
procedure might not be considered neither replicable nor reliable. However, we believed
this was the best way to implement features in order to make the application usable and
trustworthy in the eyes of our users.

During the scenario questions in the first test, many of the test subjects claimed to have
experienced the application as credible even though many of the features stated in the Stan-
ford Guidelines for Web Credibility \[43\] were not implemented in our application. With this
in mind, the answers from the scenario questions in sprint 1 were not initially expected to
be as positive towards the credibility of the application as they were. Four out of six test
subjects thought that products would be sold by the application for a reasonable price and
with a fair delivery time even though no information about neither delivery time nor price
could be found on the application. The purpose of the question scenario was to let the test
subjects pretend that the application was live and running in its current state and answer
credibility related questions following these circumstances. It is possible that some test sub-
jects did not imagine the scenario as we wanted them to and that the validity, therefore, could be questioned. By giving more clear instructions to make sure that the test subjects would understand the purpose of the scenario, it could potentially increase the validity of the method. The replicability of the method is considered to be high because it is documented in the appendices and the method chapter how the Retrospective Probing was done and what questions were formulated.

We used two methods when evaluating readability. The LIX test was used to measure readability on texts in Swedish, and a contrast checker test for text and its background was used to make sure that text was distinguishable, to an appropriate extent, from the background. Since focus was on making the application usable regarding readability, texts on the application were made sure to have a LIX-score from 0 to 30, ensuring it was easy to understand. However, this approach could lack some validity. With the target group we had, the correlation between LIX-score and the users’ perceived usability could be investigated further in order to find a LIX-score which maximizes the perceived usability. Since our target group are students, texts with more advanced language might be preferable. The reliability and replicability of this method is considered to be high because how the test was performed is described well in the method chapter and the same results will be obtained every time the test is done. The contrast checker test is replicable and reliable in the same manner as the LIX-test. It is obvious that some contrast is needed in order to distinguish what is written on the application, but with our target population and the fact that the web application is supposed to be an online store, some validity related issues with this method exists. This method makes sure that the contrast ratio is adequate according to guidelines stated in the Web Content Accessibility Guidelines [39] in order to increase the perceived usability. It is possible that our target group could prefer color combinations between foreground and background with a contrast ratio not allowed by the test, making our choice of design less usable in the eyes of the users. In commercial applications like ours, a colorful design can be perceived as pleasurable and stimulating [38]. However, the contrast test can with certainty ensure readability, making it usable to some extent.

In our case the lostness formula's validity is questionable when compared with the comments from the users during CTA and RP procedures. In some cases, during our user tests, short tasks could be completed by the users with ease and with no comments on any unclear navigational structure or misleading links. The formula, on the other hand, would indicate that the users were close to be, or even were considered lost. This was especially true for some tasks in test 3. Due to the nature of these tasks, with a short optimal path to the goal and with fewer unique nodes than optimal ones, a high lostness value was given by the formula. This misleading indication also occurred when test subjects did not have in mind to finish the tasks with as few node visits as possible. In some cases, test subjects showed signs of curiosity in wanting to explore the application and would therefore get high lostness values since many nodes were visited, but gave no comments about ever feeling lost. Higher validity and reliability could be achieved by telling the test subjects to prioritize finishing the tasks and that they would be given the opportunity afterwards to explore the application if wanted. Reminding the test subjects during the CTA procedure to just focus on the task however, could potentially affect them too much in their decision making and therefore we had in mind to interfere as little as possible during the tests.

The analysis of the market was done with two surveys, one for regular users and one for arrangers. The primary purpose of the surveys was to examine what potential users would think of the application we planned to create and if the need for it existed. Secondarily, we wanted to know how the demand on tickets would be affected by such an application. The validity is believed to be high since there is little room for misinterpreting the questions. However, maybe an option to choose “I do not know” or “No opinion” would increase the validity by ensuring that people answering questions they had no opinions about, would be able to do it more honestly. As for the replicability, it is considered to be high since the surveys can be found in Appendix A and B and how they were created and distributed is documented.
5.3. The Work in a Wider Context

in the method chapter. The survey for regular users were answered by individuals from many of the university’s programmes, and many of the event committees were represented by the arrangers answering the second survey. The reliability of the market surveys is assumed to be high because of the representativeness of the participants who answered the surveys [10].

5.2.1 Source Criticism

In the source selection process, focus was firmly placed on finding and using academic, peer reviewed sources in order to be as credible as possible. Most of the sources are academic papers, but a few complementary books covering widely accepted methods regarding readability [30], [32], [35] are also included to broaden the knowledge base on the matter. The quality of the sources combined with the sheer amount of sources used in the theory chapter have brought confidence in the theoretical foundation for the study, as well as the subsequently derived methods. Some sources used in this study can be considered to be old, especially [31], [33]–[35]. However, these sources describe well established formulas used for readability evaluation and definitions. Therefore, we believe that their content is relevant and can be used. Other sources used, written around 20 years ago, might also seem old because technology has improved and usage of web applications have changed. However, our sources have been selected with caution and we believe that they are sufficiently relevant.

5.3 The Work in a Wider Context

The biggest issue when promoting the application is and always has been about how to replace the relatively fair contemporary system - physical queuing. With a physical queue you could always ensure a ticket by standing in a queue for a longer time than others were willing to. In the web application’s current form at the end of the project, the only way to get a ticket when the demand exceeds the supply is to rely on speed at the release and a bit of luck. This may give an unfair advantage to those with better computers and Internet connection, preventing those with weaker equipment from being able to attend popular events. Even with these concessions, the pre-study (Appendix A) conducted at the start of the project showed that a slight majority of students (53.8 % of asked students) would prefer an online system even if it was based on luck.

What also must be considered is that the contemporary system also has its flaws. Excessive queuing may impact the academic performance of the students participating and can essentially prevent other students with important classes or other commitments from being able to attend popular events. This question boils down to deciding what is more important, the social benefits in convenience and simplicity of using a web application, or the ability to ensure entry by spending a vast amount of time standing in line.

What does work in favor of the web application however, is the potential to make more students feel included in the student life at Linköping University. Students living out of town have a harder time participating in activities in Linköping. If you add the requirement of queuing at uncomfortable hours just to get a ticket, then it is easy to understand why they would often just choose not to participate.

A consideration that has to be made is to make the application usable for international and English-speaking students. In the application’s current state, there is no option to change the content to English, which would exclude a lot of students. Before a serious launch, this feature would have to be implemented since the vision for the application is to be unanimously used and accessible for all. However, for this case study it was still possible to answer the research questions without the implementation of that function. We believe that if the translation is done properly, the results would be very similar for an English version.

One must also take the event arrangers into consideration as they are the ones who must be willing to use the web application. On one hand the web application would save them
time. The current system is a time consuming process where the event arrangers spend several hours preparing for the release of tickets, supervising the queue and selling tickets. The web application removes these steps of the process altogether, saving them hours since the only step in the process of creating an event and selling the tickets, using the web application, is adding the event to the application. On the other hand, the use of the web application could make tickets less attractive since students no longer would have to queue. This could result in event planners losing help provided by students during events since help is usually offered as an exchange for pre-purchase of tickets. Even though this could happen, the pre-study (Appendix B) conducted at the start of the project showed that a majority of the event arrangers (75% of asked event arrangers) would prefer an online based system which supports the promotion of the application.
This chapter compiles and reports on the conclusions drawn from this study. The received answers and results of the Aim and Research Questions are presented, followed by the perceived Consequences for Target Audience. After this the Generalizability of the Study is highlighted followed by a concluding section with Recommendations for Future Studies.

6.1 Aim and Research Questions

The aim of this study has been to create a web application to simplify the selling and buying of tickets at Linköping University, and in doing so answering the posed question:

How can a web application that sells student event tickets be constructed so that it is usable regarding navigability and readability, as well as being trusted by its users?

Steps to make the application navigable were taken in forms of using breadcrumbs to aid in orientation, avoiding scrolling by making all the content of the page visible on the screen and using straightforward navigational paths connected by standardized, self-explanatory buttons. Making the application trusted by students is a twofold challenge. On one hand, the visitors' trust relies on the application being functionally correct, and having a transparent structure where it is clear who stands behind the application. On the other hand, trust that using the application to buy tickets will result in real and usable tickets needs to come from trust in the arrangers. Therefore it needs to be clear that the application is merely a tool for the arrangers to sell tickets in a convenient and effective way. When it comes to readability, creating favorable conditions is within the realm of developmental decisions - easy to use tools for control of text readability, contrast checking, and appropriate fonts are readily available. However, in an application where content will be almost exclusively created by its users there is no real way to ensure readability of text.

This study shows that an application tailored to the needs and wants of a target audience can be achieved through the evaluation of user feedback during the developing process. By continually testing the application in a realistic environment and monitoring user interaction, a usable and visually pleasing application with a sound navigational structure can be created.
6.2 Consequences for Target Audience

Throughout the development process of the application participants in the user tests were overall positive to the prospect of the application becoming a reality. However there are still functions in need of implementation before the application could be used in a real life setting - including but not limited to student union discounts and stability concerns. On the other hand this study has provided a framework for constructing a usable application for selling event tickets. This framework can be used as a stepping stone either by event arrangers or other stakeholders if modernization of the current queue system at Linköping University would be in question, or in other areas with similar target audiences where such a sales system would be of interest.

6.3 Generalizability of the Study

This study has been made by students at Linköping University and the web application has been tested by students at Linköping University. The result is probably representative for all of Linköping University and other Swedish universities. Even though the party and event culture is not the same at different universities, it is fairly similar. However, the result would presumably not be representative for universities in other countries, non-students or older generations. These demographic segments might have different preferences regarding a corresponding web application, and would perceive online trust and handle computers differently.

6.4 Recommendations for Future Studies

If the development of the web application would continue, an English version would be needed to include non-Swedish speaking students. In that case, readability of the texts on the web application would need to be measured with tests like the Flesch Reading Ease and the Flesch-Kincaid grade level [50] instead, as the LIX test can only be used on texts in Swedish. Another high prioritized feature to implement would be a validator for student union membership. This was shown to be a desired feature by participants in the user tests, since it is needed in order to give discounts to costumers based on their affiliated union.

As stated in the chapter discussing the methods we used, modifications can be done to improve them. Representative test groups are important for the usability findings [50] and by making sure the test group with regular users would not include students with no intention to attend events, they would probably be more representative. Another modification to be done is motivating participants to do the tasks as efficient as possible in order to make navigability measurements more precise. With clear instructions to the participants before the tests to have this in mind, it is believable that this could be achieved. Furthermore clear instructions before the scenario questions in the Retrospective Probing procedure clarifying that the participants should answer the questions with the scenario conditions in mind, may be worth considering. These modifications are believed to improve the credibility of the results and are recommended to consider for future studies.
References


References


References


Appendix A
210 svar

Kön: (210 svar)

Program (ex. I, D, M): (210 svar)

Älder: (210 svar)
Hur ofta går du på kravall? (210 svar)

- 0 gånger per termin: 39,5%
- 1-2 gånger per termin: 27,6%
- 3-5 gånger per termin: 20%
- 5-10 gånger per termin: 9,5%
- 10+ gånger per termin: 5,5%

Har du någon gång köat för kravallbiljett? (210 svar)

- Ja: 74,3%
- Nej: 25,7%

Har du någon gång upplevt att kötiden var för lång? (156 svar)

- Ja: 95,5%
- Nej: 4,5%
Har du någon gång avstått från att köpa biljett för att slippa köa?  
(210 svar)  
Ja 89%  
Nej 11%  

Skulle du föredra att ha en e-biljett istället för en fysisk biljett?  
(210 svar)  
Ja 84,3%  
Nej 15,7%  

Skulle du föredra att köpa biljetten online framför att köpa den fysiskt?  
(210 svar)  
Ja 91,4%  
Nej 8,6%
Idag kan du försäkra dig en kravallbiljett genom att köa tillräckligt lång tid. Skulle du kunna tänka dig att avstå den möjligheten, om istället biljetterna beviljas slumpvis bland alla intresserade? (vid högt tryck på biljetterna är man ej garanterad biljett)

(210 svar)

Varför skulle du föredra dagens kösystem framför att köpa biljetter online?

(15 svar)

Om man verkligen vill gå så går det att lösa biljett genom att köa länge. Skönt med garantin ibland

Simplare och smidigare men jag kan tycka att om man är beredd att köa några timmar mer än någon annan som inte kan tänka sig göra det borde man ändå få biljett snarare än att de slumpas ut

Dåliga erfarenheter av att köpa online, lätt att det uppstår datorkomplikationer eller att hemsidan kraschar vid högt tryck, svårare att begränsa så att inte en person köper massa gånger och säljer vidare till ockerpriser. Med dagens kösystem har man direkttolkning med festeristerna som arrangerar vilket gör det enklare att lösa eventuella problem/frågor. Det är även socialt och taggar till själva eventet.

Det är ju tradition här på Liu :)

Pga säkerheten i att få en fysisk biljett och en muntlig bekräftelse

Vi har för tillfället för få tillgängliga biljetter till kårallen för att ett onlinesläpp skulle fungera smidigt vid högt tryck

Känns som det är mindre risk att man inte får biljett

Det finns alltid personer som vet hur man kan "tränga" sig i en onlinekö, tror inte ett tillräckligt bra system kommer kunna utvecklas för detta

Det ger en känsla av trygghet att de som orkar jobba för sina biljetter är de som faktiskt får

Det ger en känsla av trygghet att de som orkar jobba för sina biljetter är de som faktiskt får dem. Att köra saker elektroniskt skulle känna mycket mera osäkert. Dagens kösystem är väljädligt förutsägbar och pålitligt.

De som verkligen vill gå på kravall och är beredda att kämpa för det förtjänar en biljett mer än en som bara råkade ha tur med internetuppkopplingen men kanske egentligen inte är så noga med att gå.

Kökultur

De som visar störst intresse och uppfattning (genom att köa) skall belönas för sin insats

De som verkligen vill gå får möjligheten för det

Känslan, och om man verkligen vill gå på kravallen pga av artisten måste man kunna säkra sin biljett.
Appendix B

24 svar

Vilket festeri är/har du varit med i? (24 svar)

![Bar chart showing the attendance of different events with percentages.]

Är du aktiv festerist? (24 svar)

![Pie chart showing 91.7% 'Ja' and 8.3% 'Nej'.]

Har du arrangerat en kravall ännu? (24 svar)

![Pie chart showing 95.8% 'Ja' and 4.2% 'Nej'.]
Vad tycker du om kösystemet för kravaller? Bra, dåligt? (24 svar)

Bra

Dåligt

Helt okej

Både och, är liten kul grej att köa, men de är för mycket hets kring det

Helt okej, tar dock en massa tid både för de som köar och säljer biljetterna som man skulle kunna lägga på andra uppgifter

Relativt bra

Helt okej, bra med utomhuskö istället för inomhuskö

Beror helt på från år till år. Kösystemet i sig finns det inga större problem med, snarare mentaliteten hos studenterna.

Köhetsen har varit mildare sen förra året, men är inte optimalt

For de fester som oftast säljer slut tycker jag det är ok med kösystemet eftersom de som helst vill ha biljett får då fysiskt köa för att få denna.


Mindre bra

Kan förbättras


Dåligt men bättre än tidigare år

Dåligt men bättre än tidigare år ok

Dåligt
Det är bra på så vis att man vet vart man ska köa o så, men det här med köhets och att stå en hel natt ute är jag inget fan av direkt

Har sina för- och nackdelar

Både och, den som är taggad anstränger ju sig mer vilket visas i en konkret kö snarare än slumpen vid ex eleetronikst biljettstående. Elektronotiskt vore dock smidigare för att minska köhets, spelar inte så stor roll vilken dag/tid på dygnet släppet är + festersisterna slipper flera timmars arbete (både på plats för släppet, förberedelser och själv fix med biljetten)

Lite stressande och oförusågbart

Skulle du föredra ett försäljningssystem online? (24 svar)

Vilka funktioner skulle ett sådant system behöva fylla? (17 svar)

Slippa frysa utomhus i orimliga köer

Att det inte kraschar, alla får biljetter i rätt ordning (Alltså att den första personen får biljetter först osv) och att det ska vara lätt förståligt

Att man ser sin köplats, hur många biljetter det är kvar och att det verkligen fungerar.

Kunna hämta karrabatter från de olika sektionerna, ta in kortbetalningar, ge en fullständig lista på vilka de är som har handlat

Användarvänligt, pålitligt, säkert.

Flexibelt med hur många biljetter man släpper eftersom man ofta löser sista jobbara veckan innan biljettsläpp. Då är utbytet ofta förköp.

Någon slags förköpsfunktion? Annars kan det gå att lösa med att förköp är tryckta biljetter och biljettsläpp är e-biljetter

Det skulle vara smidigt om det är kompatibelt med kobra-systemet som kan kolla av om de är

Det skulle vara smidigt om det är kompatibelt med kobra-systemet som kan kolla av om de är kårmedlemmar. (Skulle minska mycket arbete för festeriet också)
En nackdel är väl om man släpper ca 700 biljetter till en kväll kan det vara "turen" för de som uppdaterar hemsidan rätt tid som får biljetter. Man kanske måste ha en strängare gräns på hur många man får köpa per kväll. Typ halvera till 2 biljetter/kväll

Ser också en risk att folk börjar förfalska biljetter. Säljer kopior.

Slippa kö, skapa mer ovärre problem mestadels för arrangörerna

Enkel och smidig betalning, rättvist kösystem


Kanske samma som för många festivaller. Försäljningen öppnar vid ett exakt klockslag genom att en länk aktiveras. Systemet köar upp alla som surfar in på sidan och säljer en biljett i taget tills alla är slut. 1-2 biljetter per person, liuid vid köp

Ser det tyvärr inte som ett bättre system då det finns många tekniskt intelligenta människor på detta campus som skulle kunna hacka dessa sidor.

Säker betalning. Se till att endast studenter på LiU kan köpa biljetterna, samt att man kan använda kårrabatter vid köpet. Smidigt och enkelt. Lätt att förstå.

Skulle kunna likna tickets.se. Så alla fester samlas under en hemsida och att man kan gå in och söka efter en fest man vill gå på och få lite info samt veta dag biljetterna släpps.

Kårrabatt, antal biljetter och att systemet inte kraschar när många är inne samtidigt

Läs ovan

Kunna registrera kårrabatter, Inte krascha vid högt tryck, Hålla ordning
Skulle du vara intresserad av vidare information kring ett försäljningssystem online?
(18 svar)

- Ja: 33,3%
- Nej: 22,2%
- Övriga: 44,4%

Skulle du vara intresserad av att testa en prototyp av ett sådant system och ge feedback till utvecklarna?
(18 svar)

- Ja: 55,6%
- Nej: 44,4%

Om du svarat ja på någon av frågorna ovan, skriv gärna ned ditt liu-id nedan så vi kan hålla dig uppdaterad!
(6 svar)

[redacted]
[redacted]
[redacted]
[redacted]
[redacted]
[redacted]
Appendix C
Formulär för inmatning av svar vid retrospective probing

*Obligatorisk

   - Festerist: Hoppa till fråga 9 efter den sista frågan i detta avsnitt.
   - Vanlig användare: Hoppa till fråga 6 efter den sista frågan i detta avsnitt.

2. Var det något som fungerade annorlunda från hur du trodde att det skulle fungera? *

3. Var du någon gång osäker på hur du skulle ta dig fram på sidan? *

4. På en skala från ett till fem: hur lätt var det att förstå på hemsidan? *

VANLIG ANVÄNDARE


FESTERI


10. Hade du känt dig trygg med att Linpings hantering av information kring kravaller samt det finansiella sker på ett säkert och korrekt sätt? (inte läcker statistik, hustle) Varför/Varför inte?

11. Hade du känt dig trygg med att Linping hade hjälpit er att lösa eventuellt uppkomna problem med era biljetter eller accessor? Varför/Varför inte?

Fortsätt till frågan 12.
SLUT


13. Finns det någon funktion till den här applikationen du skulle önska fanns i framtiden

14. Finns det någonting du vill tillägga angående testet?
MARKETING PLAN
Innehåll
Introduction .................................................................................................................. 2
NABC-analysis ............................................................................................................ 2
Need ............................................................................................................................. 2
Approach ..................................................................................................................... 2
Benefit .......................................................................................................................... 2
Competition .................................................................................................................. 2
NABC Conclusion ......................................................................................................... 3
Business Intelligence ................................................................................................... 3
PESTLE-analysis ......................................................................................................... 3
Political ......................................................................................................................... 3
Economical ..................................................................................................................... 3
Social ............................................................................................................................. 3
Technological ............................................................................................................... 3
Legal ............................................................................................................................... 3
Environmental ............................................................................................................. 3
Porters ........................................................................................................................... 3
Threat of new entrants .................................................................................................. 3
Threat of substitutes ..................................................................................................... 4
Bargaining power of customers ................................................................................... 4
Bargaining power of suppliers ..................................................................................... 4
Industry rivalry ............................................................................................................. 4
SWOT ............................................................................................................................ 5
Marketing goal .............................................................................................................. 5
STP ................................................................................................................................. 5
Segment ......................................................................................................................... 5
Target ............................................................................................................................. 6
Positioning ..................................................................................................................... 6
Marketing mix ............................................................................................................... 7
Product .......................................................................................................................... 7
Price ............................................................................................................................... 7
Place ............................................................................................................................... 7
Promotion ...................................................................................................................... 7
Introduction
The product that we want to market is e-tickets for student parties at Linköping University, and the target market is students at Linköping University. There are up to three student parties per week, where you need a ticket to enter, and generally up to 1500 tickets à 120kr available per event. Tickets are usually sold out within a few hours. Today, ticket sales take place at the university in form of a physical exchange of cash and paper tickets between students and party arrangers and no alternative to this way of trade is available. We want to sell e-tickets through a web application. This would make it easier for students to buy tickets and for party committees to sell tickets.

We conducted an NABC-analysis to find out more about our target market, their needs, possible benefits and our competition. Together with this analysis a survey for students and arrangers was conducted, and the results are used throughout this marketing plan.

NABC-analysis
Need
Our studies show that about 72% of the polled party arrangers at Linköping University would prefer an online website for their event tickets to be sold at, 92% of the questioned students would prefer to buy these kind of tickets online, and 88% have at some time abstained from purchasing a ticket because of the strenuous queueing system. These numbers clearly show that there are some problems with the current way of purchasing tickets for student parties, since a majority of both students and party arrangers are not satisfied. Today’s system requires students and party arrangers to be present at an appointed time of sale, often at inconvenient times of the day. Another problem is that tickets can be bought and then sold to other students for exorbitant prices.

Approach
We want to replace the current physical way of selling tickets with online sales. We also want to sell products that are associated with the different events like patches. We would solve the problem regarding the pickup process of the tickets by using electronic tickets that can be printed or read on any smartphone. Our web application is going to be a place for information about past and upcoming student parties, where tickets are easily purchased. The website will also take care of the resale market of tickets to the extent possible and at the same time decrease the number of tickets sold to exorbitant prices.

Benefit
Online ticket sales would mean less work for both party arrangers and students for the same utility. For party arrangers a website would mean less work regarding the actual sale and more information about who and how many that are interested to buy tickets for the event. For students, an online ticket shop would imply less time in queues, less risk for buying tickets to exorbitant prices, and more information when buying tickets. This makes the total utility higher for both students and party arrangers.

Competition
The competition is the current way of selling tickets. Resistance to change is common and our system must be convincing towards party arrangers and students. Both groups must believe our web application will change things for the better.
NABC Conclusion
In essence we see a high demand for our product combined with little to none competition. We believe that if we manage to market it according to this plan, our product will thrive at Linköping University.

Business Intelligence
It is important to understand the market we aim to operate in, both the advantages and disadvantages. By reviewing the macro and micro factors we gain profitable information.

PESTLE-analysis
Political
The political situation in Sweden is stable. As Linping is a non-profit organization and would serve as a middle hand for party arrangers and students, there are no tax laws or similar that are of interest. The party arrangers handle that part of the economy.

Sweden has the privilege of easy accessible student loans and free higher education. With this in mind it could be argued that the average Swedish student has the economic ability to buy our tickets.

Economical
Sweden has a stable and growing economy, other than this there are no significant factors.

Social
A great part of the social life at Swedish universities consist of parties and events. Almost every week during the semester at Linköping University parties that can facilitate between 1000-5000 students are arranged and sold out.

In our survey, it was concluded that 94 % of the asked students have attended a student party (Appendix A).

Technological
As our product is to be sold as an e-ticket through a web application, the technological scene in Sweden is of importance. According to SOI, 81 % of the Swedish population have access to a smartphone and 93 % have access to internet (“Svenskarna och internet 2016”, SOI2016.se). All students at Linköping University have free access to internet and computers.

Legal
Consumer law in Sweden usually give the consumer 14 days of guaranteed withdrawal, but this is not valid when buying tickets for cultural or social activities online (“Ångerrätt vid distansköp av konsertbiljetter”, Lawline.se).

Environmental
Environmental sustainability is an important factor for companies as well as regular citizens in Sweden. Sweden is considered one of the most sustainable countries in the world (“Sweden Most Sustainable Country in the World”, Enviromentalleader.com).

Porters
Threat of new entrants
Our market does not yield a high return, it is characterized by non-profit work and done for fun. Thus the threat of new entrants can be considered low, and if there would be a new entrant it is highly likely we would cooperate with them as our end goal is a simpler and better student social life.
Threat of substitutes
Our product is highly differentiated from the tickets sold in physical form today. Nevertheless, it is likely some arrangers will keep selling tickets in physical form because of the natural resistance for change. However we have through our surveys concluded that our product is a truly wanted improvement of the current system (Appendix A and B).

Bargaining power of customers
The buyer to firm concentration can be considered high, as there are a very limited number of ways to buy a party ticket and a large number of buyers. A part of the student culture at LiU is that the price is standardized for almost all parties, 100 to 130 SEK is considered normal. This makes the bargaining power of the customers low, but as the goal is to enrich the student life the customer’s complaints and feedback will always be considered.

Bargaining power of suppliers
The suppliers are in our case the party arrangers. We want all party arrangers at LiU to sell their tickets through Linping, but being reasonable it will probably take some time before this goal is reached. The only other alternative the arrangers have is to sell the tickets physically by themselves. The bargaining power of suppliers can be considered high as they have a functioning alternative in place. They may put pressure on our product to satisfy all their needs and wants.

Industry rivalry
There are no active competitors other than the existing system. As long as the users of the existing system are convinced of our products superiority there should be no competitive problems.
SWOT

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of the student social life at LiU</td>
<td>Little to no funds</td>
</tr>
<tr>
<td>Personal connections with arrangers and</td>
<td>Relies on volunteering</td>
</tr>
<tr>
<td>students</td>
<td></td>
</tr>
<tr>
<td>Product is environmentally friendly</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opporunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>No direct competitors other than the</td>
<td>A resistance to change from party</td>
</tr>
<tr>
<td>existing system</td>
<td>arrangers, value of tradition</td>
</tr>
<tr>
<td>Support from students</td>
<td></td>
</tr>
</tbody>
</table>

Most factors in the SWOT surround the student culture at LiU. In some ways the culture works with us, but in other areas it will challenge us. Our knowledge of the student social life will greatly benefit us. The party arrangers can be picky and demanding when a change is to be introduced, and therefore we will make sure to receive and contemplate the feedback and input from them.

Marketing goal

The goal of this marketing plan is to reach out to students and party arrangers and in turn make Linping the sole used ticket sales system at Linköping University. In addition we want students and arrangers to agree that this increases the quality of the student social life, by simplifying the ticket system.

STP

In order to achieve an attractive offer for our customers some key factors need to be addressed. Who are the customers we want to reach out to? And, how do we do it? By making a segmentation, targeting and positioning plan these two important questions will be answered and therefore create value for our customers.

Segment

As the service that is trying to be implemented is meant for students the segmentation aims to divide these students into further smaller distinctive groups. Within these groups traits are meant to be shared whilst having clear differences between other groups. The groups that can be identified are as follows:

1. Students in Linköping: Students here have access to four different student run party venues where two of these alternatives (Kårallen and Flamman) usually have very high demand. It can be assumed that on a regular basis they sell all their tickets leaving a number of students left without a ticket. Regarding events at Kårallen tickets are sold earlier in the week, in early mornings. Students are thereby forced to stand in line during nighttime where line last up to 12+ hours. Students are not constrained to office hours and can therefore attend these queues.
2. Students in Norrköping: Students here only have access to one party venue run by students. Tickets are bought earlier in the week where the demand is relatively high. Due to having flexible working hours they have the possibility to both buy tickets and attend parties all days of the week.

3. Employees at Linköping University (both cities): This segment has both a higher age and income than the students attending the university. They may be less prone to attend the same venues as students as they do not have the same economic dependency regarding cheap prices and also not experiencing the same strong community. Employees are more constrained to regular office hours and may therefore experience more difficulties attending a queue midweek.

4. Public: The younger part of the public probably has a quite large enthusiasm as to attending student driven venues. They may have a better economical situation than students which lets them attend other more expensive venues as well. Even though there might be an interest from this group they pose one problem. Student arranged parties apply the rule that non-students need to be accompanied by one student.

Target
The segmentation clearly shows that students are the most suitable group to focus on. Employees at Linköping University as well as the general public are both potential customer groups but do not show the same potential as students. This is because they are not as involved in the community surrounding these venues. Also they do not have the same accessibility to the sale of tickets due to regulations of having to attend with at least one other student. This leaves the two student groups in Linköping and Norrköping that share many personal traits with each other. The thing that separates these two groups is the demand on tickets. Students in Linköping are in a much greater extent exposed to long and stressful experiences regarding the buying of a ticket. This indicates that they may be more open to changing the current system of ticket sales making them the most interesting segment to target.

Positioning
Four factors should be taken into account for effective positioning, clarity, credibility, consistency and competitiveness.

Clarity - The message needs to be clear to students at Linköping University. The sale of tickets without the hassle of having to stand in line for long and inconvenient hours. The customer experience will be faster and more convenient with an online based sale of party tickets.

Credibility - In order to obtain the trust of the students an intimate and open relationship with the arrangers have to be kept intact. By showing students that the arrangers support the new system the application should include seals of approvals from arrangers and other organisations at Linköping University.

Consistency - The message of course always needs to be consistent. In other words the application must always live up to being the most convenient way of obtaining a ticket.

Competitiveness - Once trust from students and arrangers is secured the service will be highly competitive. The price will be the same as the preceding sale system without the tiring process of standing in line. With the queue being the main concern for students buying tickets in today’s current
situation a new web based alternative will be unchallenged by competitors provided that it is backed by arrangers at Linköping University.

Marketing mix

Product
Our E-tickets should have a simple neat design, without ads and other disturbances. If a customer purchases a ticket he will be guaranteed an entry at the party as long as he does not sell the ticket to someone else, since a ticket can only be used once. Tickets will have a QR-code which will be read at the entrance of a party. We will handle returns, but only if the event is sold out. The product is already established on the target market and it is in the maturity stage of its lifecycle and will stay there, so there will be no need for us to create awareness about the product or worry about it coming to the decline state of the lifecycle.

Price
The price of our products will be the same as now. Since party committees are non-profit organizations the price cannot be affected. Discounts will be available if the customer is a member of a student union. Since tickets will be purchased with less effort, through a website the customer’s perceived value will be higher.

Place
Customers will get and buy tickets in form of e-tickets. This makes distribution and handling inventory very easy.

Promotion
The best kind of promotion for us will be if the party arrangers do all their promotion, such as putting up posters, having lunch competitions, greeting students arriving to school and refer to our web application, instead of the regular physical queue. Another good way of reaching our customers will be through social media, like Facebook, Instagram and Twitter. This kind of promotion should be used before every student party to ensure that every ticket gets sold. The key message we want to send to our target market is that buying tickets through our website will be very fast and simple. Regarding tickets to different events, the party closest in time will be advertised on the front page of the website.

Throughout our development and after the website has been launched we will look back at this marketing plan to make sure we follow our marketing principles, which we have found critical for the success of our website and its products.
Appendix E

Test 1
Six users participated in this test.

Retrospective probing

1. Did anything in the web application work differently from how you expected it to work?
   - Three users answered "no".
   - One user found the "buy now" feature for events unintuitive. The user was expecting, and would have preferred, an intermediate "shopping cart" step.
   - One user thought information about a party was a good thing, but information about patches was unnecessary. The subject suggested to have only a few words of information for the patch just below the image.
   - One user said they did not realize information about patches and events was accessible by clicking the images until the test was over.
   - The password generation upon registration was perceived as unexpected by one user. The subject did not expect it to disappear when pressing a button. Furthermore, the subject would like it to be connected to Lisam or something similar (Lisam is an IT-service for students at Linköping University, where students can find information about courses and projects).
   - One user thought some buttons were unnecessary.
   - One user thought it was easy to miss that an account had actually been created.
   - Linking to the login page and presenting account information in line on the page was perceived as confusing for one user. The user would have preferred to have the account information clearly presented on a separate page.
   - One user found it unclear why student id was prompted. Voiced a wish to have student id as username instead of a separate username.

2. Were you ever unsure about how to navigate the web application?
   - Four users answered "no".
   - One user thought it was easy to miss that an account had actually been created.

3. On a scale from one to five, how easy was it to understand the web application?

![Bar Chart]

Figure 1 The number of participants who chose each alternative is shown here. 1 is not easy and 5 is very easy.
4. Do you believe that Linping would provide you with a valid ticket/accessory at a reasonable time and price? Why/Why not?

- Two users believed the price would be the same as today, with no further thoughts.
- Two users believed the price would be the same as today, but with a small service fee.
- Two users believed the delivery time would be instant.
- Two users believed the delivery time would be fair.
- One user thought the price would depend on the ownership of the web application.
- One user did not believe price or delivery time would be reasonable, since there was no information about either price or delivery. If party arrangers supported the website, they would believe price and delivery time would be reasonable.
- One user believed there would be problems with delivery, because the web application was in an early part of the development.

5. Do you believe that Linping would keep your personal information safe minimizing the risk of theft of money or private information? Why/Why not?

- Two users trusted the site’s safety as they trust student driven projects in general.
- Two users trusted the safety because they had not submitted any sensitive information.
- One user did not trust the safety of the site, because the site seemed to be in an early development stage.
- One user stated that it depends a lot on how the payment process will be handled.

6. Do you believe that Linping would help you solve your problem if for example a problem would arise with your ticket or accessory? Why/Why not?

- Two users would trust Linping if it was an established web application.
- One user would not trust Linping if there would be technical problems that concerned all ticket holders.
- One user would trust Linping if there was a way to contact the group responsible for the web application.
- One user would trust Linping because it will be made by and for students.
- One user would not trust Linping, because they did not believe Linping would take responsibility if problems would occur.

7. How did you perceive the web application in its entirety?

- Three users thought the web application was user-friendly, but the graphic design should be improved.
- One user thought the web application was a good web application that fulfills its purpose.
- One user thought the web application had great potential, but there were a lot of functions missing. No shopping cart, no price for tickets, no tooltips, no calendar, and no information on the "about" page. The subject liked the layout for buttons and did not think extra information about patches was necessary. The user wanted a web application like this to be up and running.
- One user thought the web application was easy to use once you had a user registered and were logged in.

8. Can you think of any functionality to this web application that you would wish to see in a future version?

- Four test users would like to have a "My page", with different functions. Possibility to change password, order history, billing and shipping address were things they would like the "My page" to contain.
- Two users would like to have more information about delivery and pick up of products.
- One user would like to have a way of contact or help page.
- One user would like to have a working calendar and a list of the events closest in time.
- One user would like to be able to see the amount of tickets sold for an event.
- One user would like to be able to resell tickets through the web application.
- One user would like to have the five events closest in time on the homepage, instead of only the closest. The user wanted to be able to scroll on the homepage.
- One user would like to have a page with general terms and agreements.
• One user would like to be able to get more information about events. (The user did not know that by pressing the image of an event you could get this kind of information.)

9. Is there anything you would like to add about the test?
• Three participants answered "no".
• Two participants thought the test worked fine.
• One participant thought the test worked fine and that the goal of playing the tower of Hanoi was well explained.

Concurrent think aloud
• Four users did not understand why both student id and username were required for registration.
• Three users failed to log in on their first try.
• Two users did not know if they had to log in or not.
• Two users did not understand that product images were clickable for more information.
• Two users had problems with the password disappearing when login page was reloaded.
• Two users were confused when they were not able to buy more than one product at a time.
• Two users did not see the text with username and password right away.
• One user did not want the "Register new user" button to be active once logged in.
• One user did not understand which ticket he or she just bought after finished purchase.
• One user wanted a pop up or something similar saying "Do you really want to buy his ticket?" before purchase.

Lostness

<table>
<thead>
<tr>
<th>User</th>
<th>Lostness (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.1526</td>
</tr>
<tr>
<td>2</td>
<td>0.3939</td>
</tr>
<tr>
<td>3</td>
<td>0.1111</td>
</tr>
<tr>
<td>4</td>
<td>0.1526</td>
</tr>
<tr>
<td>5</td>
<td>0.2334</td>
</tr>
<tr>
<td>6</td>
<td>0.3049</td>
</tr>
<tr>
<td>Mean</td>
<td>0.2248</td>
</tr>
<tr>
<td>Median</td>
<td>0.193</td>
</tr>
</tbody>
</table>

Table 1 Here is each user’s lostness value shown, as well as the mean and median values.
Appendix F

Test 2

Eleven users participated in this test, out of which six were party arrangers and five were regular users.

Retrospective probing

1. Did anything in the web application work differently from how you expected it to work?
   - One arranger thought a preview of the to-be created event would appear.
   - Two arrangers at first thought the site was solely for party arrangers and not for selling products.
   - One arranger did not think they would have a pre-made account to the application.
   - One arranger thought everything worked as expected.
   - One arranger expected the “Edit event” button to work but it did not.
   - One user thought the main page with the next event would show the associated patch.
   - One user was surprised when the payment method (Stripe) crashed during the test.
   - One user was surprised that they could not buy tickets to a future event, even though the event was in the calendar.
   - One user was surprised that the shopping cart did not update its icon representing the number of items in cart, when pressing back in the web browser.

2. Were you ever unsure about how to navigate the web application?
   - Five arrangers answered no.
   - One arranger was unsure how to navigate the site right after logging in.
   - One user did at first not know where to buy a patch.
   - Four users answered no.

3. On a scale from one to five, how easy was it to understand the web application?

![Figure 1](image_url)

*Figure 1 The number of Arrangers who chose each alternative is shown here. 1 is not easy and 5 is very easy.*
4. Do you believe that Linping would handle the selling of the party tickets/accessories in a reasonable way? Why/Why not? (Arranger)

- Three arrangers answered yes.
- Three arrangers implied no.
- One arranger thought the application would collapse.
- One arranger thought it would be hard to authenticate student ID so that one user only can buy the maximum number of tickets.
- One arranger thought that some sort of queue system was needed.
- One arranger was worried about when the money will reach the party committee.
- One arranger was worried about the security.

5. Do you believe that Linping would provide you with a valid ticket/accessory at a reasonable time and price? Why/Why not? (Regular user)

- Five users answered yes.

6. Do you believe that Linping’s handling of the information regarding parties and the financial parts is done in a secure and correct way? Why/Why not? (Arranger)

- Five arrangers answered yes.
- One arranger answered no.
- One arranger did not feel secure about Linping having access to their information.

7. Do you believe that Linping would keep your personal information safe, minimizing the risk of theft of money or private information? Why/Why not? (Regular user)

- Three users answered yes.
- One user was unsure, especially about how second hand tickets would be handled.
- One user answered no, not in its current state.

8. Do you believe that Linping would help you solve your problem if for example a problem would arise with your ticket or accessory? Why/Why not? (Arranger)

- Five arrangers answered yes.
- One arranger answered no, not in the web applications current state.
9. Do you believe that Linping would help you solve your problem if for example a problem would arise with your ticket or accessory? Why/Why not? (Regular user)

- One user answered no, as he was afraid the web application would be congested.
- One user answered that they trust the party committees, implying that they trust Linping by extension.
- Three users answered yes.

10. How did you perceive the web application in its entirety?

- Four arrangers thought it was clear and simple to use.
- One arranger thought the functionality was good. Wants bigger text and the ability to click images.
  Recommends to change "festeri" to something else, as not all arrangers identify as a "festeri" (note that this was only a problem in Swedish, "festeri" translates to party committee).
- One arranger thought the design could be improved, for example color confirmations in the shopping cart.
- One user thought it was easy to navigate and felt like a standard web page.
- One user thought the web application worked well.
- Two users thought the design looked good.
- One user did not trust the site as images sometimes did not appear.

11. Can you think of any functionality to this web application that you would wish to see in a future version?

- Two arrangers wanted a presentation of the arrangers at the event site.
- One arranger wanted a page with general rules.
- One arranger wanted to be able to add colors on the "My party committee" site.
- One arranger wanted the main buttons in the navbar to be bigger.
- One arranger wanted to be able to sell additional items beyond patches and tickets.
- One arranger wanted a function that asks the user if they want to buy a patch when a ticket is added to the shopping cart.
- One arranger wanted to be able to see a schedule for all the events for the specific party weekend.
- Two arrangers wanted to be able to see who else is part of their party committee.
- One arranger wanted to be able to add a release date when creating an event.
- One arranger wanted to be able to create events designated for specific people.
- One arranger thought the calendar should be the main page.
- One arranger wanted to have a search function for events and arrangers.
- One arranger wanted to add more information to the event, for example a Facebook feed.
- One arranger wanted a bigger textbox for the event information when creating an event.
- One arranger wanted patches to be available on the event page.
- One arranger wanted to be able to edit created events.
- One user wanted a function that secures a ticket if the website crashes during a purchase.
- One user wanted a function that reminds the user about the event release.
- One user wanted to be able to buy tickets at the event page of future events.
- One user wanted to be able to easily contact the party arrangers.
- One user wanted to be able to save products to favorites.
- One user wanted to be able to save products to the main page.

12. Is there anything you would like to add about the test?

- Five arrangers answered no.
- One arranger answered yes. They wanted clearer tasks.
- Four users answered no.
- One user thought the final questions about service were hard to answer.

**CTA results**

- One arranger was confused as to what the purpose of the site was. At the beginning they thought it was only to be used by arrangers.
• Three arrangers were confused by what information to input as an image link when creating an event.
• One arranger thought the login failed although it was successful.
• One arranger wanted more information about the patches, such as how they were delivered or where they could be picked up.
• One arranger argued that the QR-code ticket may make the queue longer.
• One arranger suggested more information on the contact page.
• One arranger would like to have a preview button for the created event.
• One arranger would like to have a publish function so that the event is not accessible until published.
• One arranger would like to have a delete button for events.
• One arranger was confused by the created event's page, partly because no image link was added. The placeholder link was confusing.
• One arranger would like the events ticket release date to be clearly shown.
• Two arrangers would like to see the event date at the event page.
• One arranger thought the "About" page made the application more trustworthy due to seeing whom was behind the application.
• One arranger appreciated the calendar view of events.
• One arranger was surprised he could not edit a created event.
• One arranger was surprised QR-codes were still used.
• One arranger did at first not find where to create an event.
• One arranger thought as the box for event information was small, the added information should be short.
• One arranger did not understand that they could go through with a purchase.
• One arranger thought it would be nice to be able to see the amount of sold tickets under "My party committee".
• One user did at first not see everything in the navbar.
• One arranger was surprised that the edit event button did not work.
• One arranger had some confusion about the event page and main page being identical.
• One user was confused about if current student credentials could be used to login or if an account had to be created.
• One user was unsure about having to log in to the student email to collect the password after creating an account.
• One user had problems with deciding which patch to buy, did not know if a patch related to the event had to be bought.
• One user had problems understanding that the main and event page were the same thing.
• Two users tried to login with current student credentials rather than creating a new account.
• One user was confused as to if a patch was included when purchasing a ticket, but the confusion was cleared up when the user saw the shopping cart.
• One user voiced appreciation for the calendar and about page.
• One user did not realize he automatically got redirected to the event page when logging on.
• One user did not understand that email was already chosen as the standard shipping method for tickets.
• One user was able to get back to the restricted "My page" after logging out and then reversing in the web browser.
• One user thought there would be a unique start page.
• One user had the page turned black when a patch image was pressed due to a bug.
• One user changed their password correctly, but an error message of "Wrong password" appeared.
• One user tried reversing in the web browser, this resulted in the shopping cart number displaying the wrong amount.
**Lostness**

<table>
<thead>
<tr>
<th>Arranger</th>
<th>Lostness (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.082</td>
</tr>
<tr>
<td>2</td>
<td>0.256</td>
</tr>
<tr>
<td>3</td>
<td>0.139</td>
</tr>
<tr>
<td>4</td>
<td>0.141</td>
</tr>
<tr>
<td>5</td>
<td>0.090</td>
</tr>
<tr>
<td>6</td>
<td>0.246</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>0.159</strong></td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td><strong>0.140</strong></td>
</tr>
</tbody>
</table>

Table 1 Here is each arranger’s lostness value shown, as well as the mean and median values.

**Lostness**

<table>
<thead>
<tr>
<th>User</th>
<th>Lostness (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.098</td>
</tr>
<tr>
<td>2</td>
<td>0.144</td>
</tr>
<tr>
<td>3</td>
<td>0.167</td>
</tr>
<tr>
<td>4</td>
<td>0.177</td>
</tr>
<tr>
<td>5</td>
<td>0.059</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>0.129</strong></td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td><strong>0.144</strong></td>
</tr>
</tbody>
</table>

Table 2 Here is each regular user’s lostness value shown, as well as the mean and median values.
Appendix G

Test 3

Eleven users participated in the test, out of which six were party arrangers and five were regular users.

Retrospective Probing

1. Did anything in the web application work differently from how you expected it to work?
   - One arranger said it would be possible to add events from the event page.
   - One arranger noted that it was not possible to edit the patch that was uploaded the same way as events.
   - One arranger said it was confusing that when creating an event the ticket release date is directly followed by where the event will be held which easily could be interpreted as the location for ticket release.
   - One user noted a difference in visual effects when a patch was chosen dependent on from which page it was added.
   - One user said that the web application was more visually pleasing and had more features than expected.
   - Four users said that they thought it would be possible to find information about all events on the event page, not just the next to occur.
   - One user expected to get a larger image of a patch when clicking the image instead of it being added to the shopping cart.

2. Were you ever unsure about how to navigate the web application?
   - One arranger said no.
   - Two arrangers said that they thought it would be possible to edit patches.
   - Two arrangers wanted to be able to view their patches from their event committee page.
   - One arranger said it was hard to initially find where to edit an event.
   - One arranger wanted to be able to view more than one event at a time on the event page.
   - Two users said no.
   - Three users said it was unclear that the calendar had to be used to find future events.

3. On a scale from one to five, how easy was it to understand the web application?

![Bar chart](image)

Figure 1: Here is the number of arrangers who chose each alternative shown. 1 is not easy and 5 is very easy.
4. Do you believe that Linping would handle the selling of party tickets/accessories in a reasonable way? Why/Why not? (Arranger)

- Five arrangers answered yes.
- Two arrangers expressed concerns about the pressure on the web applications during a ticket release.
- One arranger did not understand why the application also sold patches.
- One arranger wanted a receipt on what had been bought on the web application as well as in an email and more information about how the QR-system would work.
- One arranger was worried about the fairness regarding getting tickets if there is no system for queuing.

5. Do you believe that Linping would provide you with a valid ticket/accessory at a reasonable time and price? Why/why not? (Regular user)

- Four users answered yes, however two of whom were concerned that many users could pressure the servers enough to complicate the delivery of the goods.
- One user said that the founders of the web application might take a small percentage of the revenue.

6. Do you believe that Linping’s handling of the information regarding parties and the financial parts is done in a secure and correct way? Why/why not? (Arranger)

- Five arrangers found that the handling of personal information was done in a secure manner.
- Arrangers appreciated the fact that they themselves had a lot of control.
- Some arrangers proposed that an agreement between the site-holders and the arrangers would further ensure the feeling of security.
- One arranger suggested that HTTPS would make the application feel more secure. He also pointed out that the use of familiar payment methods such as Klarna or Payex would make him feel more secure.

7. Do you believe that Linping would keep your personal information safe? (Regular user)

- Three users believed that their information would be handled in a secure way. The other two users were not sure about the handling of their personal information.
- Two users that felt insecure regarding the handling of their information would feel more secure if HTTPS and Bank-ID were used on the application.
8. Do you believe that Linping would help you solve your problem if for example a problem would arise with your ticket or accessory? Why/why not? (Arranger)

- Three arrangers answered yes, they would have felt safe.
- One arranger answered that it would have been nice with help but s/he was not sure.
- One arranger said it had needed to be clearer, for example stated somewhere that Linping would help in case of problems.
- One arranger wanted more contact information.

9. Do you believe that Linping would help you solve your problem if for example a problem would arise with your ticket or accessory? Why/why not? (Regular user)

- Four users answered yes, they would have felt safe.
- One user answered that s/he did not know.
- One user added that the lack of the repurchase function felt bad.

10. How did you perceive the web application in its entirety?

- Three arrangers said it was clear and simple to use.
- One arranger said the design could be improved, and two arrangers said the design looked good.
- Four arrangers said the application was straightforward in function.
- Three users said it was clear and simple to use.
- Three users said the design looked good.
- One user said the application was easy to navigate.
- One user said the application was straightforward in function.
- One user said images sometimes had a long loading time, and further would have liked more text about what the image was during the loading time.

11. Can you think of any functionality to this web application that you would wish to see in a future version?

- Two arrangers mentioned that discounts on tickets depending on what section you belong to is needed.
- One arranger wanted to be able to edit events and patches from the event and patch pages as well as on my page and the calendar. Also, it would be necessary to be able to add events that take place during longer periods of time than one day and buy party tickets for one specific day.
- One arranger wanted to be able to choose, when creating an event, what time it would be visible for everyone else. Also, the ability to choose a time when changes to an event should happen.
- One arranger wanted the application to be in English as well so that ESN could use it too. And maybe integrate it with LiU-Store and other online stores on LiU.
- One arranger wanted to see more about the arrangers and be able to read more about them. Maybe with a link to their page. More things to do on the arranger’s home page and more alternatives to design the page with. The arranger thought there were few functions on the arranger’s page.
- One user wanted a slideshow with pictures from the upcoming events on the event page. Also, the user wanted more than one event to be shown on the event page.
- One user would prefer the upcoming events on the event page to be displayed like it is on Facebook and the ability to scroll through all upcoming events.
• One user wanted to be able to see how many tickets there were left and how many that have been sold. Also, more information about the events would be nice. Both traditional and new information this year.
• One user wanted a feature allowing you to choose which email address you want to send your bought tickets to and the ability to resend tickets if the mail got deleted.
• Two users wanted a place in the application where tickets could be sold second hand. One of them thought that a queue-system would be good to have for that.

12. Is there anything you would like to add about the test?
• Two arrangers had nothing to add.
• Two arrangers said the test was good.
• Two arrangers liked the practice of the game, Tower of Hanoi, to learn CTA. One of whom would like to see more tasks instead of being given free hands to explore the web application and another said it was slightly unpleasant that several group members were observing the test.
• Two users had nothing to add.
• Two users said the test was good.
• One user liked the practice of the game, Tower of Hanoi, to learn CTA.

CTA Results
• Two arrangers were initially confused as to from where an event could be created. This confusion was resolved in one case once the subject saw the link for "My party committee", however the other arranger was unsure whether "My party committee" or "Event" was the right choice.
• One arranger was unsure if "creating" a patch meant ordering a patch to be manufactured or if it simply was making the sales information available.
• One arranger repeatedly commented that the process was very intuitive.
• One arranger was initially unsure about where the newly created sale item could be viewed after creating a patch not connected to an event. They found it unintuitive and strange that it was different from how events were handled (this was fixed after the test).
• One arranger had a few questions regarding how tickets would be delivered. Once introduced to the function where tickets were mailed individually to the buyer's student mail after purchase, they commented that they found this to be a good and convenient idea.
• One arranger did not realize they had been logged in after the login process, and logged out when trying to log in again. They then understood that they were logged in in the first place.
• One arranger had problems finishing the create event form, as they entered time for ticket release in the wrong format.
• One arranger tried to leave the field for patch description empty, and when they got prompted to fill it in they saw that the just uploaded image had disappeared. After uploading the image again the arranger successfully uploaded a patch.
• One arranger thought the image for an event disappeared when editing, so they uploaded a new one even though it was not their intention to edit the image.
• One arranger was positively astonished by the ticket release timer for unreleased events.
• One arranger wondered why they could not buy a patch for an event that had not had it’s ticket release from the event’s page.
• One arranger was a bit unsure whether “place” would be the venue of the party or where the tickets would be sold.

• One arranger was a bit surprised that the patch needed a name.

• Two arrangers wanted to be able to put "unlimited" as how many patches a person could buy at once.

• One arranger misinterpreted the “description” of the patch during creation, and described the look of the patch instead of providing a more general text concerning the patch.

• One arranger chose an image which disappeared, and therefore had to choose a new image. This was because they made an error in the process and therefore needed to reselect an image.

• One arranger was a little confused that the size of the description field could be increased, but one could still not type more characters than before.

• One arranger was at first confused whether or not they had an account, and so at first tried to create a new account.

• One arranger found the “Create event” and “Create patch” pages easy to understand and commented several times that it was clear what to do. However, when choosing the number of tickets there should be for an event, the buttons in the number field which changed the amount by one felt unnecessary.

• One arranger said the pop-up warning that showed when trying to delete an event was good.

• One arranger was confused and did not know if there existed more than one event since only one was shown on the event page.

• One arranger clicked on a picture of a patch on the “Patches” page and expected to see a larger image. Instead, the patch was put in the shopping cart.

• One user did not initially see the ticket price on the event page.

• One user voiced a wish to have a link back to the application from the account creation email.

• One user said it was unnecessary that they had to reload the page manually to see the mail updated on "My page".

• One user said it seemed weird that it said "Upcoming event" on the event page but only one event could be seen.

• Two users were slightly confused when the main page and events page were the same.

• One user had minor issues with logging in unrelated to the application as the user had a hard time discerning the letters of generated password.

• One user was confused when not all events had an associated patch.

• One user had problems receiving mail sent by the application. The user claimed to having had similar problems with their mail client before.

• One user added one party ticket to cart before logging in, and one after logging in - and was afterwards confused about the result of having two tickets in the shopping cart.

• One user was confused during the payment process, as they did not understand the information regarding delivery methods.

• One user had some issues with launching the application.
- One user was confused when future events were not displayed on the events page (only the next event was displayed).
- One user said they appreciated the contact and about pages.
- One user desired clarification regarding pickup sites for patches.

### Lostness

<table>
<thead>
<tr>
<th>Arranger</th>
<th>Task 1</th>
<th>Task 2</th>
<th>Task 3</th>
<th>Task 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.110</td>
<td>0.361</td>
<td>0.063</td>
<td>0.174</td>
</tr>
<tr>
<td>2</td>
<td>0.305</td>
<td>0.361</td>
<td>0.361</td>
<td>0.361</td>
</tr>
<tr>
<td>3</td>
<td>0.110</td>
<td>0.361</td>
<td>0.103</td>
<td>0.361</td>
</tr>
<tr>
<td>4</td>
<td>0.174</td>
<td>0.361</td>
<td>0.361</td>
<td>0.361</td>
</tr>
<tr>
<td>5</td>
<td>0.121</td>
<td>0.063</td>
<td>0.361</td>
<td>0.361</td>
</tr>
<tr>
<td>6</td>
<td>0.036</td>
<td>0.361</td>
<td>0.063</td>
<td>0.361</td>
</tr>
<tr>
<td>Mean</td>
<td>0.143</td>
<td>0.311</td>
<td>0.218</td>
<td>0.330</td>
</tr>
<tr>
<td>Median</td>
<td>0.116</td>
<td>0.361</td>
<td>0.232</td>
<td>0.361</td>
</tr>
</tbody>
</table>

Table 1: Here is each arranger’s lostness value shown, as well as the mean and median values.

<table>
<thead>
<tr>
<th>User</th>
<th>Task 1</th>
<th>Task 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.161</td>
<td>0.053</td>
</tr>
<tr>
<td>2</td>
<td>0.111</td>
<td>0.053</td>
</tr>
<tr>
<td>3</td>
<td>0.341</td>
<td>0.032</td>
</tr>
<tr>
<td>4</td>
<td>0.110</td>
<td>0.082</td>
</tr>
<tr>
<td>5</td>
<td>0.079</td>
<td>0.079</td>
</tr>
<tr>
<td>Mean</td>
<td>0.160</td>
<td>0.060</td>
</tr>
<tr>
<td>Median</td>
<td>0.111</td>
<td>0.053</td>
</tr>
</tbody>
</table>

Table 2: Here is each regular user’s lostness value shown, as well as the mean and median values.