MedUx: improving User eXperience in healthcare services

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Abstract: User experience (UX) encompasses all aspects of the experience that a user gets from some system, including physical interaction, how the interface serves the user and graphical design. In healthcare services, UX is a fundamental concept that can affect both patients and professionals dramatically. Going from devices that provide clinical data and analysis retrieved from patients, like T3 (Laussen, 2017), to websites, where users can get a lot of their usual tasks done, reducing the bottleneck in hospital secretaries. The purpose of this work is to understand and define UX guidelines for healthcare websites, improving the user experience. The focus is to understand UX design concepts. These concepts can be usability, visual design, and human factors. We propose a total of ninety-four guidelines regarding the different aspects that affect the concepts mentioned above. The guidelines are organized in different categories, such as Optimizing the User Experience, Page Layout, Navigation, Content Organization and more. After defining the UX guidelines, we redesign an existing portal, for a company called Medclick. With this practical case, we could compare Medclick's, with other healthcare online booking solutions. From the evaluation performed, these guidelines were practical enough to impact positively the user experience. The users took considerably less time to perform tasks and clicks as well.

1 INTRODUCTION

As Don Norman and Jakob Nielsen define, "User experience" encompasses all aspects of the end user's interaction with the company, its services, and its products (Norman and Nielsen,). Users needs must be met without boring them while giving simplicity and elegance to the product. User experience does not focus on providing services of many disciplines but to merge them into in a way that the user can get the best output of them. Nowadays, to develop a website is not the primary objective. Organisations are more concerned about what people feel and need to get more attraction to their services. For that reason, user experience (UX) takes a significant role in web design.

In healthcare services, UX design tries to achieve the customer needs while meeting the organisational goals. Ultimately, this means that UX tries to improve the quality of the interactions between the patient and the healthcare provider (Norman and Nielsen,). The communication between the user and the healthcare provider, through a website, needs to feel natural and genuine, similar to interacting with an assistant to perform some task. UX is also very related to the user interface (UI) (Orlova, 2016). A user interface must be designed, to provide UX through a website. UI is the look and feel of the website, not the path to achieving the better experience of the user through services or products. So, there is a clear distinction between them. UI is more like a subset of UX; it should enhance UX. UX design and the focus of this research includes usability, information architecture, human factors, design, and system performance.

Taking into consideration the issues aforementioned, "How can we improve user experience in healthcare websites, while meeting the organisational business goals" can define the research problem;

1.1 Objectives

The project's objective is to define UX guidelines, in healthcare websites, so we can increase the experience quality and usability of those website. Then we use those guidelines, for the process of making an appointment and related, to later redesign and implement a new interface of a website. These guidelines try to cover from visual aspects, such as controlling the number of options or the alignment, to feedback like error messages.

To build these guidelines, in the first place, one needs to understand the user context and defining UX concepts and related. Since healthcare services are available to everyone, the users can be from any age group, so a clear, simple and easy to use interface is required. UX concepts, like the ones mentioned above, give technical knowledge to carry this idea an achieve the guidelines.

After defining the guidelines, they will be applied to redesign an interface of a website for a company called Medclick. The organisation provides different services related to healthcare services, such as making an appointment, chat with doctors, and others. The UI developed, based on the UX guidelines proposed, will be evaluated using the heuristics and the quantitative processes described in the related work section. Additionally, tests with users, described in the evaluation section, will be performed as well as questionnaires. After that, we can consider whether the UX guidelines defined were practical or not.

1.2 Outline

This thesis is divided into four sections. First, we will give background information of user experience related to websites by describing the state of the art of the UX topics. Visual design, human factors and usability concepts, and their terminology will be specified to understand what the proposal will be. UX design process consists of several steps, to better gather information and implementing the solution. These steps are research, prototype, design, implement and evaluate. It proceeds on describing the UX Guidelines implementation, where we show our proposed guidelines and finalizes with the evaluation of the guidelines and the website followed by the conclusion.

2 UX CONCEPTS

2.1 Defining UX

Rex Hartson and Pardha Pyla (Hartson and Pyla, 2012) define UX as the "User experience is the totality of the effect or effects felt by a user as a result of interaction with, and the usage context of, a system, device, or product, including the influence of usability, usefulness, and emotional impact during the interaction, and savouring the memory after the interaction. "Interaction with" is broad and embraces seeing, touching, and thinking about the system or product, including admiring it and its presentation before any physical interaction.". In other words, UX is a set of terms for an activity that provides a better experience for the user. These activities can either be a method of payment on an online site or be able to book online consultations as any other activity that improves the user experience, facilitating his life with pleasure.

The goal of UX is to reach the best experience possible, through a range of concepts, regarding users desires, needs and behaviours (Orlova, 2016). We will focus on usability, visual design (how the design make the user feels) and human factors concepts. Since our work is focused on an User Interface (UI). The persuasiveness of the website is another concept of relevance. To illustrate, if a user is booking an appointment through a healthcare website, and he reaches the step of choosing a doctor. If the information about the available doctors is not clear, or do not establish trustworthily, it will affect the credibility of the doctors or the website, making the user quit from booking that appointment through that website. Although, since visual design and usability affects persuasiveness, it will not be the main concept of this work.

These goals can be stimulated by business goals, human desires, and product's needs (Orlova, 2016), (Hartson and Pyla, 2012). For example, power consumption in a laptop, learnability of a product and avoiding user errors are UX goals. To do so, service or product providers must understand users behaviours, for example, how they think? What their habits are, what type of actions they do, why they do it, what their goals are, desires or needs?

UX starts more distant from the actual design; a wider view needs to be taken to understand what is necessary to do. Too much scientific thinking may lead to project failure. First, providers need to understand what type of information users can give to use the service. Understanding those inputs is a critical step when trying to eliminate human-based errors since these errors are the main cause of system failures. For example, Amazon had a big outage of its Simple Storage Service, due to an incorrect command entered by an authorised employee (LEVY,).

Usability can be defined as the human-computer interaction component ensuring effectiveness, efficiency and satisfaction. Usability criteria can be, usefulness (criteria that allow the user to use the system to achieve its goals), learnability, memorability, effectiveness, efficiency, desirability, and delightful (Orlova, 2016).

Usability is not the same as "user-friendly". The focus is on the performance of the user regarding productivity. Effective design is part of the usability, but not the goal, to "look pretty" is extra to enhance other concepts.

2.2 Visual Design

The visual design aims to shape and improve the user experience through considering the effects of illustrations, photography, typography, space, layouts, and colour on the usability of products and their aesthetic appeal (Hashimoto and Clayton, 2009). Visual design stand for visual communication through the website interface. Many topics characterise the visual design, mainly typography, page hierarchy, colours, among others. Such topics enhance interest and trust by the user. In healthcare services, a responsible and trustful appearance is required to make the user feel safe. These concepts are useful to study the different possibilities of visual design that can make the user integrated and pleased with the experience, while the information is correctly perceived and provided.

The size used is significant to perceive the information correctly. Normally, when you want to decrease the font size, it is because of unnecessary data. Bold, clear headers may attract the attention of the user and get him to give more value to what insight (Austin, 2017).

Users should feel calm and comforted when opening a healthcare website, knowing that they have come to the right place to address their healthcare needs, questions, and concerns. This atmosphere is best achieved with an appropriate colour palette that projects a sense of well-being. There are many hues and tones to choose from on both the cold and warm sides of the spectrum (Chebanova,). Cold tones are preferred since they provide a sense of tranquillity.

2.3 Human Factors

Enjoyable or not, a website is only applicable if it has good performance. Otherwise, it will ruin itself by making the users frustrated. So, this is a category of most importance. A good design for a web product is what the targeted audience deserves to get the best experience. As Orlova Marríia (Orlova, 2016) said, "Well-know the target audience is a web designer's regular duty and a key to the successful result of the project. Understanding people's mind provides a build rite sensation to web designers.". For that purpose, there are a lot of psychological approaches. In this section, we will give a brief explanation of these factors.

As Vivian Zhang (Zhang, 2018) said in her article Designing for Working Memory, "working memory is where we learn". However, this memory has limitations, can only store a few pieces of discrete information. Therefore, the importance of this factor to UX. One does not want to submerge the user in the information that he cannot process efficiently. Better to have an intuitive design, where the user can freely navigate, focusing on their goal. One of the key points for a user complete his task is his motivation. If the task seems longer to complete, then people will lose motivation. Naturally, people accelerate to complete their tasks when they are close to the goal, like accepting user terms without reading before hitting register. This is called the goal-gradient effect (Limited,). For example, the website process of booking an appointment can be shown as a set of easy steps, and their completeness is shown to give the user a sense of progress.

3 UX DESIGN PROCESS

Like any other design methods, UX has its design process to develop a product. This design process consists of to understand, research, sketch/prototype, design, implement and evaluate. Research and understand will define the problem, business requirements, competitor analysis, and design problems. Prototyping can be done using sketches and wireframes. Methods like heuristic evaluation help in recognising usability problems.

3.1 Understand

Every solution comes from a problem. First, we need to understand and model the problem. As Saadia Minhas (Minhas, 2018) said in her article about the UX design process, Before beginning the design work, let your Design team understand the requirements clearly.

Business managers are close to the clients and better know what they need; the design team can work close to them for that purpose. Understanding user environments helps to provide a clear vision or direction to what the design may start. This process, along with the human factors mentioned in the previous section, aid look deeper into what people may feel or act.

Defining user personas, use cases and user flows through business modelling, provides a better view for this step.

3.2 Research

Researching is a crucial step in any design process. Defining state of the art helps to understand how the outer world is using new features and concepts. Sherif Amin, a Product Designer, called it a UX Competitive Analysis. He listed three purposes of this analysis:

1) Understand market competition

2) Learn about your domain

3) Get inspirations and ideas from your competitors

Follow design trends, design principles, and latest user experience guidelines.

3.3 Prototype

The last two steps drive this one. Drawing paper sketches, whiteboard flows, and wireframes help designing solutions and later implementing the visual design. Evaluation of these sketches is required on this step to provide a better outcome (Yadav, 2019).

3.4 Design

Gather the sketches from the last steps, revise and use them along with design specifications (principles, guidelines, colours, typography, iconography) to start filling the interface. As mentioned before, visual design is a huge step and has several components.

3.5 Implement

Since to complete the UI functionalities are required, the technical team can start the implementation of these functionalities while the designing is occurring, providing a backend for later designers use. This simultaneity is vital because minor changes in the design may be needed.

3.6 Evaluate

This is the final step before deploying the website. Here users test the look and feel, and we have a realistic idea of the usability factors. Changes may need to be done, and this step helps to accomplish them. For that we consider user participation tests, heuristic evaluation and query techniques (Dix et al., 2004).

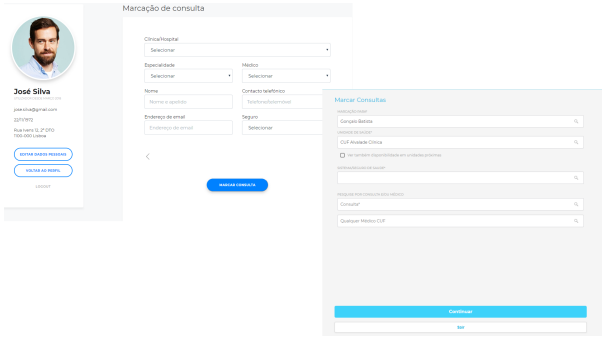

Figure 1: Similarities between Medclick and myCuf

4 HEALTHCARE ONLINE SERVICES

Several hospitals and clinics already have their services to book appointments online and manage those appointments. Even Portugal national healthcare service has it. Here we will show three primary examples of what is being practised concerning design and process flow to book an appointment.

4.1 Medclick

Medclick provides an online scheduling solution, combining multiple clinics, that can be associated, and specialists, so a patient can solve his healthcare needs in a simple, quick manner. This is the portal that our thesis aims to enhance, by using the developed guidelines. Although we already had the foundations to build a proper design, the whole structure needed to be revised.

4.2 MyCuf

Cuf is one of the most private hospital centres used in Portugal. Its process to make an appointment is very similar to the designed-in Medclick website, see figure 1 on page 4. It has a main form to choose the speciality, doctor, clinic or hospital location, and the healthcare insurance to be used. The main difference is that for choosing the date of the appointment; a calendar is provided, see figure 2 on page 5. If some slot is clicked, the options for that day pops-up. Also, Cuf gives the possibility to book more appointments on the same day, while in the same process flow.

4.3 Doctoralia

Another online scheduling portal for healthcare needs, see figure 3. This website is also available

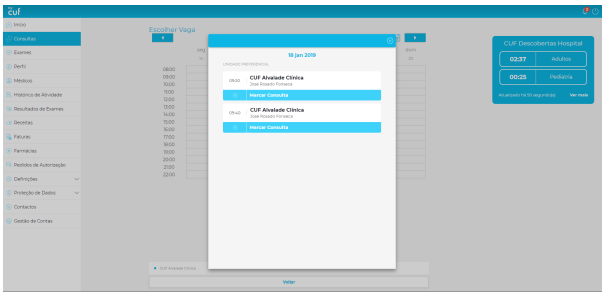

Figure 2: MyCuf calendar to book appointment

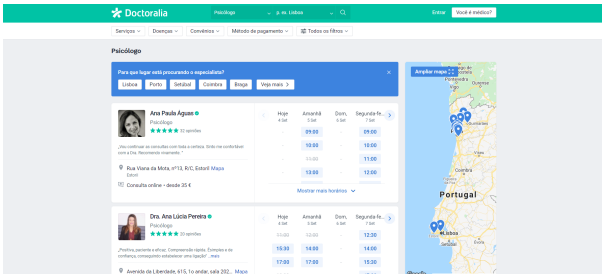

Figure 3: Doctoralia website

in Portugal and it is very similar to ZocDoc. It has less functionalities but it keeps the same structure other websites usually have, a list of doctors with a week calendar, followed by a full map, all in the same screen. From the evaluations performed in section 6, we will see that this design affects the amount of time users take to schedule an appointment.

5 UX GUIDELINES FOR HEALTHCARE WEBSITES

Our Guidelines are separated in three subsections, the guidelines presented on subsection 5.1, are retrieved by using the evaluations done on already existing websites, specifically DOCASAP, MyCuf, ZOCDOC and Doctoralia, combined with the UX concepts presented on the previous section. The purpose is to detect the main flaws on already existing solutions, and register them, then combining with the main trends and concepts of UX, and considering this is for healthcare purposes (information should be clear as possible), to create guidelines that enhances the experience and quality of user in a healthcare website. We also took advantage of an existing book with suggested guidelines from the secretary of health and human services of the USA, in collaboration with others (Leavitt and Shneiderman,). This book already aims to increase the easy-to-use of public websites. Those guidelines are presented on subsection 5.2. Also, on subsection 5.1, we organized the guidelines in the same categories as the ones on subsection 5.2.

5.1 Proposed Guidelines from Related Work

Design Process and Evaluation

ID-1 Define clearly the Web site's goals before beginning the design process.

Optimizing the User Experience

ID-2 Sites should not prevent viewers from returning to a previous site

ID-3 Sites should not redirect the viewer to a site; the viewer did not intend to visit.

ID-4 Features that facilitate the use of the site should be provided and easy to find. For example, clickable items should be closer to the top of the page. Users usually look there to find them.

ID-5 A pop-up or confirmation page, with the respective information, should be presented when the user is about to commit a relevant action.

ID-6 Placeholders should be given to help the user understand how he needs to input data.

ID-7 Use the appropriate colours to come into sigh the website's desired feeling. Do not use too many. Cold tones are preferable.

ID-8 Use schemes that already exist and the users know.

ID-9 Provide hints or corrections for the user's input.

Page Layout

ID-10 Features that access other services of the website should not deviate the user's attention. Must be placed in proper menus and location.

ID-11 Items should be presented by some relevant degree order, avoiding clutter.

ID-12 Do not overwhelm the user with the page elements. Introduced them when it is convenient.

ID-13 Place the aimed actions and information at the centre of the page. Relevant, but not essential information, should be placed on the left side of the page.

Navigation

ID-14 Always provide some feedback about user location on the website.

Headings, Titles, and Labels

ID-15 Labels should be placed on top of input boxes, or they should be self-explanatory.

ID-16 Titles should be bold and in uppercase.

ID-17 The header should contain expected information, such as logo/identity, title, and navigation. When applicable, login/logout, search, and notifications.

Text Appearance

ID-18 Use 16px as the default font size.

ID-19 Use percentage over fixed-size fonts.

ID-20 Use Sans Serif font or similar for readability.

ID-21 Use at most two fonts and weights. If another one is required, be careful that is used in the right way.

ID-22 Use 50 to 60 characters per phrase.

Content Organization

ID-23 Items should be provided with their relevant information.

ID-24 If an item is not available for some transitive reason, a description that justifies it should be provided.

ID-25 If some process can be covered by other, at some point, an option to do it should be provided.

ID-26 Use pop-up menus rather than dropdown menus, when possible.

ID-27 Web site's features should be provided with help documentation or be self-explanatory.

5.2 Research-Based Web Design Usability Guidelines

The Research-Based Web Design Usability Guidelines (Guidelines) were developed by the US Department of Health and Human Services (HHS), in partnership with the US General Services Administration (Leavitt and Shneiderman,). These guidelines are designed to assist developers in the decisions they need to make for their websites. These guidelines are rated in terms of *Relative Importance* (**RI**), the ones that are more important to follow first, and *Strength of Evidence* (**SE**), the ones that give greatest confidence in implementing. Bellow the guidelines, we described why it was added to our guidelines list. Also, related to the scales mentioned, RI and SE, we only chose the strongest ones, since others are more general purpose guidelines and not relevant to this work since they apply to every website.

Design Process and Evaluation

ID-28 Provide content that is engaging, relevant, and appropriate to the audience. RI-5 SE-5.

As we already saw in the related work, the information should be explicit, clear, polite, and precise, so the user does not feel lost and tricked. For example, when the user is booking an appointment, he must always know at which step he currently his and intuitively proceed to the next step. Another way, building an appointment scheduling platform had no advantage from a phone call to a healthcare establishment. This goes well with guidelines 20 and 21, combining engaging information with a process that a user recognizes, without being flooded by additional information, will feel much more comfortable and enjoyable for him.

ID-29 Use all available resources to better understand users' requirements. RI-5 SE-4.

As mentioned during this work, understanding is one of the Ux design process phases. Without it, there was no need to have a concept called "User Experience".

ID-30 Involve users to improve the completeness and accuracy of user requirements. RI-5 SE-3.

Perfect guideline to not miss the design big picture related to the user needs.

ID-31 Set performance goals that include success rates and the time it takes users to find specific information or preference goals that address satisfaction and acceptance by users. RI-3 SE-3.

It is important to measure how the systems are responding to users; in the end, their satisfaction is the goal of UX.

Optimizing the User Experience

ID-32 Allow users to perform tasks in the same sequence and manner across similar conditions. RI-4 SE-5.

This is very important, so the user learns to use the web site across multiple pages and devices. When possible, always use the same structure of similar content.

ID-33 Do not require users to remember information from place to place on a Web site. RI-4 SE-5.

As described in the human factors sub-section, working memory is minimal. It is from must importance to take that work from the user when possible.

ID-34 Provide users with appropriate feedback while they are waiting. RI-4 SE-4.

For example, if the user reschedules an appointment or is booking one when the healthcare providers or establishments are being loaded, that information should be provided. Another way the user may think he is on the wrong page.

Accessibility

ID-35 Provide a text equivalent for every non-text element that conveys information. RI-4 SE-2.

Helps the user to identify the purpose of a non-text element.

ID-36 To ensure accessibility, provide frame titles that facilitate frame identification and navigation. RI-2 SE-2.

For example, in a profile page, it can contain a diversity of elements that the user can navigate and customize, or in booking an appointment page, filtering and selecting should be distinguished. These elements must be well identified with proper titles.

The Home Page

ID-37 Enable users to access the homepage from any other page on the Web site. RI-5 SE-3.

It can give a safe point so the user can start or restart a new task.

ID-38 Present all major options on the homepage. RI-5 SE-2.

As we described during this work, all content that is from major importance should be provided to the user. There is no better place to dispose of those contents that the home page.

ID-39 Treat your homepage as the key to conveying the quality of your site. RI-5 SE-4.

Since we are working in the healthcare area, this is of most importance. The user should feel that he can fulfil his healthcare needs just by looking to the homepage.

ID-40 Clearly and prominently communicate the purpose and value of the website on the homepage. RI-4 SE-3.

There are many healthcare websites for different purposes. It is important to reflect what is the primary goal of the website and why, so the user knows he gets what he wants just by seeing the homepage.

ID-41 Limit the homepage to one screenful of information, if at all possible. RI-3 SE-2.

Avoid redundant information on the homepage so that the user does not need a long scroll to view all the content.

Page Layout

ID-42 Visually align page elements, either vertically or horizontally. RI-4 SE-5.

As we mentioned in the **Human Factors** section, it is important to give an intuitive design, so we take advantage of the working memory. Users prefer consistent alignments of structural items to do so.

ID-43 Use a fluid layout that automatically adjusts the page size to monitor resolution settings that are 1024x768 pixels or higher. RI-3 SE-3.

It is essential to have consistency among screen sizes, without losing functions or intuition of the page.

ID-44 Use frames when certain functions must remain visible on the screen as the user accesses other information on the site. RI-1 SE-4.

ID-45 Make page-length decisions that support the primary use of the Web page. RI-3 SE-3.

Pages that need a quick browse or navigation, such as the homepage, should be shorter. For example, booking an appointment should be fast and consistent, providing the information needed in the less possible space (then the user will need fewer clicks and scroll to find the desired doctor, clinic). Pages that need uninterrupted reading should be longer.

ID-46 Limit the amount of white space (areas Page Layout without text, graphics, etc.) on pages that are used for scanning and searching. RI-3 SE-4.

Less white spaces can be related to faster scanning, or the users prefer moderate amounts, but they do not impact their searching performance, also ”Too much separation of items on Web pages may require users to scroll unnecessarily.”.

Navigation

ID-47 Ensure that tab labels are descriptive of their function or destination. RI-3 SE-3.

Users like to be error-free while navigating a website, so labels should be clear and descriptive enough to convey that intention if that is not possible, due to lack of space or other reasons, instead not use them.

Scrolling and Paging

ID-48 Use an appropriate page layout to eliminate the need for users to scroll horizontally. RI-5 SE-4.

Horizontal scrolling is tedious and may occult information, obligating the users to scroll horizontally to continue visualizing the information.

Headings, Titles and Labels

ID-49 Ensure that category labels, including Headings, Titles, and Labels links, clearly reflect the information and items contained within the category. RI-5 SE-4.

If this guideline is followed, users will find the navigation trough these items much easier, especially when the website has a lot of different components.

ID-50 Put a descriptive, unique, concise, and meaningfully different title on each Web page. RI-4 SE-2.

This is referred to as the browser title page. This is useful if the user bookmarks the page, then he can identify the wanted one.

ID-51 Use descriptive headings liberally throughout a Web site. RI-4 SE-5.

Headings help to classify and provided intuition to the page information and organization. As we saw on the guideline above, "Items should be provided with their relevant information", the same applies to headings. If headings are well-written, users can scan quickly and error-free, especially older users.

ID-52 Use headings that are unique from one another and conceptually related to the content they describe. RI-4 SE-3. If headings are not distinguishable, users loose time trying to decipher the difference, and may lead to navigate to unwanted sections or pages. This is important not to mismatch the user's expectations of the contents the page will show.

ID-53 Visually distinguish (i.e., highlight) essential page items that require user attention, particularly when those items are displayed infrequently. RI-4 SE-3.

For example, when a user is booking or cancelling an appointment, it is crucial that he has the notion of the actions he is submitting to. Alternatively, for example, when the user wrongly inputs data, highlight that item for that purpose is a usable and straightforward way to show the error to the user.

Links

ID-54 Use link labels and concepts that are meaningful, understandable, and easily differentiated by users rather than designers. RI-5 SE-4.

To avoid confusion, wrong decisions, and waste of time, links should be explicit and clearly differentiated.

ID-55 Provide links to other pages in the Web Links site with related content. RI-4 SE-2.

This can seen when a user is booking an appointment, the goal is actually to choose a doctor in a determined time and space. Nevertheless, the user may want to check some doctors profile, clinics, reviews or other content. This is an important guideline for the user to feel in control and not lost.

ID-56 Make the link text consistent with the title or headings on the destination (i.e., target) page. RI-4 SE-4.

The correlation between the clicked link, and the heading provides the necessary feedback to the user, so he knows he reached the destination page.

ID-57 Use text links rather than image links. RI-4 SE-4.

Test links, from a functional point of view, are faster to load and easier to identify as a clickable item. Also, text links can be more descriptive than an image.

Text Appearance

ID-58 When users are expected to rapidly read and understand prose text, use black text on a straight, high-contrast, non-patterned background. RI-4 SE-5.

This increases readability compared to the medium textured background. This is a critical measure when we want the page to be iterated with a better performance.

ID-59 Ensure visual consistency of Web site elements within and between Web pages. RI-4 SE-4.

The errors made using inconsistent displays are much higher than using visually consistent displays. This includes font sizes, characters, spacing, colours, and more. This also goes along with the heuristics presented on the related work.

Lists

ID-60 Arrange lists and tasks in an order that best facilitates efficient and successful user performance. RI-4 SE-5.

The order of the presented item can facilitate the navigation and understanding of the user. They should be arranged in a meaningful order. For example showing doctors with no availability in the middle of the ones that have, can cause confusion or end up with a page full of unavailable doctors, causing the user to think that there are no available appointments.

ID-61 Make lists easy to scan and understand. RI-4 SE-4.

Using visual attributes like borders, backgrounds, allow the users to identify a set of items as a list quickly.

ID-62 Display a series of related items in a Lists vertical list rather than as continuous text. RI-4 SE-4.

Again, this relates to the easiness of scanning and the experience the user has while iterating through a list. Well organized lists tend to be rapidly and accurately scanned. This is also related to the Gestalt Law of Proximity, which states "the brain tends to group items that are close together in space, ie. In the same Proximity (XLCUBED, 2018). In a vertical list, we can quickly identify more similar elements and group them than a horizontal list, that probably would require much more scrolling to see the same amount of items.

Screen-Based Controls (Widgets)

ID-63 Distinguish clearly and consistently between required and optional data entry fields. RI-5 SE-3.

Users should have the possibility to choose if they want to fill optional data or not. Optional data and required should be easily determined. For example, when registering or booking an appointment, there might be some information that is useful for the system but not crucial, and the user may want to keep that information to himself.

ID-64 Ensure that a pushbutton's label clearly indicates its action. RI-5 SE-2.

The label of a pushbutton should identify the action that will happen when it clicked.

ID-65 Ensure that data entry labels are worded consistently so that the same data item is given the same label if it appears on different pages. RI-4 SE-3.

Again this is related to the consistency of the website. Consistency keeps the user on track of his actions and his expectations upon taking one. If possible, apply consistency labelling.

ID-66 Display an associated label for each data upon taking on the entry field to help users understand what entries are desired. RI-4 SE-3.

Placing a label in each data entry, for example, helps the user to not confuse with the data entries themselves. The label should concisely and unambiguously define the required entry.

ID-67 Do not require users to enter the same information more than once. RI-4 SE-3.

Re-entry of data implies additional steps and frustrates the users. Also, it can introduce errors. Information given by the user should be used throughout the website if possible so that it can be reused.

ID-68 Use the computer to detect errors made by users. RI-3 SE-2.

This also goes along with the expectation of the users. They do not know if they are making a mistake; the computer should help the user to identify what he needs to correct to make a successful task.

ID-69 When using free lists, show as many options as possible. RI-3 SE-3.

Besides, this helps the time needed to find the desired item; sometimes, the scrolling may not be obvious.

ID-70 Display default values whenever a likely default choice can be defined. RI-3 SE-2.

For example, if a user is registered, the default values can be his name, health insurance number, phone number, and more. This complements not requiring the users to re-enter data. It also speeds the process.

Graphics, Images, and Multimedia

ID-71 Use background images sparingly and make sure they are simple, especially if they are used behind the text. RI-4 SE-5.

Backgrounds strongly influence the readability of the page. They should be used wisely and always respects the user regarding the easiness of readability.

ID-72 Ensure that all clickable images are either labelled or readily understood by typical users. RI-4 SE-4.

Images might not be enough to understand or remember its meaning. Labelled images are much more effective to use.

ID-73 Place your organization's logo in a consistent place on every page. RI-4 SE-4.

This is the classic reference if the user is present on the website. Some sites may redirect users to other pages, having the logo implies if they left or not the website. Also, it should be consistently displayed, usually on the top left corner of the page.

Writing Web Content

ID-74 When describing an action or task that has a natural order or sequence (assembly instructions, troubleshooting, etc.), structure the content so that the sequence is obvious and consistent. RI-5 SE-4.

Learning tasks unusually is frustrating and time-consuming. Sequences should go along with what the user is accustomed to, increasing the understanding and expectations of the user.

ID-75 Do not use words that typical users may not understand. RI-4 SE-4.

A healthy guideline to ensure the user understanding the information, avoiding confusion, and ease the navigation.

ID-76 Compose sentences in active rather than passive voice. RI-3 SE-4.

Active sentences help the users know concisely who is active and what is being acted upon.

Content Organization

ID-77 Organize information at each level of the Web site so that it shows a clear and logical structure to typical users. RI-5 SE-4.

The information should be organized to reflect the site goal and user needs. The experience a user has with a well-organized website is much smoother and understandable. A poorly organized website causes errors, frustration, and annoyance.

ID-78 Structure, each content page to Content Organization, facilitate scanning: use clear, well-located headings; short phrases and sentences; and small readable paragraphs. RI-5 SE-4.

Important headings should be placed in the centre of the page so that they can be quickly identified. Since users usually do not read the whole page, they are just searching for the desired information; the website should facilitate this behaviour.

ID-79 To allow users to efficiently find what they want, a design so that the most common tasks can be successfully completed in the fewest number of clicks. RI-4 SE-3.

This complements the guideline above. Crucial information should be placed on the homepage. The more they navigate to find the desired information, the more incorrect choices they may do. This helps to reduce the time of the tasks to be performed by the user by reducing the number of clicks and pages to be analyzed.

Search

ID-80 Design search engines to search the Search entire site or clearly communicate which part of the site will be searched. RI-5 SE-3.

If a search engine is available, make it reach the entire website. Another way the user may get frustrated for even tried to use it. If that is not possible, make visible what portion of the site is being searched.

ID-81 Include specific hints to improve search performance. RI-3 SE-3.

This increases the effectiveness of tasks since the user gets reliable feedback about what he is doing and what is expected from the website. This turns reluctant the need for instructions.

5.3 Guidelines Retrieved From Heuristic Evaluations

ID-82 Avoid screens with extended information and scroll (home page).

ID-83 Choose icons that satisfy the information.

ID-84 Disable form buttons until the necessary information is provided.

ID-85 Show the current type of user when there is more than one type of user available (in this case patient, professional, provider...)

ID-86 Do not place images that seem like buttons when they are not.

ID-87 When selecting options, give ways the user can manipulate them freely.

ID-88 Calendar view is more appropriated that a week bar.

ID-89 Build short, as possible, and clear menus.

ID-90 Eliminate unnecessary white spaces.

ID-91 Be coherent with languages

ID-92 Choose appropriated colours to buttons.

ID-93 Place labels on unclear elements.

ID-94 Be sure that the actions' elements do what they are expected to do.

6 EVALUATION

We implemented, as a practical use case, the UX Guidelines in https://medclicksv.herokuapp.com/ Medclick's Portal. We aimed to create the design for the "book appointment" use case, so we could compare user tests, using different websites, to evaluate the efficiency of the implemented guidelines.

6.1 Evaluation Results

Tests Description To start our evaluation, we have as a goal to measure the impact the guidelines has on the website's design. To covey with this idea, first, we choose two more websites to compare with https://medclicksv.herokuapp.com/ Medclick's Portal, https://www.doctoralia.com.pt/Doctoralia and https://www.saudecuf.pt/MyCuf. Note that the percentage was covered in the process of booking appointments and no more. Since we had this limitation of booking real appointments and register the users in production platforms. Doctoralia respected fifty-six percent of our guidelines, MyCuf seventy-one and Medclick ninety-six.

Time Results

First, we start by analysing the time results. We immediately notice a big difference between Medclick and the other solutions, see figure 6. Proving that users take less time to perform tasks using Medclick. We want to see if the time distribution between Medclick and the other solutions, had a significant difference. We used the Student's t-test two-tailed, with equals to 5, since we want to know the probability of Medclick time results being less or higher than the other solutions. The result tables can be seen in figures 4 and 5. Notice that the results are represented per task. By analysing table 4, we can say with confidence that the guidelines did their work. Almost every task, with 95 per cent of confidence level, took less time in Medclick than in Doctoralia.

Then we performed a linear regression between the time results and the percentage of the guideline followed. Although this should be done with a wider scope of testing solutions to provide a more confident

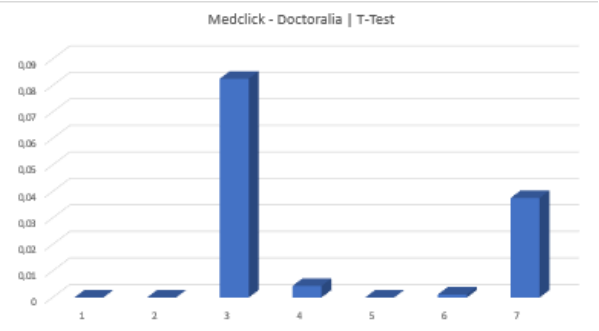

Figure 4: T-Test Medclick - Doctoralia results per TASK-ID

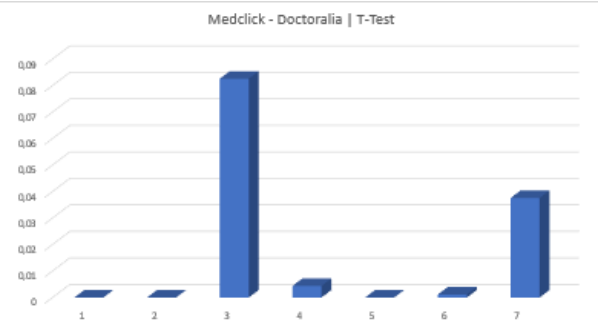

Figure 5: T-Test Medclick - MyCuf results per TASK-ID

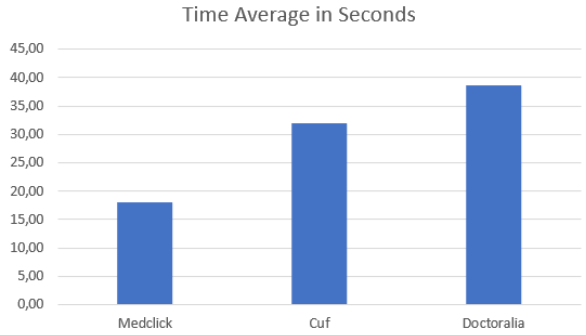

Figure 6: Time average results per website

correlation, we got three solutions that follow a significant difference of guidelines. We notice that the correlation was, in fact, strong, 0.998877, also we got a good fit of the regression model, 0.995511. Our regression is also reliable, with a significance of 0.030171. To conclude the time results evaluation, we can determine that the more guidelines healthcare websites follow, better performance, in time, the users are going to have.

Clicks Results

Now, we move to the evaluation of the click test results. Since clicks are countable, we made a Poisson distribution test to compare Medclick clicks results with the other solutions. We present the Poisson

distribution tables comparing the average clicks distributions between two solutions. Again, the averages were made per task in order to not influence the test results. Although we did not get as good results as we did on the time analysis, we notice that for more complex tasks, users made far less clicks in Medclick, with a confidence level of 95 percent, than in other solutions. See tables 2 and 1.

TASK-ID	Average Clicks Medclick	Average Clicks Doctoralia	POISSON DISTRIBUTION =0.5
1	2,7	4,4	**0,185142286**
2	8,1	16,4	**0,017644731**
3	3,4	4,6	**0,325706283**
4	11,7	20,4	**0,017518318**
5	3,3	13,9	**0,00051381**
6	6,3	13,6	**0,018132471**
7	9,3	14	**0,10939937**

Table 1: Poisson distribution test Medclick - Doctoralia

Task-ID	Average Clicks Medclick	Average Clicks MyCuf	POISSON DISTRIBUTION =0.5
1	2,7	12,1	**0,000479814**
2	8,1	13,6	**0,075319908**
3	3,4	10,6	**0,006634702**
4	11,7	16,8	**0,092033047**
5	3,3	0	
6	6,3	12,8	**0,029085942**
7	9,3	12,9	**0,172519342**

Table 2: Poisson distribution test Medclick - MyCuf

7 CONCLUSIONS

With this thesis, we identified an issue of improving user experience in healthcare websites, while meeting the organisation's goals. There are many solutions for this matter, with different approaches and styles. User experience is a way to study the best solution possible, considering evolving factors. These factors can be, mainly, the domain that it is going to be applied, design trends, market competition, design principles, requirements and the user's environment.

Here we tried to study the main concepts that define UX. These concepts were usability, visual design and human factors. The potential to accomplish users goals can be defined as usability. The visual design tries to improve user experience through visual concepts, such as typography, colours, layouts, among others. Considering healthcare requirements, such as tranquillity, responsibility and trustworthiness, the colours used should be mainly blue and white. Sans Serif is the most affordable font option for this matter. Human factors provide a way to understand users mind and how it could affect a website and tasks flow. If the user is overcharged with a diversity of elements of a website, he could get lost and just abandoned it.

We proposed a group of ninety-four UX guidelines for healthcare websites. These guidelines represent a proper way to improve and enhance the user experience on healthcare websites. They are separated by categories like "Page Layout", "Text Appearance" and more. We implemented these guidelines into Medclick's portal for our practical case, by going through the UX design process, with the help of the guidelines, we redesign and improved the user experience of it. From our evaluation reports, we compared Medclick's portal, after our guideline implementation, with other well-known solutions, MyCuf and Doctoralia, to see how the users performed. From a performance point of view, Medclick, with notice, had good results, registering the less time to perform tasks and less clicks. Also from a qualitative point of view, during the test a lot of users complained about other solutions approach in some features, like the calendar. In Medclick we improved the calendar design and the users were amazed by how it works. We can infer that these guidelines are flexible enough to be practically implemented in healthcare websites, increasing user performance and experience.

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