Usability of Content Management Systems on touchscreen mobile devices

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ABSTRACT
Content Management Systems (CMS) can support the creation and maintenance of an e-commerce website and its content. Together with the advance of mobile technology and Internet, it is now possible for business owners to manage their online store using their mobile touchscreen devices. This thesis aims to define the usability problems of the existing CMSs when they are used on mobile touchscreen devices. Heuristic evaluation was performed in three CMSs in order to gain a better understanding of how CMS on touchscreen works and what are the major issues that could downgrade usability. Based on the results of the evaluation, a prototype was implemented and evaluated in order to find out if the design characteristics of the prototype can enhance usability. The impact of the prototype is discussed in terms of efficiency and heuristics violations. Moreover, design guidelines are suggested and uncovered usability problems for further research are provided.

Keywords
Heuristic evaluation, Content Management System, Touchscreen mobile devices, Usability, Usability heuristics, Usability evaluation, Design, Design prototypes

1. INTRODUCTION
We are in the era of Internet, connectivity and mobility. Advance mobile technology has entered our life and mobile devices are part of it. Today, more and more people are getting a mobile Internet subscription and it is predicted that by 2020, the number of the subscription will be more than 8.2 billions, where 6.1 billions are unique users[9]. This creates a global network with billions of connected devices where people can search, share and consume digital content at their fingertips.

The progress of Internet technology and the development of the web technologies that can handle monetary transactions lead to the growth of e-commerce. E-commerce or electronic commerce is the buying and selling of products and goods online[21]. E-commerce websites are online catalogs where the consumers browse and buy. An online presence in today’s global network is essential for every business to promote their firm, attract more consumers and sell their products to consumers all over the world.

Moving to e-commerce and creating a digital store can be a difficult process for business owners. They need to manage a lot of content in different formats, update it frequently and also take care of orders and online transactions. All the information has to reach the consumers at the right time for the business to work. A Content Management System (CMS) can support business critical core operations, as for example the e-commerce transactions. Maass[13] points out that the CMSs in the market right now, are developed either with a specific industry in focus or for a general wider target group. In addition, Boiko[5] mentions that a CMS can underlie not only e-commerce but other services like personalized publications, advanced websites, multiple publications, knowledge management and online communities. BigCommerce, Shopify and Weebly are some of the CMSs developed specifically to support e-commerce. Even though, there are a lot of CMSs available for the end-user, one has to understand when a CMS is needed. The amount of content a business has, the amount of contributions, the amount of changes in the content and layout and also the number of publications are factors that determine if a business should use a CMS or not.

Content management systems were traditionally designed for the use on desktop devices with standard WIMP interaction. More recently, the users’ interaction with interfaces has expanded beyond keyboard and mouse, and touch interaction is more and more used. Therefore, it is expected that a CMS can also be used on a mobile touchscreen device, so that the users can manage their content on the go and always be connected with their customers. However, that requires a mobile and touch-friendly CMS where the user can easily and efficiently perform tasks on, without frustration.

The demands of the users for new tools lead to rush development of gestural interfaces, according to Norman[19]. Due to that, well-tested and understood standards of interaction design were being overthrown, ignored, and violated, leading to unnatural interactions, as Norman pointed out. In order to address the issues in usability of the CMSs designed for touchscreen devices the following question was formed:
What are the most important characteristics of CMS on touchscreen mobile devices from a usability perspective?

2. BACKGROUND

2.1 Content Management Systems

A CMS is a computer application that supports the creation and modification of digital content [1]. Bob Boiko [5] explains in detail the term CMS, how it works and why it is important. The CMS is responsible for collection, management and publishing information therefore the system consists of 3 sub-systems. The collection system where all the raw information is stored. The raw information can have various formats and it can even be retrieved from other sources or created by one or more authors. The raw data are converted into content components which are stored into a management system. Then, the publication system pulls the content components and publishes them in the desired format. The publications can be web publications or other type of publications like print publications.

Web publications are what most people want from a CMS. Web publications are Internet, Intranet or extranet sites which can be static or dynamic. Static sites are those that the CMS produces once in the beginning, while dynamic sites are generated dynamically as the user clicks and requests for the next page to be produced. Publishing services and templates are called in order for the pages to be produced.

During the 90s, websites were built by engineers using HTML static web pages. Later, other languages such as PHP and PERL were designed to support dynamic content. Then, CMSs appeared in the market as tools for managing dynamic content and that sped up the process of creating and updating a website. This changed over the years and now CMSs are not just tools, but also support critical core operations in a business ecosystem and are an integral part of it. Also, individuals started to use CMS to manage online content. Today, anybody can manage his own digital content space in real-time with a minimum of technical requirements most of the time for free [13].

2.2 Usability

As the technology changes, the user interfaces that used to be common become out of date. The International Organization for Standardization has done much work on identifying international standards for HCI that can apply to any in- tant (the “heuristics”). If a heuristic is violated while the evalu- ator performs the tasks of the evaluations, then there is a usability problem. In other words, a usability problem is discovered when a dialog element doesn’t apply to the heuristics good design practices. Based on Nielsen’s research about the number of evaluators, three to five evaluators are enough to discover most of the usability problems in a system [18].

Many researchers and designers use heuristic evaluation to inspect interfaces for usability problems. Nielsen, in a case study, examines a phone based interface through heuristic evaluation and classifies the problems based on severity rate, dialogue element and heuristics. Also, in this study he involved three groups of evaluators; novice evaluators, single
experts and double experts in order to figure out the proportion of problems found by each category of evaluators. Novice evaluators have knowledge about computers, but no usability expertise. Single experts are usability specialists, but no specialized with the domain of the interface that they evaluate. Double experts are those who are usability and domain experts. Nielsen concluded that major usability problems have more possibilities than minor problems to be found by the heuristic evaluation. Novice evaluators found 30% of the usability problems found by double evaluators. Double evaluators could find more usability problems than the novice evaluators, due to their experience in the domain and their experience evaluating interfaces.

In another case study [20], researchers examine three course management systems by heuristic evaluation in order to find usability problems and generate knowledge about the interactive properties of the systems. Nielsen’s heuristics list [15] was used during that evaluation. Even though a lot of problems were found, the researchers concluded that specific CMS heuristics could be more effective but the research in this area is still immature. Bos et al. [9] suggested a new set of 12 specific heuristics for CMSs. Instroza et al. [11] worked on touchscreen-based mobile devices specific heuristics and developed another set of 12 heuristics. However, more validation and practical application needs to be done to prove the value of these heuristics. Even though Nielsen’s final list of heuristics was released in 1994, it is still the most used list.

On the other hand, researchers are testing CMS usability and touchscreen interfaces not only by heuristic evaluation but also with user testing. Unal et al. in their study about usability of Web-based Course Management Systems, asked for 135 students of a university to use different course management systems during a semester. Through this user study they compared the different systems and concluded which one was students’ favorite and which one is better for what purpose [24]. Fernandez et al. evaluated different user interface designs and input methods on touchscreen mobile devices by conducting a user study of two implemented prototypes [3].

3. METHOD
To gain a better understanding of the usability of Content Management Systems on touchscreen mobile devices the research was divided into three stages. First, a heuristics evaluation of existing systems was conducted. Secondly, solutions to results of the evaluation were implemented into a design prototype. Finally, the prototype was subjected to heuristic evaluation. The research is focused on e-commerce CMSs that work on Android tablet devices.

3.1 Heuristic Evaluation of existing CMSs
The evaluation of three existing systems was conducted by a group of three evaluators. One single expert, the author of this thesis, whose studies focus on web development and user interaction, with knowledge on CMS. Two novice evaluators males 28 years old IT consultants on telecommunication and web development respectively, without prior knowledge in usability or CMS.

3.1.1 The process
The first stage of the evaluation was a briefing on the method, the domains and the scenario. The novice experts were introduced to the heuristics, ensuring that they will have a wide spectrum of usability concerns and that they will use the heuristics effectively when evaluating the systems. Then, they were given a short introduction to the three systems. The systems that were evaluated are three e-commerce systems; Big Commerce, Shopify, and Weebly. The first two are responsive website-based CMSs, so they can be used on mobile devices. Shopify is available as a native mobile application. The session ended by presenting the specific scenario that the evaluators will go through while evaluating. The scenario focused on two main goals of the users, one for editing the layout of the website and one for managing the content (products) of their store. To achieve these goals, six main tasks had to be performed, each one of them divided into subtasks (see Appendix A).

After the briefing session, the evaluation took place. The evaluators evaluated the CMSs in a different order and they performed the tasks individually and independently from each other. The evaluation session lasted for about 7 hours for each evaluator. When the evaluations were over, the evaluators met for one-hour debriefing session where they discussed the uncovered problems, possible solutions and their experience interacting with each CMS. Finally, severity ratings of each usability problem were collected by asking the evaluators to answer a questionnaire. The questionnaire contained a list of all the usability problems that were found by the evaluators and a severity rating scale for each one of the problems. The severity rating scale that was used was the scale that Nielsen has designed, where each problem can be rated with 0(not a usability problem), 1(cosmetic usability problems), 2(minor usability problem), 3(major usability problem) or 4(catastrophic usability problem). Since each evaluator had uncovered some of the usability problems in the list, well-defined descriptions and screenshots were provided in the questionnaire to ensure that the evaluators will be able to understand and rate each problem, even the ones that were not found by her/him.

3.1.2 The heuristics
For the reasons mentioned in section 4.2, Nielsen’s set of heuristics [10] was selected for the evaluation. The set consists of 10 heuristics, which are general principals for user interface design and can be found in Table 1.

3.2 Prototyping
The usability problems that derived from the heuristic evaluation, are potential problems that the users might face when they use a CMS on a touchscreen device. The uncovered common and major problems were taken into consideration while designing the prototype. The solutions to the detected problems were all proposed and designed in one prototype. First of all, designs on paper were made for each screen of the system. The goals of the paper prototype was to create a first design proposal for every page in the system, in order to ensure a good navigation and to note how the pages

1. https://www.bigcommerce.com/
2. https://www.shopify.com/
3. https://www.weebly.com/se
are connected and what functionalities and interactions are needed.

Based on the paper prototypes, a high fidelity prototype was created using Justinmind prototyping tool. This tool supports prototyping for touchscreen mobile devices and interactivity like tapping, on load page actions, inputting text, pictures uploading and switching between dynamic panels based on users request. In addition, variables were used to bind input fields to text fields and a database was created to store products, add new ones or retrieve a product for the user to edit it and save it upon request. The prototype was shared with the evaluators, directly from Justinmind environment, on the tablet and tested as an application.

3.3 Heuristic evaluation of the Prototype
The process that was followed for evaluating the prototype, was the same with the process described in the 4.1. The evaluation was conducted by the same group of evaluators, under the same scenario and tasks as before. The evaluators conducted the evaluation in one hour. Then, a debriefing session was followed, where a discussion was held about the prototype and the performance of the tasks on it. The severity rating of the usability problems took place after the debriefing session.

4. RESULTS
4.1 Heuristic Evaluation of existing CMSs

4.1.1 Usability Problems Classification
BigCommerce, Shopify and Weebly are the three CMSs that were subjected to heuristic evaluation by the group of three evaluators. These evaluations resulted in uncovering several usability problems on the interfaces, that are summarized in Table 1, and were discovered while performing the defined tasks. These problems are classified based on their severity, the 10 applicable heuristics and the location of the problem between two different parts of the system, the customization of the website layout and the content management, which for e-commerce CMS, refers to the management of the store’s products. For every CMS in Table 1, there are two columns: one for the interface where the design layout tasks were performed and one related to the content management interface. The number of problems in Table 1 represents the cumulated number of problems found by the three evaluators, excluding the duplicate problems which were only counted once.

Looking at the overall number of usability problems uncovered, it can be noticed that BigCommerce broke the heuristics more times than the other two systems. In addition, the evaluators estimated that the performance of the tasks in BigCommerce took the longest time out of the three systems and the duration of the evaluation lasted almost double the time of the evaluation of the other two systems. The performance on Weebly and Shopify was almost the same, with the interface of Weebly (Figure 2) being more preferable to the evaluators and it was described as more intuitive and faster during the debriefing session.

4.1.2 Effect of the Individual Heuristics

Figure 1: Number of usability problems in each heuristic in BigCommerce, Shopify and Weebly
Table 1: Usability problems found in two different system parts (Layout and Content Management) of BigCommerce, Shopify and Weebly CMSs, as well as the number of major and minor problem in each on and the number of violations of each heuristic.

<table>
<thead>
<tr>
<th>Interface</th>
<th>Content Management Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Big Commerce</td>
</tr>
<tr>
<td></td>
<td>Layout</td>
</tr>
<tr>
<td>All problems</td>
<td>43</td>
</tr>
<tr>
<td>Severity of problem:</td>
<td></td>
</tr>
<tr>
<td>Minor usability problems</td>
<td>16</td>
</tr>
<tr>
<td>Major usability problems</td>
<td>27</td>
</tr>
<tr>
<td>Applicable heuristic:</td>
<td></td>
</tr>
<tr>
<td>H1 Visibility and system status</td>
<td>4</td>
</tr>
<tr>
<td>H2 Match between the system and the real world</td>
<td>3</td>
</tr>
<tr>
<td>H3 User’s control and freedom</td>
<td>8</td>
</tr>
<tr>
<td>H4 Consistency and standards</td>
<td>7</td>
</tr>
<tr>
<td>H5 Error prevention</td>
<td>3</td>
</tr>
<tr>
<td>H6 Recognition rather than recall</td>
<td>2</td>
</tr>
<tr>
<td>H7 Flexibility and efficiency of use</td>
<td>11</td>
</tr>
<tr>
<td>H8 Aesthetic and minimalistic design</td>
<td>5</td>
</tr>
<tr>
<td>H9 Help users recognize, diagnose and recover from errors</td>
<td>5</td>
</tr>
<tr>
<td>H10 Help and documentation</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 1 presents the number of violations of each heuristic in the three CMSs. It can be noticed that all the systems faced many problems regarding how flexible the system is to cater all kinds of users and how efficiently the evaluators could perform the tasks (H7). Also, a lot of consistency issues were found between the layout and the content part of BigCommerce and Weebly (H4).

In addition, the evaluators encountered many problems in the navigation and the control of their actions in Shopify and BigCommerce (H3), whereas Shopify’s and Weebly’s design did not prevent the evaluators from error situations (H5). In contrast, it can be observed that, in all the CMSs, the least violations were assigned to system’s help and documentation (H10). In BigCommerce and Shopify the second least violated heuristic was the recognition rather than recall (H6) where in Weebly the evaluators uncovered the least problems referring to the systems status (H1) and help in recovering from an error (H9).

A better understanding of what each of the most violated heuristics actually mean, and what elements in an interface do not apply to the heuristics’ good design practices, can be obtained by presenting and elaborating specific issues in usability discovered in the three CMSs. To begin with, Flexibility and Efficiency of use (H7) is related to the options that are provided to both experienced and novice users when they perform a task, meaning that the interface should support all users to perform the desired tasks efficiently and fast. A common problem regarding H7 was the limited number of options while editing the layout of the website. For example, in BigCommerce, the users are not able to upload an image as a logo. They also cannot enter a font size different than 24, 26, 28, 32, 36, since those were the only ones available in the drop down menu and there were only three font families available. Moreover, the preview of the website wasn’t automatically updated after every change which slowed down the performance of the tasks, since one had to reload the website preview to see the results of his/her actions. Furthermore, the keyboard hid a big part of the screen and the users could not perform the tasks efficiently since they had to scroll in the small area left in order to find the input field in which they were typing the values. Sometimes the keyboard occluded the screen in a way that the evaluators could not perform the tasks at all (Figure 3). In Shopify and Weebly, the evaluators faced the same problems when trying to change the logo or the image of the logo. Also, there was no option for changing the font family and some of the buttons in editing the layout did not respond which reduced the effectiveness of the system. In all the CMSs, the color picker window was small and laggy, which caused frustration to the evaluators when they needed to pick a color by touching and dragging their fingers on the small area.
The heuristic H3, User Control and Freedom, implies that the users should be able to undo or redo an action, leave an unwanted page and navigate freely and easily in the system. In Shopify, the user performs all the tasks related to the theme design in a pop up modal (Figure 4), which can be accidentally closed by touching outside the modal. That action makes the users lose all the changes they made, and cannot be undone. Also, the navigation between different options in the theme design menu was not ideal, the evaluators were not able to go back to a higher level of the tree menu structure. Exiting a subcategory in the menu resulted in exiting the whole theme design modal. In Weebly, the provided undo and redo button were working only for one step backwards and forward respectively. In some cases, those buttons were not available.

A lot of usability problems were assigned to the heuristic Consistency and Standards (H4). In different parts of the same system, its conventions were violated. One could find similar buttons that performed different actions based on what page they were displayed in, different structure of menu options, inconsistent naming in menus and in different part of the CMS.

Many usability problems caused the breach of the heuristic Error prevention (H5). The design was not always careful to prevent a problem from occurring in the first place. For example, in BigCommerce, a regular keyboard appeared instead of a numeric pad for input fields that required only numbers. In addition, in Weebly, tapping on the cancel or exit button resulted in leaving the page, without any warning, and all the progress so far was discarded. The same issue was detected in Shopify with the delete buttons, where a product was permanently deleted without any warning.

The fifth most violated heuristic was the Aesthetic and Minimalistic Design (H8). For instance, in Shopify, all the Layout tasks were performed in a small pop up modal which did not use all the available display space. As a result, the design did not use the screen efficiently and that can affect users’ experience when they want to edit the layout of their website on that system. In BigCommerce, when a save action was performed, a dialog box confirming the successful saving stayed on the screen for a long time and the evaluators were unable to close it. As it was mentioned, the keyboard also caused problem in the interface visibility. All that resulted in less available space for the users to continue their tasks.

4.1.3 Major vs Minor Usability Problems
The severity ratings of the problems were collected from the questionnaires that were provided to the evaluators. In those, they rated the problems using a severity scale from 0 (I don’t agree that this a usability problem) to 4 (This is a catastrophic usability problem) taking also into consideration the number of times the problem appeared and how easy it was to recover. Then, the average severity rating of each problem was calculated and problems with rating between 0 and 2 defined as minor while problems with rating over 2 defined as major.

It is worth mentioning some of the major usability problems that were common in the three systems, since those were the ones that had a higher priority to be fixed and influenced the design of the prototype. The navigation in BigCommerce was problematic. Once the evaluators entered the edit Layout, they were unable to go to the page on which they were before. Meanwhile, the navigation in the other CMSs felt unintuitive and a lot of unexpected redirections occurred which made it hard for the evaluators to know where they were and how to go back. Sometimes the back button of the tablet was undoing the changes on the design, rather than directing them back to the previous page. There was no back button designed in the interface. In addition, input fields were occluded by the keyboard. The side menu containing the settings for editing the website, covered a big part of the screen and a lot of content was blocked by it. Also, the names of the elements in the side menu and the elements that they referred to on the website were confusing and it was hard to understand what they actually referred to.

Minor problems in usability are those which might make the user hesitate for a few seconds but do not significantly obstruct them to perform the task [12]. The buttons that
did not appear like pushed when pushed is an example of a problem labeled as minor. In addition, “Apply changes” button and a “Save changes” button might confuse the users for a second before they decide which one they should select.

4.1.4 Problems in usability based on tasks.

Besides the heuristics and the severity rating, the tasks that uncover the usability issues are another way to analyze the results of the evaluation. Looking at the problems that occurred in BigCommerce, the most usability problems rated as major were found when the evaluators performed the tasks for editing the layout of the e-commerce website. The tasks related to adding a product on the store, editing and deleting existing products led to uncovering more minor usability problems than major. These patterns can be noted in Shopify and Weebly too. Overall, the tasks related to the customization of layout resulted in more usability issues than the tasks related to product management.

Shopify’s, Weebly’s and BigCommerce’s interface for managing the products of the online store did not differ a lot. The products were presented as a list to the user of the CMS. For adding a new product or editing an existing one, the interface had designed as a form with fields for “Title”, “Description”, “Price” etc. A main difference that improved the effectiveness in completing the tasks, in Shopify and Weebly, was that the evaluators were able to add the size, the color and more variants of the product in a separate field, where in BigCommerce those variants could only be added in the description field. In addition, it provided the users with a cleaner interface, where the information and the content appeared to the users gradually, making it easier for the user to read and fill in the necessary data.

Each CMS gave the evaluators a different way to edit the design of the store. Shopify and BigCommerce provided the evaluators with a website preview and a side menu where they could perform changes in the layout and see those changes in the preview. The BigCommerce lacked the auto refresh of the preview after every change but made better use of the available screen size. Shopify provided auto refresh of the preview but the interface was a modal smaller than the screen size and didn’t use the screen size efficiently.

A usability issue that has already been mentioned was that it was difficult sometimes to understand what element in the side menu matched with what element in the store’s website. Design options that needed more space to be performed efficiently than what was available in the side menu(i.e color picker, font families), were performed in a pop up modal, without any redirection. In the side menu, the users can also hide and show different elements of the selected section or change the content of the section. For example, they can change the title of the welcome page in the side menu and simultaneously see the change in the section.

4.2 Design Prototype

The design of the prototype was divided in two steps: the creation of paper prototypes and then the implementation of the prototypes using a prototyping software.

The paper prototype consists of fifteen screens in total. One for the main menu of the systems, four for editing the design of the website and ten for showing the product list, uploading and editing products.

The final prototype designed on Justinmind supported interactivity with buttons and links where almost all of them were clickable by tapping. The visual elements and the page layout looked like how an actual CMS optimized for touch-screen mobile devices could be. The prototype was designed for 1024x600 pixels screen size, the same size as the screen size of the tablet that was used to evaluate the first three systems. Sample text and images were used for the products already existing in the prototype. The final prototype can support tasks for editing the design of an e-commerce website and managing the products shown on it. Screenshots of the interactive prototype can be found in Appendix B.

As mentioned before, two parts of a CMS were implemented in the prototype; the Layout and the Content Management. A combination of a WYSIWYG interface and a side menu composed the theme design interface of the prototype. The idea of combining those two in one interface was based on the discovered usability issues and the usability advancements of using a WYSIWYG interface and a side menu on a touch-screen. The users can tap on the different sections of the online store (i.e header section, welcome section, products section) and then the side menu appears showing only the design options for the specific section (Figure 5). This design also aims to decrease the amount of information presented to the users in the side menu, and also makes it easier for them to match the options in the menu with the element in the website. Design options that needed more space to be performed efficiently than what was available in the side menu(i.e color picker, font families), were performed in a pop up modal, without any redirection. In the side menu, the users can also hide and show different elements of the selected section or change the content of the section.

Figure 5: Screenshot of prototype’s Layout interface

The interface of the content management page is similar to those of the three CMSs that were evaluated, with difference in the menu and the way that information for adding/editing a product appears. All the products are presented in a list.
Table 2: Usability problems found in two different system parts (Layout and Content Management) of the prototype, as well as the number of major and minor problem in each on and the number of violations of each heuristic.

<table>
<thead>
<tr>
<th>Interface</th>
<th>Prototype</th>
<th>Layout</th>
<th>Content</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All problems</td>
<td></td>
<td>16</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Severity of problem:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor usability problems</td>
<td></td>
<td>13</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>Major usability problems</td>
<td></td>
<td>3</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Applicable heuristic:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1 Visibility and system status</td>
<td></td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>H2 Match between the system and the real world</td>
<td></td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>H3 User’s control and freedom</td>
<td></td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>H4 Consistency and standards</td>
<td></td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>H5 Error prevention</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>H6 Recognition rather than recall</td>
<td></td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>H7 Flexibility and efficiency of use</td>
<td></td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>H8 Aesthetic and minimalistic design</td>
<td></td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>H9 Help users recognize, diagnose and recover from errors</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H10 Help and documentation</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

with title, description, price and image. The user has to tap on the title of a product for a pop up menu with icons for “edit”, “delete” and “copy” to appear (Figure 6) The user can add new products by tapping on the "plus" icon which is always fixed to the bottom left corner of the page. In the dialog for uploading a new product, only the basic variables are visible to the user, more variants appear when the user unfolds the section containing more variants. Entering the product price is only available through a numeric pad. The cancel buttons ensure that the users will not lose their progress and the keyboard does not cover the input fields.

Figure 6: Screenshot of Content Management(Product list)

4.3 Heuristic evaluation of the Prototype

4.3.1 Uncovered usability problems

The prototype was subjected to heuristics evaluation and the results are illustrated in Table 2. The classification of the usability problems is based on the severity ratings, the applied heuristics and the two different parts of the CMS; the layout and the content management of the online store. Overall, it can be noted that the prototype had less usability problems than the other three CMS. Although, the layout interface had more usability issues than the content management interface, most of them were rated as minor.

Table 2 shows also the total number of times that each heuristic was broken during the evaluation of the prototype. It is obvious that the most problems uncovered are related to the flexibility of the systems and how efficient was the performance of the tasks (H7). Half of those issues are located in the layout interface and two of them were rated as major. Firstly, when the evaluators chose the bottom section (products section), they could only see the bottom part of the side menu and they had to scroll up to see the rest of the options and then scroll down to see how those had applied to section’s layout. Secondly, the pop up modals were located with their absolute position on the top part of the page which made the evaluators scrolling up to find the modal. Both of these usability issues could affect the efficiency of use when specific tasks are performed. The rest of the issues were in the content management interface and only one of them was rated as major. The evaluators faced that problem when they added a new product; the description of each input field was not cleared out when the evaluator selected it, so the evaluators had to manually delete the description of the input field.

The second most violated heuristic was the one related to prototype’s match with the users real world (H2). That issue referred to elements in the interface for which, when they were selected, there was no visual indication that they were actually selected and they did not seem like pushed. One of them was rated as major and it was uncovered when the evaluators selected a product in the products list. There was no visual feedback on which and if the product was selected and it was reported as unintuitive.
4.3.2 Debriefing session
A short debriefing session was held at the end of the evaluation. The evaluators reported that they performed all the tasks in less time than the time they needed to perform the tasks in the other three systems. Due to the scope of the thesis, some functionalities were not implemented in the prototype, but the evaluators were aware of it and they could do all the steps that were required for the tasks. For example, the evaluators could do all the steps they have to in order to change the font family of the welcome title, but in the end the welcome title wasn’t changed. The prototype was evaluated as if these functionalities were working, since these will not be usability issues if a fully functional system was developed in the future. The Layout interface of the prototype felt intuitive to the evaluators and they expressed their preference towards it more than the Layout interfaces of BigCommerce, Weebly and Shopify.

5. DISCUSSION
This study is focused on usability of CMS when those are used on mobile touchscreen device. The purpose of the study is to gain a better understanding of the CMS interface and how that should be designed to improve usability and touch-friendliness. Three existing CMSs that are used on mobile devices were subjected to heuristic evaluation. The evaluation helped in understanding those systems and the usability issues the users may face when they use them. Based on those, a prototype was designed, aiming at enhancing users experience and suggesting design guidelines for CMS on touchscreen mobile devices. The research answers what are the characteristics of CMS on touchscreen mobile devices form a usability perspective.

5.1 Summarized problems that influenced the prototype
The common problems of the three systems that were indicated by the heuristic evaluation influenced the implementation of the prototype. One of them was the navigation inside the systems. In the existing CMSs there were frequent redirections to other pages while performing the tasks. The users should be kept in context and not be sent off to new pages without an indication that this is about to happen. Additionally, it was a struggle to navigate back to the page that the users were on, as well as knowing every time where they were. Another problem was the inconsistent design and naming in the Layout and Product Management parts.

Another common issue were the problems created by the size of the screen and the design that was not optimized for that. The screen size significantly affects efficiency of use and every extra information in a dialog diminishes the visibility of important information. In two of the existing systems, the size of the website preview was small when editing the layout. The side menu covered more than 1/3 of the screen and in one CMS it couldn’t be closed at all. Furthermore, the keyboard sometimes covered almost all the screen leaving only a small part of it visible to the user. Combined with the size of the screen, input fields can also affect usability since they require more effort from the user.

5.2 Suggested design guidelines
The following design guidelines can be extracted by summarizing the design decisions during the prototyping phase.

- Combine a WYSIWYG interface and a side menu for the Layout part of the CMS.
- Use pop up windows or modals either for tasks that require more screen space, avoiding in this way the redirections, or for always warning the user about deleting an item or leaving a page without saving their progress.
- Use headlines fixed to the top of the page and the modals, to help the users recognize where they are, and navigation/action button that are consistent and in all the part of the CMS (e.g. back icon on the top left corner, save/cancel buttons on the bottom of the dialog window).
- Reduce the amount of information on each screen, keep a minimalistic design, use icons. Give the users the possibility to reveal more information/options when they need it.
- Select a numeric keyboard over the regular keyboard when only number are required. Have hints of what the input fields should contain in order to improve efficiency of task performance and avoid errors.
- Avoid input fields when possible. Buttons for increasing/decreasing numerical values (font size) and lists that the user can choose from were used.

5.3 Critical discussion
There is still a lot to be done in the field of research about touch friendly CMSs. It was difficult to find CMSs that could work on a touchscreen device and moreover be evaluated. Even though there are a lot of CMSs in the market, most of them do not provide a responsive website admin panel, so they cannot be used on mobile devices, or the native application does not support a lot of functionalities, so they could not be evaluated. Thirty five CMSs were tested on an Android tablet and only three of them could be used on the study. Those CMSs were fully functional on the touchscreen mobile device and a variety of tasks could be chosen for performing during the heuristic evaluation.

The usability problems found are related to the tasks carried out. Problems concerning the Layout and the Content Management were discovered since the tasks were centered around those functionalities of a CMS. The results point out that the Layout tasks faced much more issues in usability than the tasks related to upload and edit a product. Customizing the layout of a website on a touchscreen was more problematic than expected, but the tasks related to content could be performed in a smoother way. The theme design contains a lot of different functionalities and actions that can be done. Previous research talks about the relationship between functionalities and usability and how usability should use to enhance functionality. Another factor that could had downgraded usability on the Layout interface is the screen size. The prototyped Layout interface aimed to keep the same amount of functionalities but resolve as many as possible usability issues that can be created by the limit of display size.
The prototype was compared to the selected CMSs in order to evaluate the degree to which the prototype improved the usability. Observing Table 1 and Table 2, comparisons can be done between BigCommerce, Shopify, Weebly, prototyper, and their issues in usability. It can be noted that the Prototype design resulted in the least usability problems in total. In addition, there were only seven major problems, three in the Layout and four in the Content part, this number is the least number of major issues in all the systems. The evaluation of the first three CMSs showed that the Layout part had more major usability issues than minor issues, but this is not the case for the prototype where significantly less major issues than minor ones. Overall, it can be observed that the prototype violated the heuristics less than the other systems did, the major problems in the Layout were reduced significantly and only four heuristics were violated by the product interface.

Given that the severity rating of the problems are based on the judgment of the evaluators, the real effect of those problems on the users might differ. Testing the prototype with real users should complement the heuristic evaluation in order to confirm the improvement in usability and efficiency of use and further examine potential issues.

In the heuristic evaluation, the evaluators review a system’s interface and its compliance to accepted usability principles in order to find out potential usability problems. One of the advantages of the heuristic evaluation is that expert opinion about an interface and feedback can be obtained in short time and with few resources. Additionally, feedback can be gathered in the early stages of the development which makes it possible to evaluate even paper prototypes.

Trained double experts have more possibilities to discover more usability issues but unfortunately they are difficult to find. Since this evaluation was conducted by one single expert and two novice evaluators, the results depended on how effectively the evaluators inspected the interfaces with the heuristics. The analysis resulted in that the evaluators did not find problems related to some heuristics. This could mean that the interfaces did not violate the specific heuristics. On the other hand, the evaluators might not have been very well trained discovering issues that applied to the specific heuristics.

5.4 Future work
The thesis focuses on improving the usability of the theme design and the products management interface of a CMS when this is used on a touchscreen mobile device. Evaluation of more functionalities and interfaces of a CMS should be conducted in order to obtain feedback of the usability of the whole system. This can be achieved by defining more tasks to be performed by the evaluators.

Further validation of the value of the suggested design in this thesis should be done with user testing. Ideally, while the users perform the tasks in the three systems and the prototype, in a different order, the effectiveness and efficiency of performing the tasks will be measured. More research should be done on evaluating the effectiveness of Nielsen’s heuristics on evaluating CMS on touchscreens or attempting to define a set of heuristics specifically for these domains.

6. CONCLUSION
This thesis aimed to address the usability issues of e-commerce CMS interface, when used on touchscreen mobile devices. The results of the evaluation of three existing e-commerce CMSs pointed out common usability problems in their user interface. Based on those problems a prototype was designed aiming to suggest solutions to those problems and improve the usability. The prototype was evaluated and the results were compared to the results of the existing CMSs. It can be noted that the prototype violated the heuristics less times than the other systems. Design guidelines were derived from the design decisions during the prototype phase. User testing is recommended in order to confirm the value of the prototype. More research needs to be done in the usability of more parts of an e-commerce CMS.

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7. REFERENCES


APPENDIX A
The tasks regarding the Layout were: change logo (text or image, alignment), change welcome title (text, font family, font size, font color), change background of a section (color or image).

The tasks related to the Content Management: Add new product (title, description, price, size, image, other variant), edit an existing product (title, description, price, size, image, other variant), delete a product.

APPENDIX B
Screenshots of the prototype

Figure 7: Screenshot of Main Menu
Figure 8: Screenshot of Layout
Figure 9: Screenshot of Layout and side menu for the header section
Figure 10: Screenshot of modal for choosing family font
Figure 11: Screenshot of modal for choosing background color
Figure 12: Screenshot of modal for choosing background color with color picker

Figure 13: Screenshot of Content Management (Product list)

Figure 14: Screenshot of Content Management (Product list) with menu options for selected product

Figure 15: Screenshot of warning pop up window about deleting a product

Figure 16: Screenshot of "Add a Product"

Figure 17: Screenshot of "Add a product" with more options
Figure 18: Screenshot of "Add a product" with more options

Figure 19: Screenshot of warning pop up window when leaving a the page

Figure 20: Screenshot of pop up window for confirming that the changes have been saved