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# MedUx: improving User eXperience in healthcare services

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# Abstract

Nowadays, many technologies exist with a diversity of interfaces and usability. 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 to websites, where users can get a lot of their usual tasks done, reducing the bottleneck in hospital secretaries.

The purpose of this thesis is to understand and define UX guidelines for healthcare websites, improving the user experience. Understand UX design concepts, that can be usability, visual design, and human factors. For that reason, studying people behavior related to web design is another required factor. 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 and more.

After defining the UX guidelines, we redesign an existing portal, for a company called. The organization provides different services related to healthcare services, such as making an appointment, chat with doctors, and others. With this practical case, we could compare Medclcik's improved design, following the proposed guidelines, with other healthcare online booking solutions. From the evaluation performed, these guidelines were practical enough to impact positively the user experience. With these results, we could identify a positive result of implementing these guidelines.

# Keywords

User Experience Guidelines Usability Visual Design Human Factors Healthcare

# Resumo

Hoje em dia, existem muitas tecnologias com uma diversidade de interfaces e usabilidades. A experiência do utilizador (UX) engloba todos os aspectos da experiência que um usuário obtém de algum sistema, incluindo a interação física, como a interface cliente-servidor e o design gráfico.

Nos serviços de saúde, UX é um conceito fundamental que pode afetar drasticamente tanto os pacientes como os profissionais. Indo desde dispositivos que fornecem dados clínicos e análises recuperadas de pacientes, até websites, onde os usuários podem realizar muitas de suas tarefas habituais, reduzindo o engarrafamento nas secretarias de hospitais.

O objectivo desta tese é definir directrizes UX para websites de cuidados de saúde, melhorando a experiência do utilizador. Compreender os conceitos de design UX que podem ser usabilidade, design visual, e factores humanos. Por essa razão, o estudo do comportamento humano relacionado com o web design é necessário. Propomos um total de noventa e quatro directrizes relativas aos diferentes aspectos que afectam os conceitos acima mencionados. As directrizes estão organizadas em diferentes categorias, tais como Layout da Página, Navegação e muito mais.

Após definir as diretrizes UX, redesenhamos um portal existente para uma empresa chamada Medclick. A organização oferece diferentes serviços relacionados com os serviços de saúde, tais como marcar uma consulta. Com este caso prático, podemos comparar o desenho melhorado da Medclcik, com outras soluções de reserva online de cuidados de saúde. A partir da avaliação realizada, estas directrizes têm um impacto positivo na experiência do utilizador, identificando um resultado positivo da implementação destas directrizes.

# Palavras Chave

Experiência do Utilizador Diretrizes Usabilidade Aspecto Visual Fatores Humanos Cuidados de saúde

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# 1

# Introduction

## 1.1 Motivation

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 [8]. 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 [8]. 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) [4]. 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;

## 1.2 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.

## 1.3 Thesis Outline

This thesis is divided into several main chapters. First, we will give background information of user experience related to websites by describing the state of the art of the UX topics, on chapter two. 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 on chapter three, where we show our proposed guidelines, then we explain how we implemented this guidelines in Medclick's portal on chapter four, and finalizes with the evaluation of the guidelines and the website on chapter five followed by the conclusion on chapter six.

# 2

# Related Work

In this chapter, we are going to show the concepts used to develop the objective, the UX guidelines. We start by defining the UX concept on section 2.1, then some sub-concepts of UX: Usability 2.1.1, Visual Design 2.1.3, Human Factors2.1.4 and the UX Design Process2.2. Then we finalise by analysing existing solutions similar to Medclick's goal.

## 2.1 UX Concepts

Defining UX

Rex Hartson and Pardha Pyla [9] 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 [4]. See figure 2.1 on page 7. 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 [4], [9]. 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 [10].


**Figure 2.1:** UX components [1]

### 2.1.1 Usability

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 [4].

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.

#### Desire for Usability

In past years, usability was not considered an important concept. Users were much more technical and had the patience and desire to overcome usability problems. As mentioned in Rex Hartson and Pardha Pyla book [9], ”As more people began to use computers, the general public, and the press were generally slow to realise that we all can demand a better user experience. Statements of misplaced blame fail to inform or educate the public about the role of user experience in design.”

The following example gives a good insight into this matter, ”the failure of voting machines in Florida was blamed by the press on improperly trained poll workers and confused voters. No one publicly asked

the question of why it takes so much training to operate a simple ballot machine or why citizens experienced with voting were confused with this system." [9]. This example means that a simple service or product, being experienced, should be easy to use. Users should complain about bad design decisions instead of themselves.

### 2.1.2 User Experience over Functionality

Very often, products more developed in functionality matters can be seen being surpassed by others that are better regarding user satisfaction like BlackBerry and iPhone. BlackBerry dominated the market, but since the launch of the iPhone, it became obsolete. Users can only get, even if they assume the correct functionality of products, the experience of what they are doing by the interface. Plus, users want to accomplish their goals, so products that are effective and playful are mainly preferred. This was the main reason for the iPhone to overcome BlackBerry. Although blackberry was more functionally useful, the iPhone was user-focused, full of attractions and stylish. Nevertheless, the iPhone was useful, although it had a far higher user experience, evidencing the preference of UX over functionalities.

The following example clears the difference between usability and UX. Consider a freeway (usability) and a mountain road (UX), a freeway is usable since it has no oncoming traffic, enables you to get from point A to point B in a fast manner and has consistent signage, hence requiring little learnability. In terms of usability, a freeway is highly usable, but it is boring when assessed in terms of user experience. In contrast, something that focuses on user experience is depicted as highly emotional. Thus, a twisting mountain road is less usable but, because of its scenery, the smell of nature and the excitement of the climb, it conveys a pleasant user experience [11].

### 2.1.3 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 [12]. 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.

#### Typography and Fonts

Fonts are used to give a particular feeling to the text; for example, "impact" font can be used to make

bold text, ”comic sans” font to trans-pass creativity. Different fonts can be used to give focus to different text elements. As Sophia Bernazzani [13] said in her article, ”Things seem easier to do when they are easier to read.”, Headers need to be clear and motivate the user to fulfil the task. In fact, according to a study by the Norman Nielsen Group, ”your visitors will only ready between 20 and 28 per cent of the words on your site ” [14]. The space between words and lines, as well as the typeface and font size, they all work together to bring balance to the text.

The font used for text it is not that important for readability, the number of additional and decorative elements will decide the readability of the font [4]. Typography is the art of arranging all of this together. See figure 2.2 on page 9. The size used is significant to perceive the information correctly. Normally,

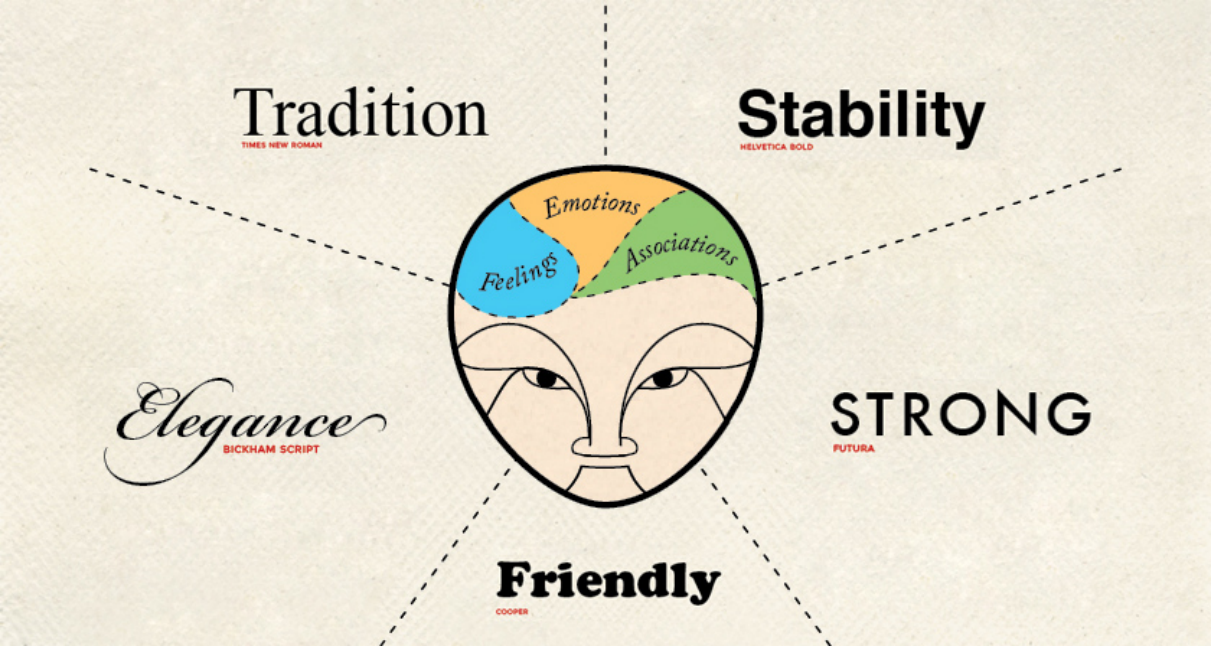


**Figure 2.2:** Fonts and Feelings perceived by them [2]

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 [15]. The font size needs to be large enough to be readable, must common 8-12 is the ideal size for readability. However, nowadays we reed most from a website, 16px is claimed to be the best font size for websites, since the distance we normally keep a device its bigger than a book. Also, some prefer to use percentage over fixed sizes due to the different screen size of devices and browsers are used.

Different sizes can be used to cause different impressions and appeal to the attention of the user to different fields of the website. Different fonts with the same size can appear to be bigger or smaller due to x-Height of fonts letters. The X-Height is the difference between the baseline and the meanline of letters [4]. See figure 2.3 on page 10.

Since healthcare services target a wide range of users with varying abilities and device specifications,

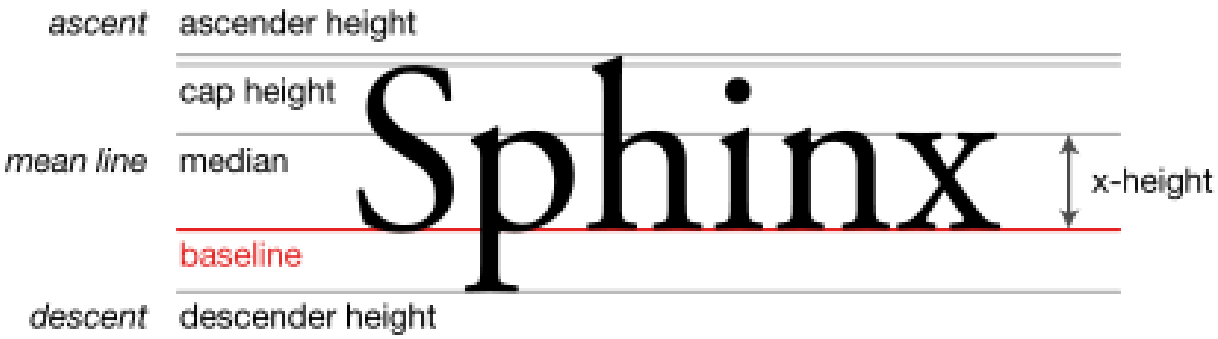


**Figure 2.3:** x-Height [3]

it is important to use simple and easily readable fonts. This ensures that the available information is accessible and consistently displayed to users. So, Sans Serif is the good font to use on a healthcare website, since it provides better readability across digital mediums [16].

#### Contrast

More than one font can be useful to emphasise parts of the text. Excessive use of different fonts makes the output of what is important be uncomprehended. Two fonts and weights make a clear hierarchy, and it is enough to ensure readability with different emphasis. The bad colour combination can be a drag for readability, for example, white over yellow or blue over red. Also, detailed or noisy background images can affect the redness of the website badly. See figure 2.4 on page 10.

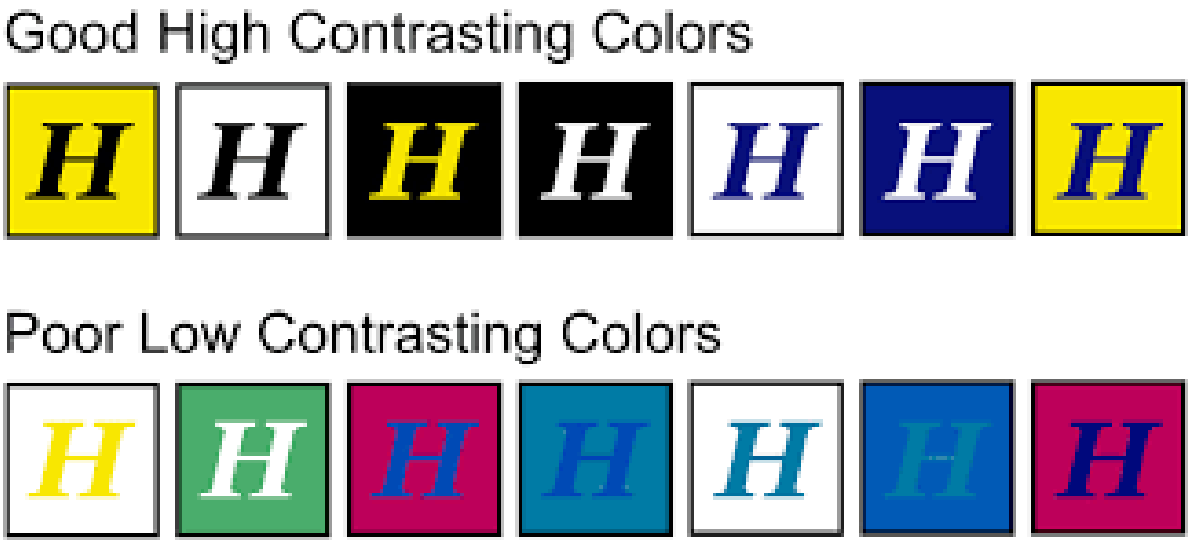


**Figure 2.4:** Relation between contrasts and colours [4]

#### Text Size

As Robyn Collinge said in his article from 2017 [17], ”keep it short”. Long lines in printed media are welcome to the readers, although that does not happen in websites. Keeping the text short, around 50 to 60 characters, makes the user does not lose its focus on the text and do not skip lines. Even though you have the same amount of text, the user thinks it is more achievable to complete the reading than with long phrases. Long paragraphs are not needed in a website if the user reads only around 20 to 28 per cent of the text, and reading from a website takes 25 per cent longer than from paper, users will scan the paragraphs without seeing what is inside. So short paragraphs will become more comfortable this task of scanning the website text, paragraph by paragraph.

**Colours**

Colour is another important factor of the visual design. It creates an expected relation between the product and the user. Different cultures use different colours; they assign a specific colour to certain feelings. See figure 2.5 on page 12. The table below shows the traditional assignment of colours to feelings. Also, colours should be used as the convention obeys for the user do not get confused or tricked by it. Users should feel calm and comforted when opening a healthcare website, knowing that they have

**Table 2.1:** Traditional assignment between colour and feelings

| | |
|---|---|
| Red | Passion, love, anger, aggressive |
| Orange | Playful, energetic, cheap |
| Yellow | Happiness, friendly |
| Green | Natural, stable, prosperous |
| Blue | Serene, trustworthy, inviting |
| Purple | Luxurious, mysterious, romantic |

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 [16]. Cold tones are preferred since they provide a sense of tranquillity. The possibilities for the colour schema are large, but we can resume it all to the colour wheel and different methods of implementing the colour wheel. Mainly, the complementary method is used to provide a safe and clean page while giving dynamics to the page. Therefore, blue and white tones will suffice to fill layouts according to the requirements.

### 2.1.4 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 [4] 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

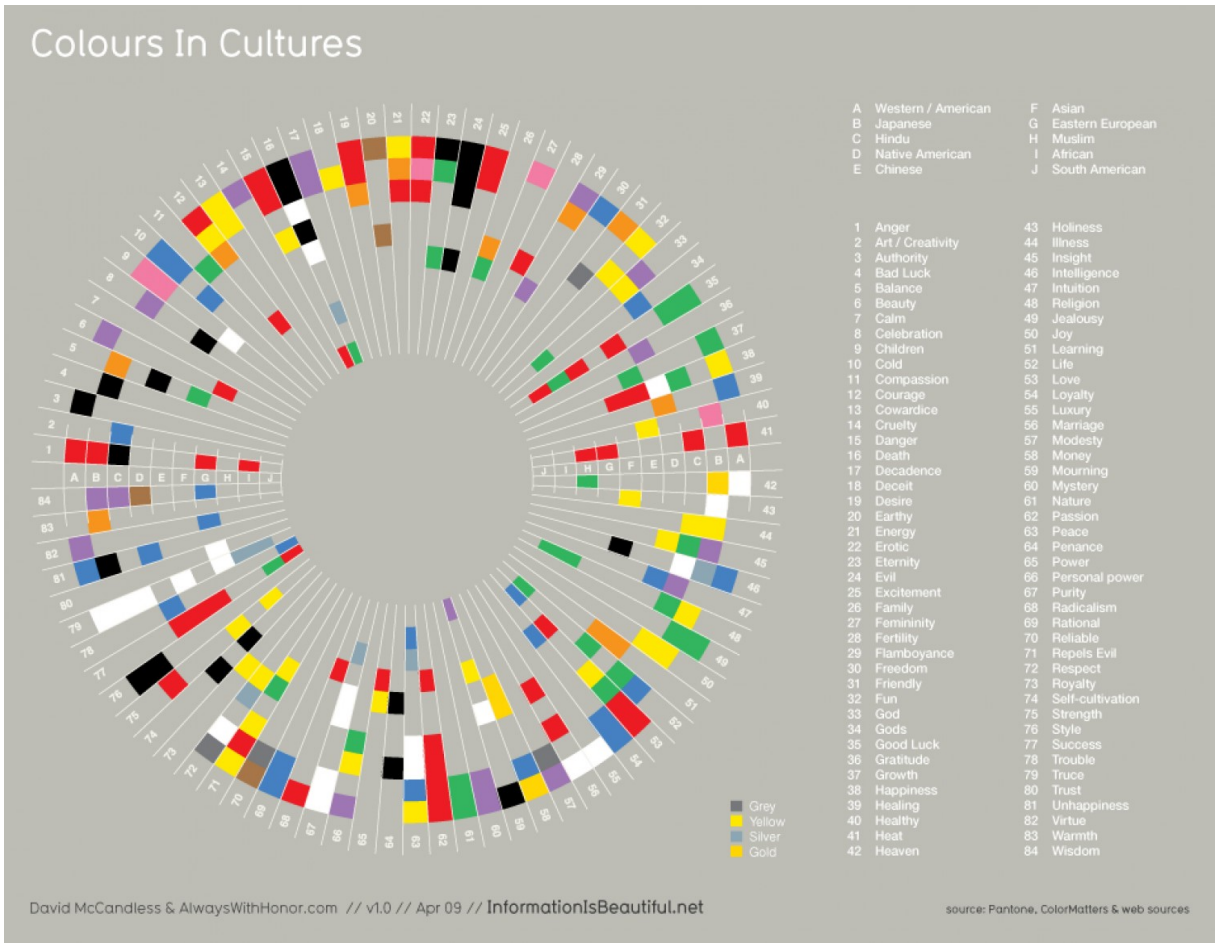


**Figure 2.5:** Examples of what colour could mean in different cultures [5]

web designers.". For that purpose, there are a lot of psychological approaches. In this section, we will give a brief explanation of these factors.

### Working Memory

As Vivian Zhang [18] said in her article Designing for Working Memory, "working memory is where we learn". Working memory is what allows us to read, to do the math and define schedules. It works like temporary storage where we retain information. Information can also be stored in long-term memory, that will be discussed later.

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. For example, if the user wants to change some aspect of the next appointment, such as

the doctor or the time, these options must appear next to one another. Alternatively, for example, when the user books an appointment, the system should display the option to book another appointment on the same day. This option avoids losing time in the same process.

**Cognitive Load**

Cognitive load is the load on working memory at a specific point in time [19]. Cognitive load theory has been aimed primarily at the improvement in teaching and learning through attention to the role and limitations of working memory but, of course, also applies directly to human-computer interaction.

Due to the limitations of working memory, users can get lost performing a task, leading to a stressful path of finding what they were looking. Malgorzata Piernik [20] made a list of what could affect both user experience and conversion, caused by unwilling increment of the cognitive load by too much of design:

1) Raise of bounce rate (users quit the site fast because what they experience is too much or they do not understand what the site is about or what is the action they are supposed to do). To illustrate, if the homepage of a healthcare website, focused on booking appointments, is full of other formations, like advertisements or other services, the user may lose the primary intention of the website, that is booking appointments. Good design is self-explanatory.

2) Shallow depth of user visits (users leave a website without going to different sections and pages of the website as they do not understand what to do). Use schemes that already exist and users know.

3) Raise of time per visit without raise of conversion (users spend much time looking for a piece of information, but they cannot see the way to complete actions to get expected results). For example, if a user wants to reschedule an appointment, the option to do so must be straight. Presenting near appointments, with the option to change them, when users log in or when they enter the appointments page, is a straightforward and precise way of providing that service to users.

4) Decrease of conversion (the users are confused about how to act as A to Z). The information or the way to complete a task must be intuitive and obvious. For example, the steps to book an appointment should be almost natural to the user. Like when people book appointments with a phone call, they have already chosen the speciality they want (if not, usually an assistant helps) and where they want. They need to know when they can be attended. The website must be prominent as well, in the way the user can book an appointment.

This problem can mainly be solved by adjusting and adapting the design for better user experience by making it simple, with clear instructions, recognition vs recall, intuition or predictability of operations, explicit on the main site operation (what is for) and reduce the number of tasks to operate.

**Long-Term Memory**

Information stored in short-term memory can be transferred to long-term memory by ”learning”, which

may involve the hard work of rehearsal and repetition, Rex Hartson and Pardha Pyla [9].

So basically, this is not what is expectable from a user to perform his tasks. To try to remember how he got to that point on the website. Operations should be built-in working memory mindset to get the most out of user performance, improving his experience.

**Recognition vs. Recall**

Computers do not have these kinds of limitations on their memory; they store and interpret data when available. One way to relieve human memory requirements in interaction design is by leveraging the human ability for recognition. Since childhood, one probably hear or say, ”I do not remember, but if I see it, I know”, this is the basis of recognition. Provide choices to the user instead of making him do it from memory; it is the focus of this property.

As Rex Hartson and Pardha Pyla in their book [9] said, ”Recognition over recall does work better for initial or intermittent use where learning and remembering are the operational factors, but what happens to people who do learn? They migrate from novice to experienced user hold.”. Users start to make tasks without thinking about what they need to do, like muscular memory. Cognitive hints that helped the user can now become a wall to performance. For example, when the user is searching for a hospital or a doctor, it is faster if the website provides the options that were used recently in previous appointments.

For experienced users, the case may be the opposite, and they may want to enter the name of the doctor or hospital, and not proceed by the tedious clicking over some pages. Also, in this case, when the user enters some keywords, if the website provides completeness for users commands, the task will be faster, and probably free of input errors.

**How do people see and read?**

According to Ho Vision Group [21], there are two kinds of vision systems, central and peripheral. The central system helps us identify clarity and detail, will peripheral is vital for motion processing and orientation. Users will focus on the centre of the screen, so the purpose of the website should be clearly shown at the centre of the page. While, for example, log in the icon should be at the border, just to let the user know he is logged in.

Then the users start to read the information provided. This does not mean that they understand what they are reading. Titles should reflect the meaning of the text. For example, if a user is making an appointment through a website, and the step title is ”CHOOSE THE SPECIALTY”, the available specialities should be presented and irrelevant information, like which hospital or date, should be presented in the appropriated time. Also, since people are not accustomed to reading in uppercase letters, capital letters can be used to give attraction to titles.

**Motivation**

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 [22]. 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. Using progress bars, represented in image 2.6 on page 15), illustrates this example.


**Figure 2.6:** Lusiadas hospital, progress bar from booking appointment process

## 2.2 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. See figure 2.7 on page 16.

### 2.2.1 Understand

Every solution comes from a problem. First, we need to understand and model the problem. As Saadia Minhas [23] said in her article about the UX design process, Before beginning the design work, let your

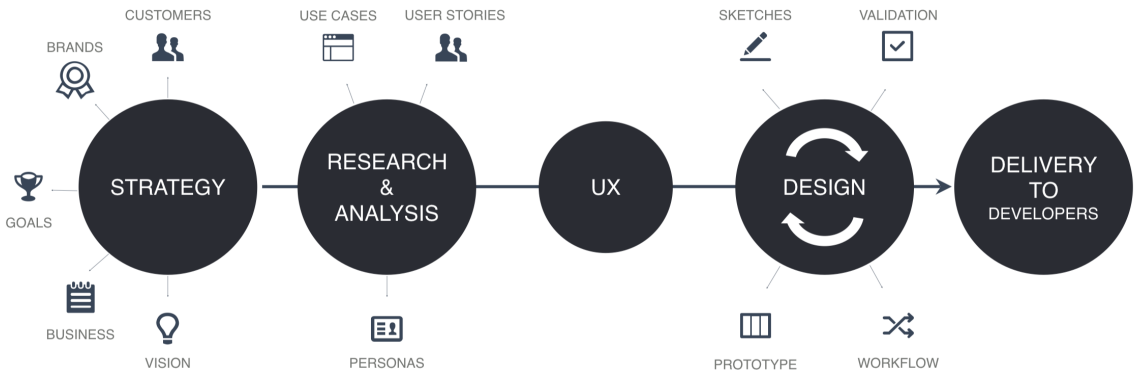


**Figure 2.7:** UX Design process [6]

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. See figure 4.1 on page 41.

### 2.2.2 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.

### 2.2.3 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 [24].

#### Wireframing

A wireframe is a simple and straightforward draw of the layout that targets the leading information group, the outline of structure and layout and description and vision of the user interface [24]. It is like a blueprint of a building, contains the main idea and conceptual model of the interface. It is swift to build and cheap, making it feasible to make numerous modifications.

### 2.2.4 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.

### 2.2.5 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.

### 2.2.6 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 [7], described on chapter 5. Below we present some of the two fundamental laws for website evaluation.

**Fitts's Law** Fitts's law, applied to web design, states that the amount of time required for a user to move

a pointer to a target area is a function of the distance to the target divided by the size of the target. Thus, the longer the distance and the smaller the target's size, the longer it takes.

As Idf Instructor [25] said, some of the major implications for user interface design and user experience, in turn, are considered below:

1. *Command buttons* and any other interactive element in the graphical user interface must be distinguished from other non-interactive elements by size. As interactive objects decrease in size, there is a smaller surface area, requiring a level of precision that increases selection times.

2. *The outer edges and corners* of the graphical user interface can be acquired with higher speed than anywhere else in the display, due to the spinning action of the screen. As the user is restricted in their movements, the pointing device cannot move any further when they reach the farthest points of the screen; fixing the cursor at a point on the periphery of the display. So, the option to use the central services of the website should be provided in those areas

3. *Pop-up* menus better support an immediate selection of interactive elements than dropdown menus as the user does not have to move the cursor from its current position. Therefore, graphical designs that allow the user to interact without moving help to reduce the 'travel time'. For example, if the user clicks on a near appointment, a pop-up menu, with the valid options, give immediate progression rather than dropdown menus, where users may not perceive that more options are available by clicking the appointment.

4. Selecting options within *linear menus*, whether vertical (e.g. dropdown menus) or horizontal (e.g. top-level navigation), takes longer than clicking options in *pie menus* - where choices are arranged in a circle. Travelling distance is minor, and the buttons are larger. To illustrate, if a healthcare website provides services, like booking appointments, chat with doctors, using a chatbot, among others, the home page can contain a pie menu with the services that are considered more important to the website's owners.

5. *Taskbars* unable movement through the interface as they require a more time-consuming level of precision than when options are placed on the outer limits of the screen. Although unconnected to Fitts's Law, multiple taskbars can introduce a certain level of confusion or at the very least require the user to engage consciously with the screen arrangement to ensure appropriate selection.

**Hick's Law**

Having many options to perform a task can affect user performance profoundly. Hick's Law predicts that the time and the effort it takes to decide, increases with the number of options. [26]

This law applies to every single decision among multiple options. Reducing the number of options makes the interface friendlier, and the user commits his actions faster. Like in a "register" process, if a good template is provided to the user, one that helps with the date, address and phone number format or clear spaces to introduce data and error in fields, the user will fill the form much faster and less likely with errors.

In another way, Hick's law cannot be applied to complex decisions, like choosing a doctor to perform an appointment or choosing something to eat. In those case, this law cannot determine the time to decide.

Hick's Law can also affect the design of the website if a user spends much time without making an action, he is probably distracted from the primary goal, and some changes may need to be made. Also, the number of page views can indicate the efficiency of the website.

## 2.3 Heuristic Evaluation

For evaluation purpose, "heuristic evaluation" method will serve to classify the usability problems of the website interface. It does not provide a systematic way to generate fixes to the usability problems or to redesign with better qualities. Still, many usability problems have a quick fix, and due to the systematic evaluation of the website, this method can give significant clues to determine an excellent revised redesign. According to Jakob Nielsen (1995), there are ten general principles for interaction design. They are not guidelines but principles to reach a better interface. An example on where we can use some of these guidelines is presented below:

1. **Visibility of system status**

   For example, in a healthcare website, when someone makes an appointment, the system should immediately give feedback, through some kind, to the user, in order to give him the certainty that the task was completed. Otherwise, he may proceed to make an appointment again due to lack of feedback. Also, the website can compel users to action. If they are making an appointment and see that there are few slots left, they may act in an instant.

2. **Match between system and the real world**

   This is very important for the user to acknowledge what the website is transmitting. Besides, if a

website process is built on a mental model, along with proper design, the users are going to learn how to interact with the UI a lot faster. Also, the best process is built into a conceptual model; the more enjoyable will be for the users.

3. **Error prevention**

   There are two kinds of errors that the users usually make — slips and Mistakes. Slips occur when users intend to perform one action but perform another. Introducing one instead of two when they are registering the date of birth on a website, exemplifies this subject. That could be corrected if a ”confirm data” before the register is provided or using a calendar instead of keyboard input.

   Mistakes happen when users actions are inappropriate, considering the task context. For example, if a power plug indicated light when it was off, many users would misunderstand and connect some cable without any effect.

4. **Recognition rather than recall**

   This heuristic is critical as it is related to the memory concepts mention before. It has a significant impact on users performance and enjoyable flow of tasks. It is faster to recognise some process instead of trying to remember how it is done.

5. **Flexibility and efficiency of use**

   For example, an option to book an appointment with the same doctor as the previous one could help expert users not to repeat the process of booking an appointment with the same doctor. Since in many appointments, the doctors send the patient to do exams, and another appointment is required to discuss those exams.

6. **Help users recognise, diagnose, and recover from errors**

   Error messages are vital, takes the lost feeling from the user away. They should be explicit (like when an email is sent and did not reach the receiver), human-readable language (provide some understandable description for the error instead of system code), polite (instead of blaming the user, provide a clear message of what they are doing wrong), precise and constructive (for example if a healthcare professional is on vacation and cannot perform appointments, the system should provide the date he will be available again).

## 2.4 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.

### 2.4.1 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. An analysis about the old, base, version of Medclick, by using heuristic evaluation, is presented in appendix A on chapter A. Although we already had the foundations to build a proper design, the whole structure needed to be revised.

### 2.4.2 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 2.8 on page 22. 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 2.9 on page 22. 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.

### 2.4.3 Malo Clinic

We only referenced this solution here because it gives the possibility to book an appointment without registration. See figure 2.10 on page 23

### 2.4.4 DocASAP

This solution is a similar one to Medclick's objectives. DocASAP also provides a different option for healthcare providers, depending on insurance, distance and other choosable factors. The interface, although very busy, provides to the user the necessary information, for him to decide what to choose. He can see differently available slots in a week for every provider. See figure A.2 on page 94. Also, he

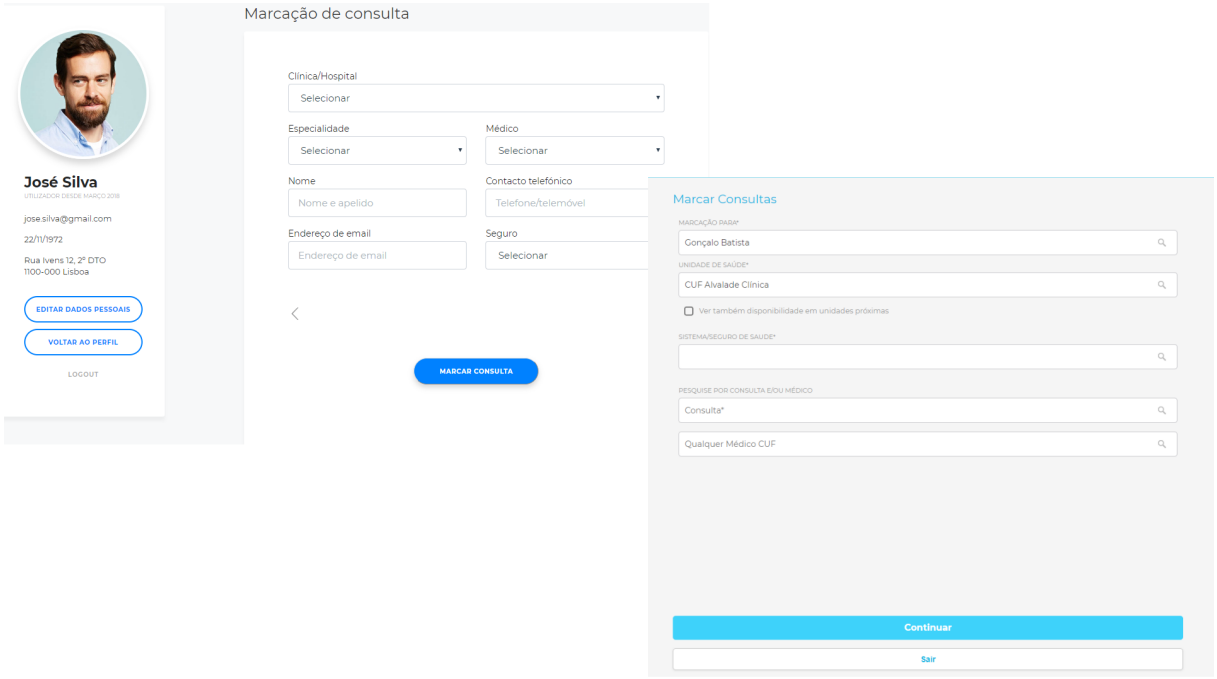


**Figure 2.8:** Similarities between Medclick and Cuf

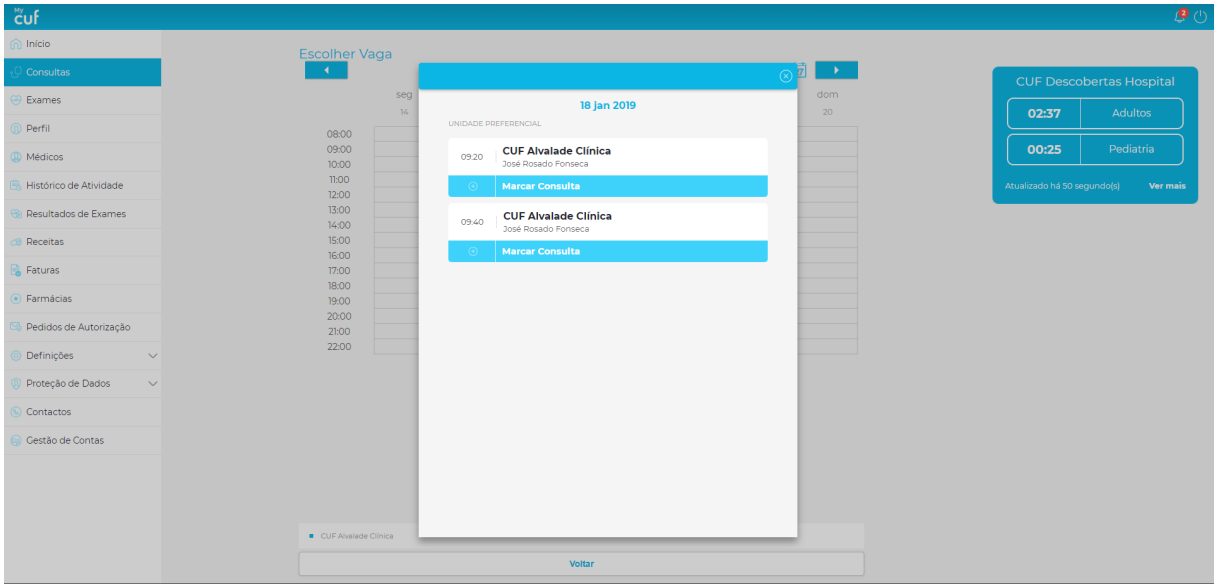


**Figure 2.9:** Cuf calendar to book appointment

can get directions to the location of the healthcare provider. A form gives the possibility to send a self-diagnosis, before booking the appointment, of the reason the user wants to book an appointment. This solution is user-centred. Good UX is retrieved from the usage of this website. This website is legitimate what the practical case should look, after applying the proposed guidelines.

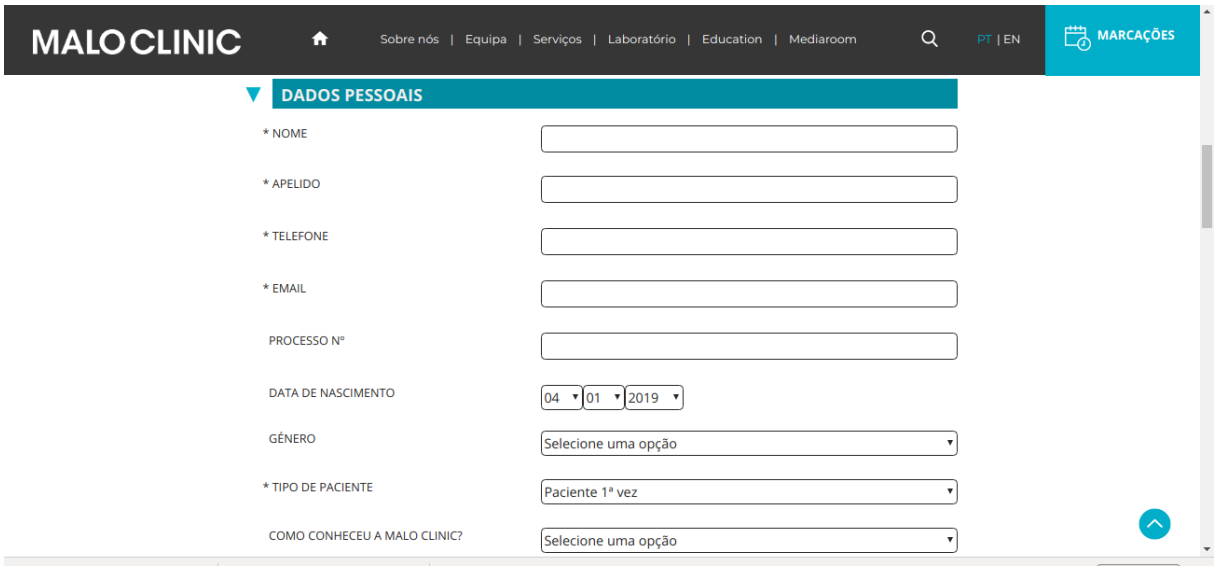


**Figure 2.10:** Malo clinic's form to an unregistered user

### 2.4.5 ZocDoc

Also another solution similar to the above one. This is a more playful solution, although it has a lot of ”noise” in the pages. Also, the colours are pretty eccentric, giving a more electric feeling instead of tranquillity. See figure 2.11, page 23.

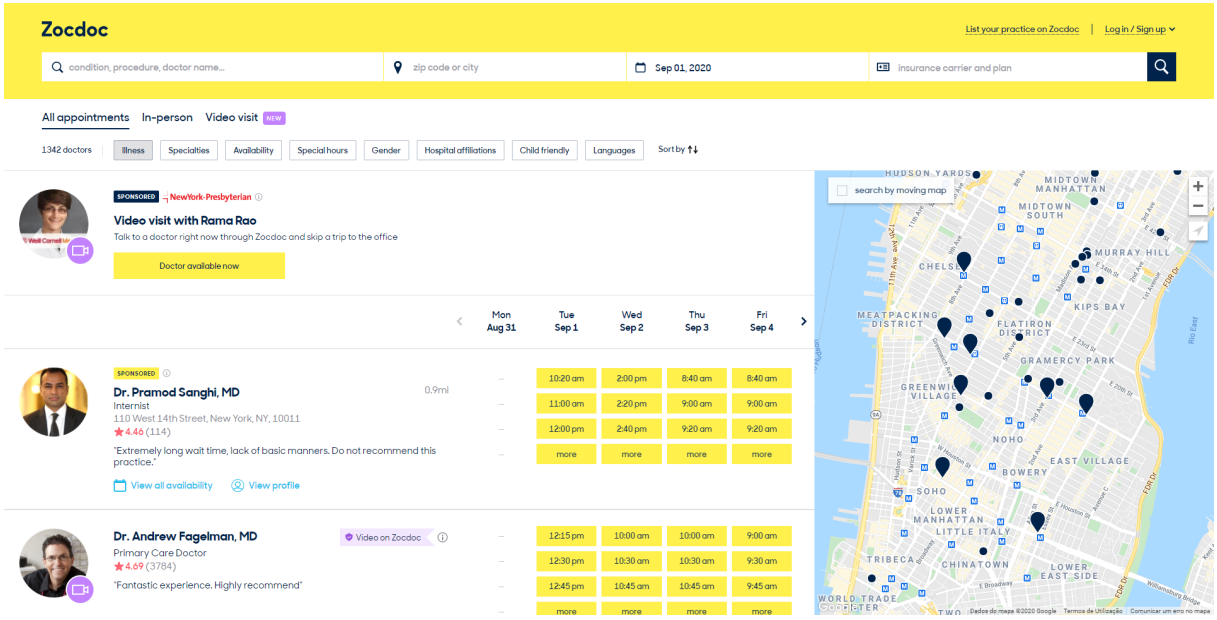


**Figure 2.11:** ZocDoc website

### 2.4.6 Doctoralia

Another online scheduling portal for healthcare needs, see figure 2.12. This website is also available 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 chapter 5, we will see that this design affects the amount of time users take to schedule an appointment.

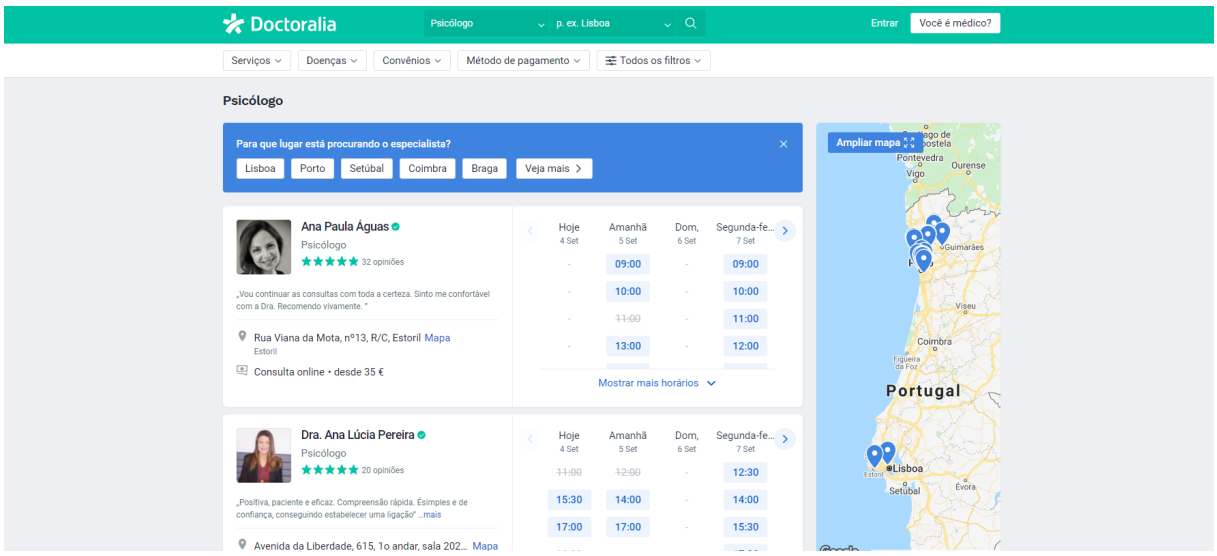


**Figure 2.12:** Doctoralia website

### 2.4.7 Conclusion

The process itself and the basic requirements that Medclik's portal already requests to users, to book an appointment, are very similar or equal to other solutions. The main differences between other solution are in the flow of the process, including the details of every piece of information presented. The heuristic evaluations of these solutions, as well as Medclick's portal, are presented in the appendix A on chapter A. The following tables 2.2, 2.4 and 2.3, represents the issues founded on the heuristic evaluation of Medclick's old portal, DOCASAP and MyCuf respectively. This analysis was performed in the process of booking appointments in each solution. MyCuf's process design is very similar to Meclick's old portal, so as expected, the same type of issues are present, see table 2.2 and 2.3. DOCASAP has a simple flow of actions and design, not showing so many issues on our evaluation, table 2.4.

| Problem Type | Low | Guarded | Elevated | High | Sever | Total Score |
|---|---|---|---|---|---|---|
| 1. Visibility of system status | 0 | 0 | 1 | 0 | 0 | 1 |
| 2.Match between system and the real world | 0 | 0 | 0 | 0 | 1 | 1 |
| 3.User control and freedom | 0 | 1 | 0 | 1 | 0 | 2 |
| 4.Consistency and standards | 0 | 0 | 1 | 0 | 0 | 1 |
| 5.Error prevention | 0 | 2 | 0 | 0 | 0 | 2 |
| 6.Recognition rather than recall | 0 | 0 | 0 | 1 | 1 | 2 |
| 7.Flexibility and efficiency of use | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.Aesthetic and minimalist design | 0 | 0 | 0 | 0 | 2 | 2 |
| 9.Help users recognize, diagnose, and recover from errors | 0 | 1 | 1 | 0 | 0 | 2 |
| 10.Help and documentation | 0 | 0 | 0 | 1 | 0 | 1 |
| Number of problems discovered | 0 | 4 | 3 | 3 | 4 | 14 |
| Percentage of problems discovered | 0% | 29% | 21% | 21% | 29% | |

**Table 2.2:** This table represents the heuristics problems founded ordered by type and severity of Medclick's page

| Problem Type | Low | Guarded | Elevated | High | Sever | Total Score |
|---|---|---|---|---|---|---|
| 1. Visibility of system status | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.Match between system and the real world | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.User control and freedom | 0 | 0 | 1 | 0 | 0 | 1 |
| 4.Consistency and standards | 0 | 1 | 0 | 0 | 0 | 1 |
| 5.Error prevention | 0 | 0 | 2 | 0 | 0 | 2 |
| 6.Recognition rather than recall | 0 | 0 | 0 | 2 | 1 | 3 |
| 7.Flexibility and efficiency of use | 0 | 0 | 1 | 0 | 0 | 1 |
| 8.Aesthetic and minimalist design | 0 | 1 | 1 | 0 | 0 | 2 |
| 9.Help users recognize, diagnose, and recover from errors | 0 | 1 | 0 | 0 | 0 | 1 |
| 10.Help and documentation | 0 | 0 | 0 | 1 | 0 | 1 |
| Number of problems discovered | 0 | 3 | 5 | 3 | 1 | 12 |
| Percentage of problems discovered | 0% | 25% | 41,7% | 25% | 8,3% | |

**Table 2.3:** This table represents the heuristics problems founded ordered by type and severity of Cuf's page

| Problem Type | Low | Guarded | Elevated | High | Sever | Total Score |
|---|---|---|---|---|---|---|
| 1. Visibility of system status | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.Match between system and the real world | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.User control and freedom | 0 | 0 | 0 | 1 | 0 | 1 |
| 4.Consistency and standards | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.Error prevention | 0 | 1 | 1 | 0 | 0 | 2 |
| 6.Recognition rather than recall | 0 | 0 | 0 | 0 | 1 | 1 |
| 7.Flexibility and efficiency of use | 0 | 0 | 1 | 0 | 0 | 1 |
| 8.Aesthetic and minimalist design | 0 | 0 | 1 | 0 | 0 | 1 |
| 9.Help users recognize, diagnose, and recover from errors | 0 | 0 | 0 | 1 | 0 | 1 |
| 10.Help and documentation | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of problems discovered | 0 | 1 | 3 | 2 | 1 | 7 |
| Percentage of problems discovered | 0% | 14,3% | 42,9% | 28,5% | 14,3% | |

**Table 2.4:** This table represents the heuristics problems founded ordered by type and severity of DOCASAP page

# 3

# UX Guidelines for Healthcare Websites

In this chapter we present the UX guidelines aimed to enhance the user experience of healthcare websites. Notice that these guidelines can be applied to any solution. In the next chapter, we redesign and create a new interface, based on those guidelines, so we can test their practicability.

## 3.1 Approach

Our Guidelines are separated in three subsections, the guidelines presented on subsection 3.2.1, are retrieved by using the evaluations done on already existing websites, specifically DOCASAP, MyCuf, ZOCDOC and Doctoralia, presented in the appendix A, chapter A and chapter 5, combined with the UX concepts presented on the chapter 2. 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 [27]. This book already aims to increase the easy-to-use of public websites. Those guidelines are presented on subsection 3.2.2. Along with the guidelines, there will also be a description of why they were elected, based on the needs of healthcare websites, and the UX concepts described on chapter 2. Also, on subsection 3.2.1, we organized the guidelines in the same categories as the ones on subsection 3.2.2.

## 3.2 UX Guidelines

### 3.2.1 Proposed Guidelines from Related Work

#### Design Process and Evaluation

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

#### Optimizing the User Experience

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

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

**GuidelineID-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.

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

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

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

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

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

#### Page Layout

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

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

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

**GuidelineID-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

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

#### Headings, Titles, and Labels

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

**GuidelineID-16** Titles should be bold and in uppercase.

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

#### Text Appearance

**GuidelineID-18** Use 16px as the default font size.

**GuidelineID-19** Use percentage over fixed-size fonts.

**GuidelineID-20** Use Sans Serif font or similar for readability.

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

**GuidelineID-22** Use 50 to 60 characters per phrase.

**Content Organization**

**GuidelineID-23** Items should be provided with their relevant information.

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

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

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

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

### 3.2.2 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 [27]. 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**

**GuidelineID-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.

**GuidelineID-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".

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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 [28]. 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)

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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

**GuidelineID-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.

**GuidelineID-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.

**GuidelineID-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**

**GuidelineID-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.

**GuidelineID-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.

### 3.2.3 Guidelines Retrieved From Heuristic Evaluations

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

**GuidelineID-83** Choose icons that satisfy the information.

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

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

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

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

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

**GuidelineID-89** Build short, as possible, and clear menus.

**GuidelineID-90** Eliminate unnecessary white spaces.

**GuidelineID-91** Be coherent with languages

**GuidelineID-92** Choose appropriated colours to buttons.

**GuidelineID-93** Place labels on unclear elements.

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

# 4

# UX Guidelines Implementation on Medclick's Portal

In this chapter we will present how did we design Medclick's portal and the changes we made, based on the implemented UX guidelines for healthcare websites. Our main goal is to redesign every page within the ”make appointment” use case. Since there are also other use cases related to this one, we will also consider them, such as ”search”, ”manage appointment” and ”no show”. The goal within this UX design process is to build a portal where people can book their appointments safely and quickly while enjoying using it. For that, we will use the UX guidelines for healthcare websites, presented on chapter 3, and apply them to Medclick's portal. Based on the research done, we started by creating the business processes for the use cases described above, so it will be easier to understand the flow and what each party must do in Medclick's portal. Also, it gives us the context of what kind of tasks are included and which type of users are going to use this portal.

## 4.1 Understand

Before we can start the design phase of Medclick's portal, based on the guidelines, we need to understand who is going to use the web portal and what tasks they are going to perform. Medclick already made a functional analysis of the web portal. The functional analysis includes user personas, use cases, tasks, and requirements. Below, we present the current user personas and use cases of Medclick's portal. We only worked on the use of cases related to Anonymous User and Patient.

Given this functional analysis, we were able to select the main use cases for our practical case, only considering the patient-user persona and the anonymous user persona. The anonymous user can only ”search for open appointments”, ”register” and ”authenticate”. The registered patient user can ”search for open appointments”, ”book appointments”, ”Edit/Manage appointments”, ”provide current location” and ”be notified about the appointment”. Below we present the business processes that reflect the functional analysis of Medclick. See figures 4.1, 4.2, 4.3 and 4.4. These process flow were used along with the guidelines to facilitate the design of Medclick's portal.

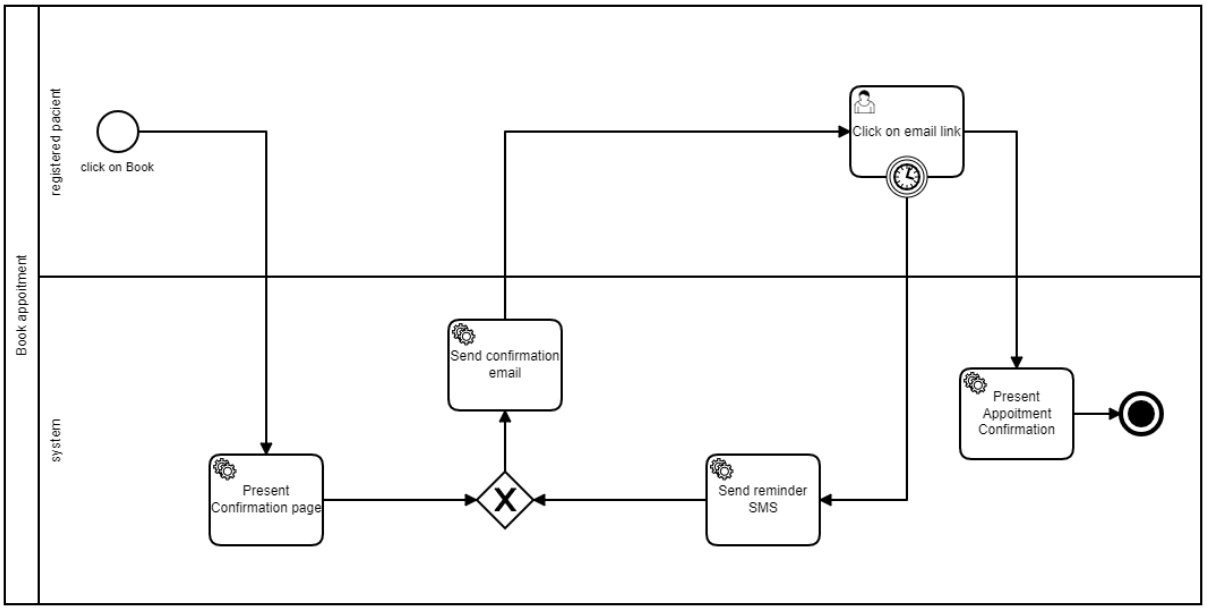


**Figure 4.1:** Process of making an appointment

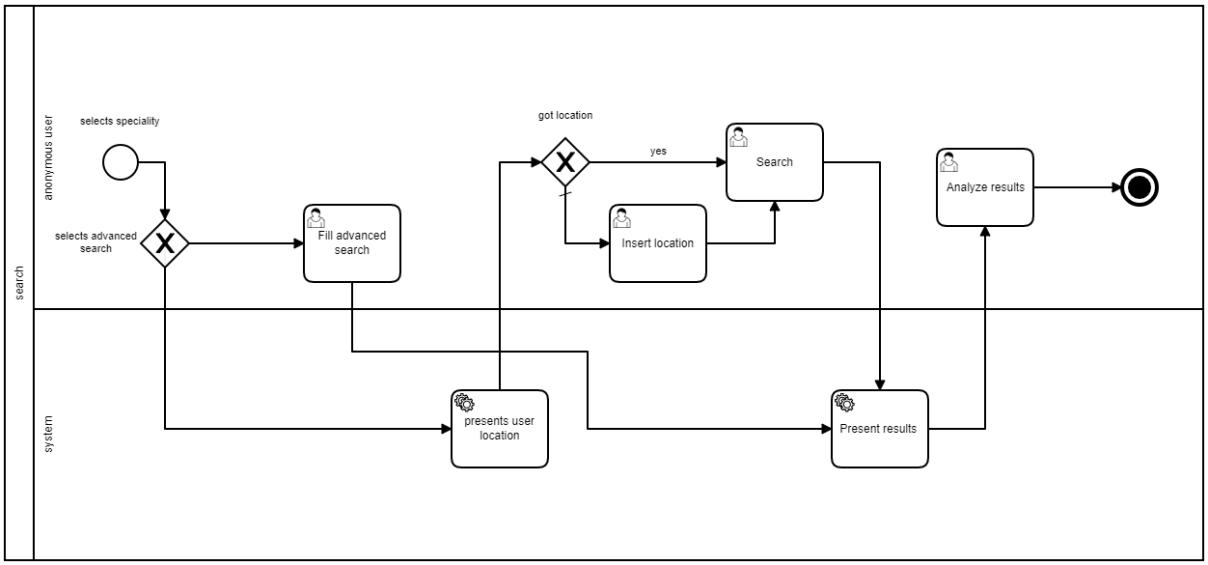


**Figure 4.2:** Process of searching an appointment

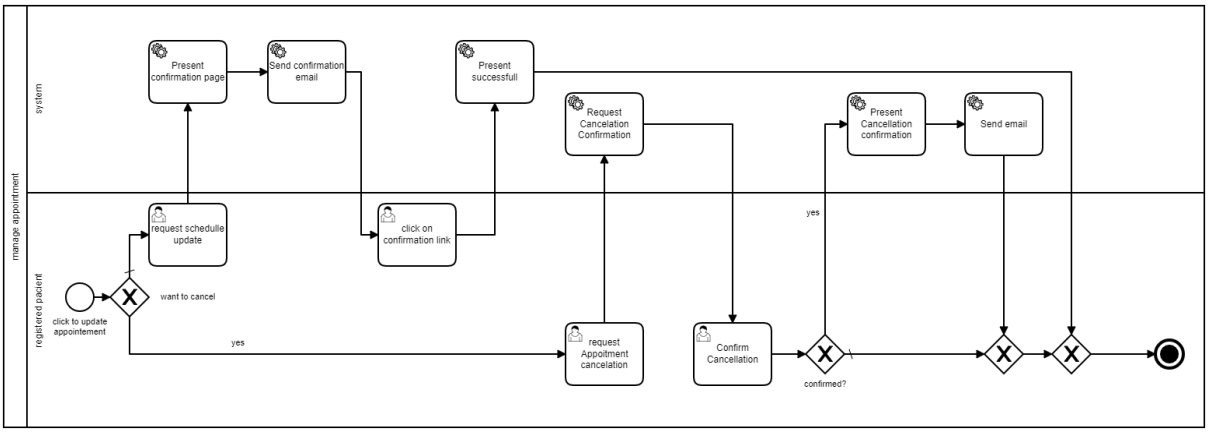


**Figure 4.3:** Process of managing an appointment

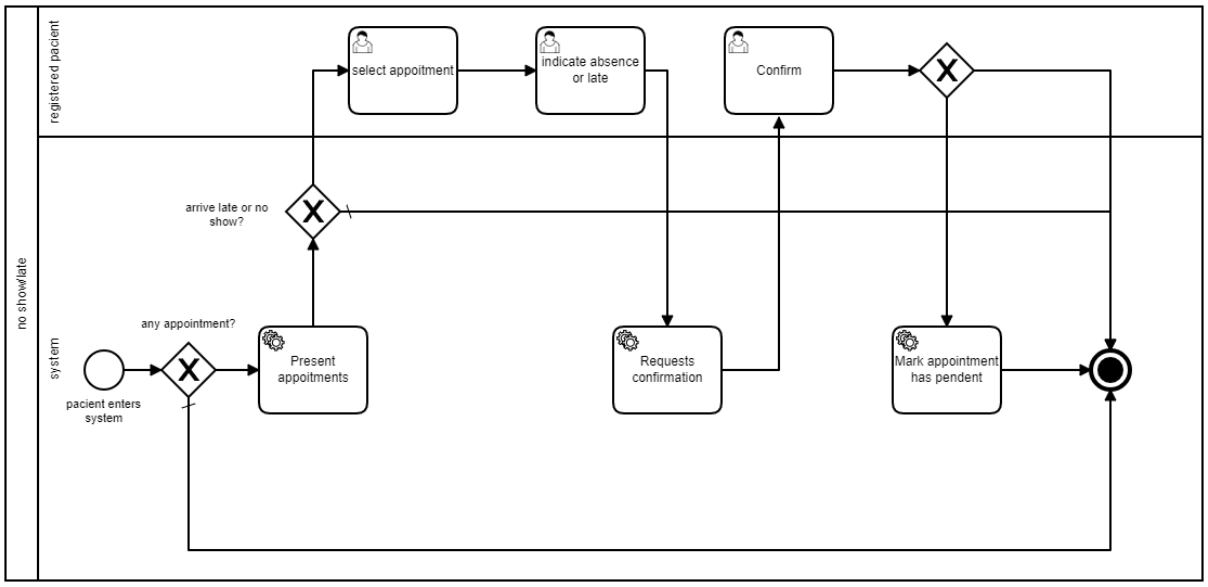


**Figure 4.4:** Process of indicating the absence or late

Observing these business processes and considering business requirements, we made some changes on the task flows of the following use cases:

1. ”Search for open appointment” - We introduced the option of selecting the insurance, since it can better categorise the initial search. Also the we can change the search data while the system presents new results. See figure 4.5.

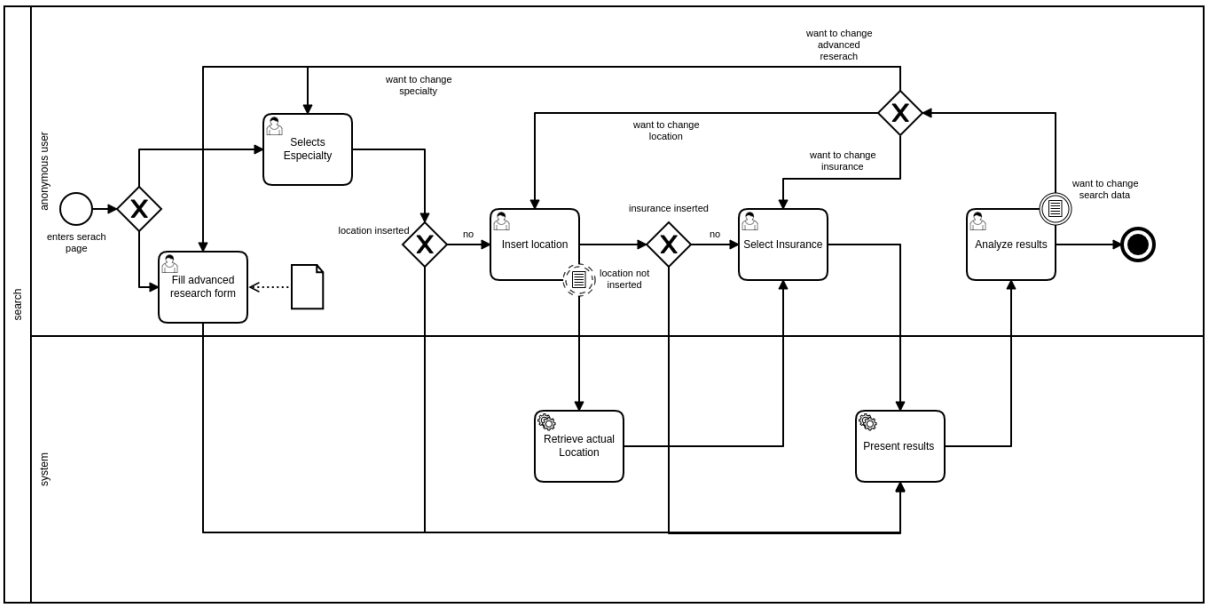


**Figure 4.5:** Correction of the process of searching an appointment

## 4.2 Medclick's Portal Redesign

In this section, we will present some examples of the major changes made to Medclick's portal, based in our guidelines. Complete images are found by visiting Medclick's Portal. Also, we give a list with measures applied, since some are complex to show in a figure.

### 4.2.1 List of Measures Taken

1. **GuidelineID-2** All pages in the Medclick's portal do not block the user from going back.

2. **GuidelineID-3** There are no redirections to different pages unless the user navigates to them. While navigating, no pages are loaded unless it corresponds to the intended page.

3. **GuidelineID-7** The chosen colours for Medclick's portal are blue and white since we want an environment that provides tranquillity, clarity, and purity, as already mentioned in the related work. Then we used some complementary tones or shadows to highlight and evidence other elements of the pages. These colours will be shown throughout every example shown in this section.

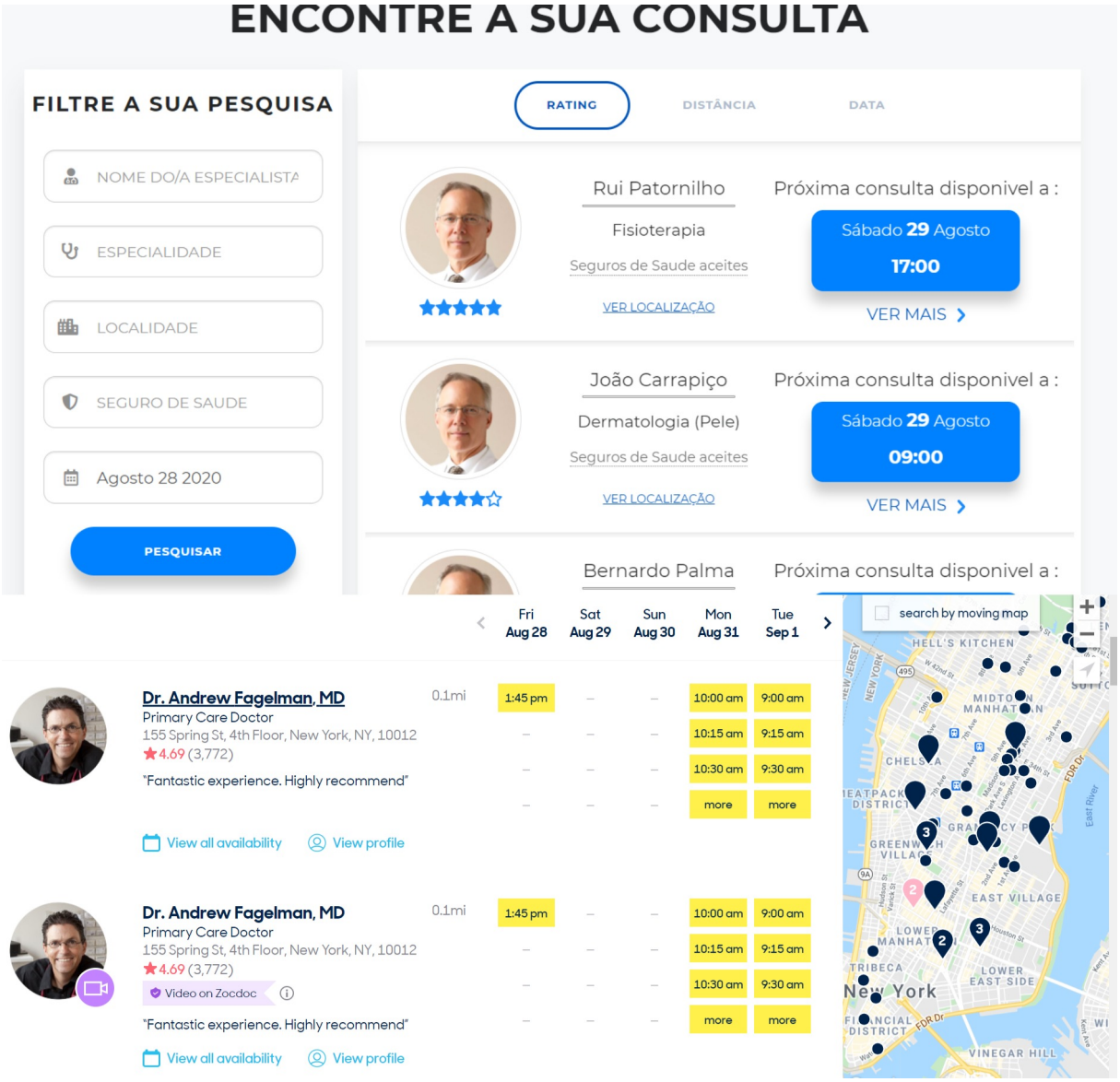


**Figure 4.6:** GuidelineID-7,12,21 example: Medclick's search vs ZocDoc

4. **GuidelineID-8** We followed classic page schemes, such as the navigation bar on top of the page, the logo in the left top corner, the burger menu on the right top side, the contacts in the footer, and more. We also followed the classic flow of booking an appointment by phone, first choosing the speciality, then filtering the available slots regarding the doctors and locations. The objective was to get close as possible to the user so that he would feel in control and familiar using Medclick's portal.

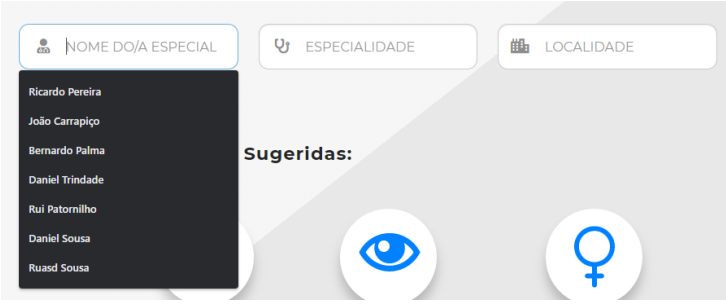


**Figure 4.7:** GuidelineID-8,15 example: self explanatory input on Medclick's portal

5. **GuidelineID-9** On every input box we placed hints for auto-completion or formatted text, like dates. See figures 4.30 and 4.8.

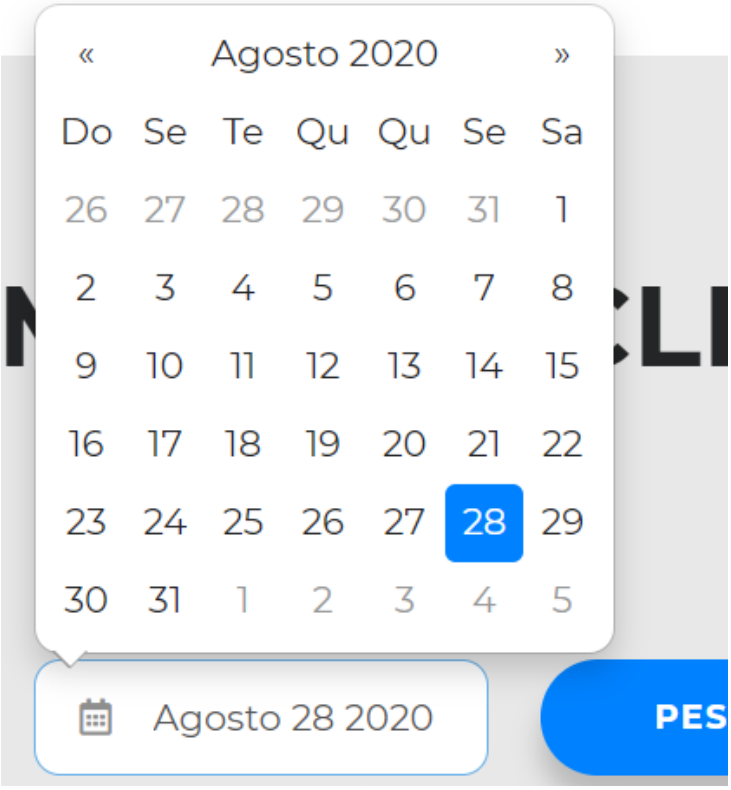


**Figure 4.8:** GuidelineID-9 example: date input box on Medclick's portal

6. **GuidelineID-11** The home page is present first with the goal of the website, booking appointments fast, representing the what. Then the advanced search, since it follows the primary goal. The next frames reflect the how and why of Medclick's portal. When a user searches, the doctors are presented in some relevant order, or by rating, or by distance or by date, see figure4.9. Other examples, such as the doctors that have available appointments appear first than the ones that do

not have, in the profile the first thing a patient sees is their booked appointments, by date order, respects some relevant order.

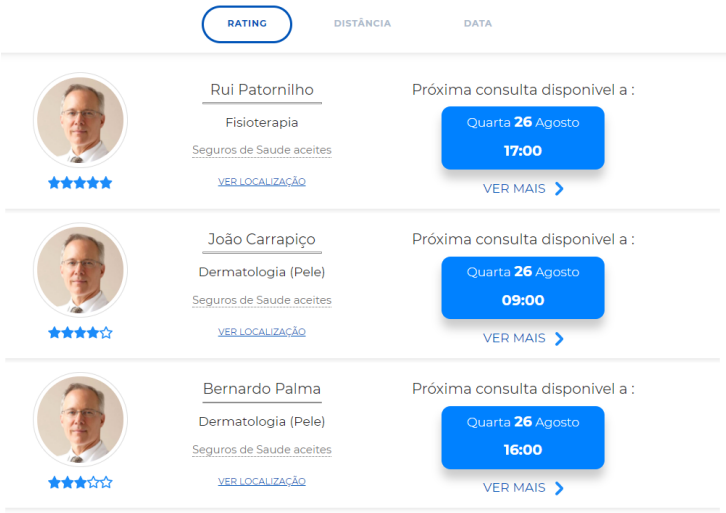


**Figure 4.9:** GuidelineID-6,11,61 example: Doctors order on Medclick's portal

7. **GuidelineID-10,12,13** Medclick's portal was designed for simplicity, we present what is necessary, and we kept the focus on that. Other features can be accessed, but they have located them appropriately. The user is never distracted from page elements that do not belong to the flow of action. An example of this is the home page; we start by the call to action right in the centre and an advance search link, related to the task, below. Then as the user scrolls down, he can see other topics relevant to the website but conveniently displayed, in a particular order. The same happens on the search page; we only present the map to search doctors in the second frame of the page. The first one presents the doctors since it is the main feature. Other websites presented the map along with the doctors, in a right pane, and that caused some frustration because the page seemed flooded, See figure 4.6.

8. **GuidelineID-14** Besides each page having their header's title describing what is intended with the current page, we also placed a page title on every Medclick's page. See figure 4.10.


**Figure 4.10:** GuidelineID-14 example: page title on Medclick's portal

9. **GuidelineID-15** The "speciality" input box, it could have "speciality" label on top of the box, and the place holder can be "Ex: Cardiology", or the placeholder itself could be "speciality", and when the user click it, he can select or write the speciality. This example is again reflected on the search

input boxes, see figure 4.7. When this was not possible, labels were applied, see figure4.11.

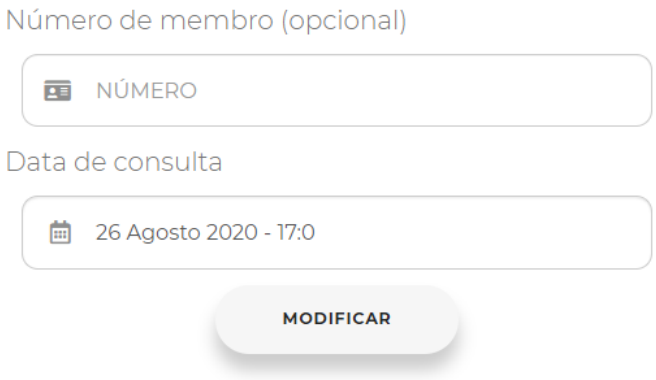


**Figure 4.11:** GuidelineID-15 example: input with labels on Medclick's portal

10. **GuidelineID-16** The only title kept in lower case was in the home page. Since the Medclick's logo is on lower case, the business wanted the home page to keep its consistency. The remaining titles are in bold and uppercase.

11. **GuidelineID-18** 16px was used as the default font size in Medclick's portal.

12. **GuidelineID-19** We did not respect the percentage over fixed-size guideline when developing Medclick's portal. There were already some default fonts define by the business side. They were adjusted to respect the previous guideline.

13. **GuidelineID-20** The business side defined some default fonts. These fonts were already Sans Serif.

14. **GuidelineID-21** There was only used one type of font-family, "Montserrat, Helvetica, Arial, sans-serif" (CSS property). For the weights, we made a combination of 400 and 700. A clear example can be seen in figure 4.12.


**Figure 4.12:** GuidelineID-21 example: fonts and weights used on Medclick's portal

15. **GuidelineID-22** Along with the Medclick's portal, we use simple phrases, short and ambiguous as

possible. Some exceptions respect the will of the business side, but they do not affect the usage of it. Such as the secondary title on the home page.

16. **GuidelineID-23** Every item in Medclick's portal is only presented with its necessary information or information related to it. For example, the list of doctors is provided with their availabilities, locations, profiles, ratings, assurances, and descriptions. Example in 4.13 and 4.14.


**Figure 4.13:** GuidelineID-23,87 example: doctor list item on Medclick's portal

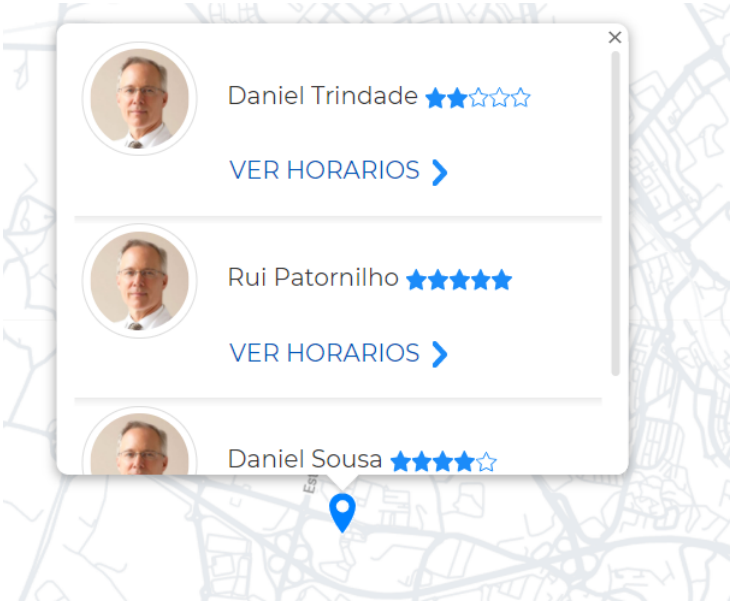


**Figure 4.14:** GuidelineID-23 example: doctors map list on Medclick's portal

17. **GuidelineID-25** When a user is not logged and tries to book an appointment, the process covers the login part, see figure 4.15.


**Figure 4.15:** GuidelineID-25 example: login when the patient is not logged on Medclick's portal

18. **GuidelineID-26** When a user is using a smaller screen, for example, in a smartphone, and the search is presented in a pop-up menu, see figure 4.16.


**Figure 4.16:** GuidelineID-26 example: pop-up search on Medclick's portal

19. **GuidelineID-27** We tried to get all features close as possible to be self-explanatory. We have an excellent flow of actions, with each step described and the elements translate directly to what they perform. Also, we have how it works frame, so the user gets an overall idea of what is expected. See figure 4.17.


**Figure 4.17:** GuidelineID-27,42 example: how it works on Medclick's portal

20. **GuidelineID-28** We applied on Medclick's design a similar process of a phone call to book an appointment, with the appropriate information shown at the supposed action.

21. **GuidelineID-30** During the development of Medclick's portal, some feedback was provided by users in an informal presentation, such as:

    - The call to action button should have a more attractive colour. So, we changed from white to the complementary colour of dodger blue. See figure 4.18.
    - Use the map as a secondary feature, not as the main feature. Example already shown in guideline 20, figure 4.6.
    - A way to simply manage my booked appointments. See figure 4.19.


**Figure 4.18:** GuidelineID-30 example: call to action on Medclick's portal


**Figure 4.19:** GuidelineID-30,58 example: see booked appointments on Medclick's portal

22. **GuidelineID-32** In Medclick's website, if a user starts by searching in the first frame of the home page or the advanced search or on the profile page, it always gets to the same flow. Intentionally

he learns his expectations on what he is about to commit. The same when a user reschedules an appointment, the same calendar with the same buttons appear, so he recognizes the same steps as before.

23. **GuidelineID-33** Every information that the user input on a search is used in the next pages. Also, every information we get from the user profile is used when filling an appointment booking, with the possibility for the user to change it.

24. **GuidelineID-37** We placed Medclick's logo on every page located on the top left corner.

25. **GuidelineID-38** On Medclick's portal we placed the major options in a relevant flow, first the search with the navbar on top that can access login, register and profile, then the advanced search, followed by the why and how then the App promo. Since the most significant function, for now, is to book appointments, that was the focus on the homepage. See figure 4.20.

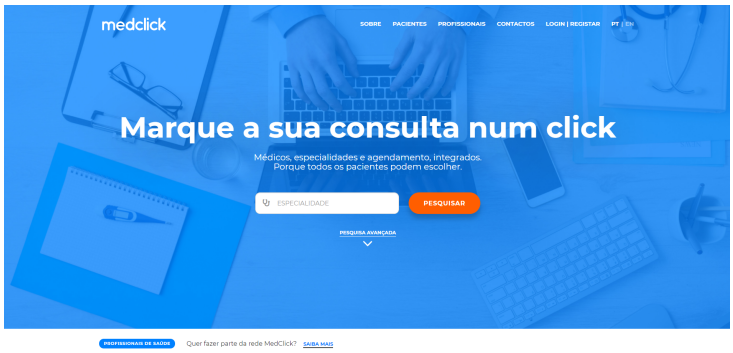


**Figure 4.20:** GuidelineID-38,73,83 example: homepage on Medclick's portal

26. **GuidelineID-39** We used an accessible language and tons of white and blue as already mentioned. Also, we present the home page as clean as possible, considering the business needs.

27. **GuidelineID-40** On Medclick's portal the title, already decided by the business side, communicate its purpose, in Portuguese, "Marque a sua consulta num click", meaning book your appointment in a click. Along with the simplicity of the page, it passes the idea that a user can book an appointment quickly and efficiently.

28. **GuidelineID-41** We reduced Medclick's portal homepage to the information that the business side considered needed and what we wanted to present. We ended up with the call to action in the first place, with the practical options of the website accessible from it, then the how and why followed by the app promo and partners.

29. **GuidelineID-43** Medclick's portal adjusts to a diversity of screen sizes. When the screen gets smaller, we align some elements vertically and use burger menus or pop-ups. When the screen is

bigger, we expand those elements too, where they can be easily accessed.

30. **GuidelineID-44** When booking an appointment, the healthcare providers or optional search method must remain visible while the user changes to search so that he can see the actual changes. See figure 4.21.

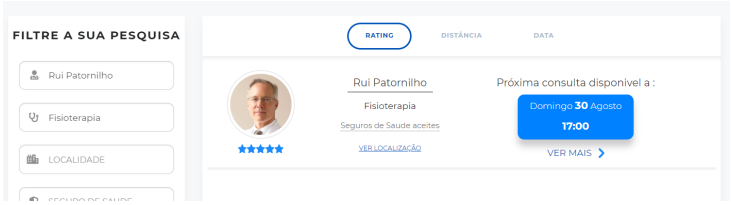


**Figure 4.21:** GuidelineID-44,58 example: search frame on Medclick's portal

31. **GuidelineID-47** Medclick's tab labels reflect precisely where do they go, following usual standards. This could be already seen in figure 4.22.


**Figure 4.22:** GuidelineID-17,47,89 example: page header on Medclick's portal

32. **GuidelineID-48** On Medclick's portal, we just have vertical scrolls.

33. **GuidelineID-49** Each title, label and links are placed accordingly within their frames and reflect the category they are presented on Medclick's portal.

34. **GuidelineID-50** Each page has a respective title on Medclick's portal.

35. **GuidelineID-52** On Medclik's portal, no heading is equal, and they are strictly related to the content presented.

36. **GuidelineID-56** Every text link is consistent with the destination title.

37. **GuidelineID-58** We used a white background and black text for the most important and detailed information on Medclick's portal. Some figures shown above reflect this, such as figure 4.21, 4.19 and 4.23.

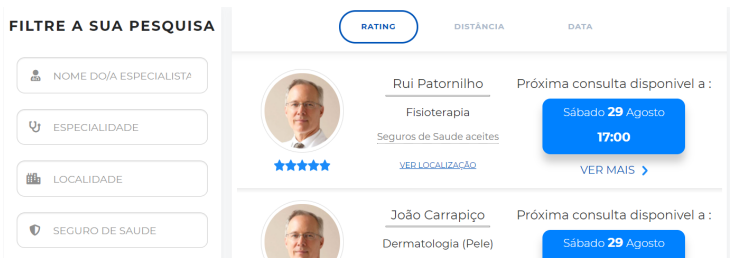


**Figure 4.23:** GuidelineID-13,42,58 example: search pane in the left side and available doctors in the center

38. **GuidelineID-58** We kept navbars, layouts, menus, fonts and other page elements consistent throughout every page.

39. **GuidelineID-60** On Medclick's portal, when we show the list of available doctors, we present it in a meaningful way, or by rating, or by distance or by date. Also, the list is arranged in a way that the doctors with no available slots are placed last. Other features that facilitate the navigation of the list are provided.

40. **GuidelineID-61** The doctor's list makes use of visual attributes to differentiate when one doctor begins clearly, and another ends. Example on figure 4.9.

41. **GuidelineID-67** On Medclick's portal, we use the information already provided every time that is possible, as the information from the patient's profile.

42. **GuidelineID-69** Although showing as many options as possible in a list is a difficult job; we managed to keep visible three doctors on the search page on Medclick's portal.

43. **GuidelineID-70** On Medclick's portal, if a user does not provide a date, we go to the earliest available, when finishing booking, we use the phone number or assurance number if the user-provided it as default information.

44. **GuidelineID-74** On Medclick's portal, we simplified the process of booking an appointment by showing things right when they are needed and not all over the place. The results can be seen in chapter 5.

45. On Medclick's portal, we organized each page by sections, that are meaningful and related.

46. **GuidelineID-79** We kept the flow of actions pretty straight forward for the user and the results were confirmed. See chapter 5.

47. **GuidelineID-80** We did not design a search engine since it goes out of the scope of our work within the Medclick's portal.

48. **GuidelineID-82** We reduced the home page to simple screens with the goal of the website, the how and why, promo app and partners. See figure 4.20.

49. **GuidelineID-85** For now, Medclick's portal only has the ”patient” type of user registered. There is no specialist login. Although in the future a simple description under the name of the user can fit this guideline. See figure 4.24.

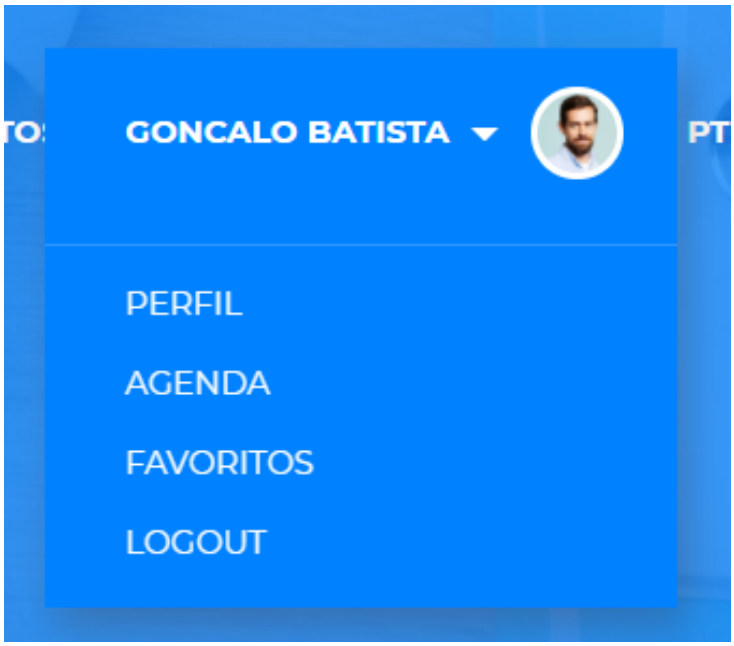


**Figure 4.24:** GuidelineID-85 example: current user menu on Medclick's portal

### 4.2.2 UX Guidelines Implementation Figures

Here, we present some guidelines implementations that are simply expressed in figures.

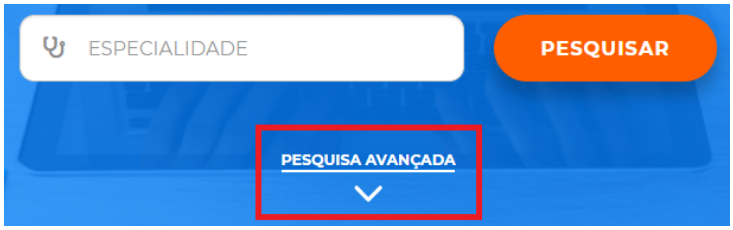


**Figure 4.25:** GuidelineID-4 example: advanced search link on Medclick's portal


**Figure 4.26:** GuidelineID-5 example: confirm appointment on Medclick's portal

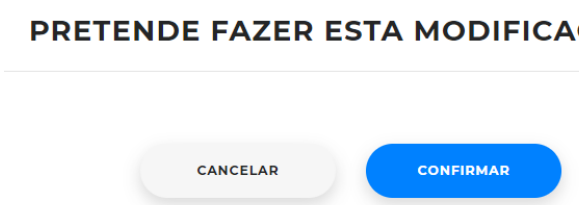


**Figure 4.27:** GuidelineID-5,64 example: change appointment on Medclick's portal

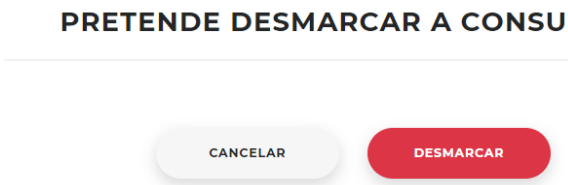


**Figure 4.28:** GuidelineID-5,53,64 example: cancel appointment on Medclick's portal


**Figure 4.29:** GuidelineID-6,42,72,83,87 example: advanced search inputs on Medclick's portal

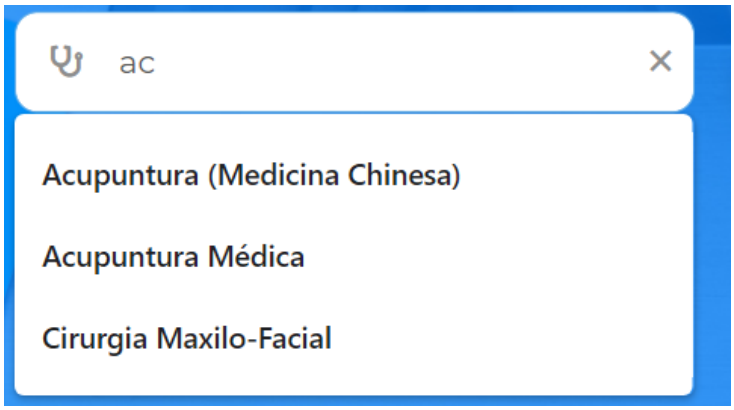


**Figure 4.30:** GuidelineID-9,68,81 example: auto-completion text on Medclick's portal


**Figure 4.31:** GuidelineID-10 example: home hamburger menu on Medclick's portal

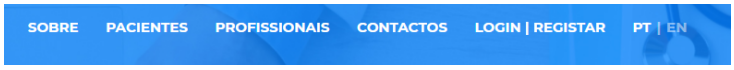


**Figure 4.32:** GuidelineID-10 example: home navigation bar on Medclick's portal


**Figure 4.33:** GuidelineID-16 example: title on Medclick's portal

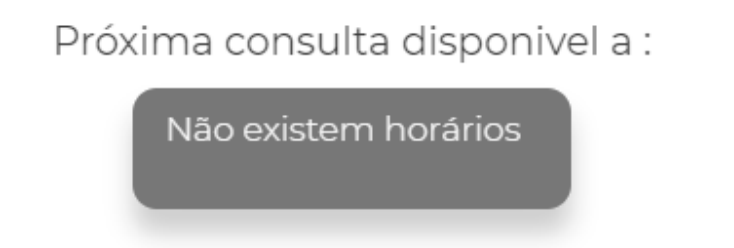


**Figure 4.34:** GuidelineID-24 example: unavailable appointments on Medclick's portal

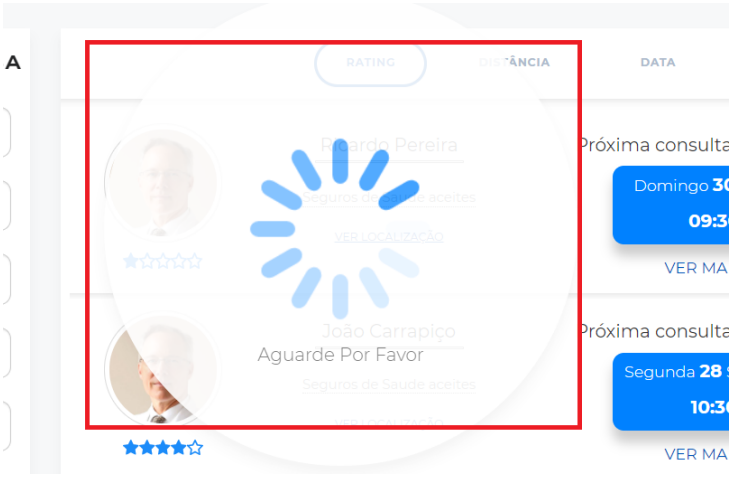


**Figure 4.35:** GuidelineID-34 example: spinning wheel on Medclick's portal

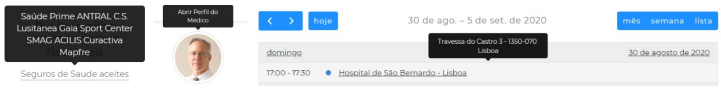


**Figure 4.36:** GuidelineID-35 example: tool tips on Medclick's portal


**Figure 4.37:** GuidelineID-55 example: doctor location on Medclick's portal


**Figure 4.38:** GuidelineID-57 example: mix of images and text links on Medclick's portal

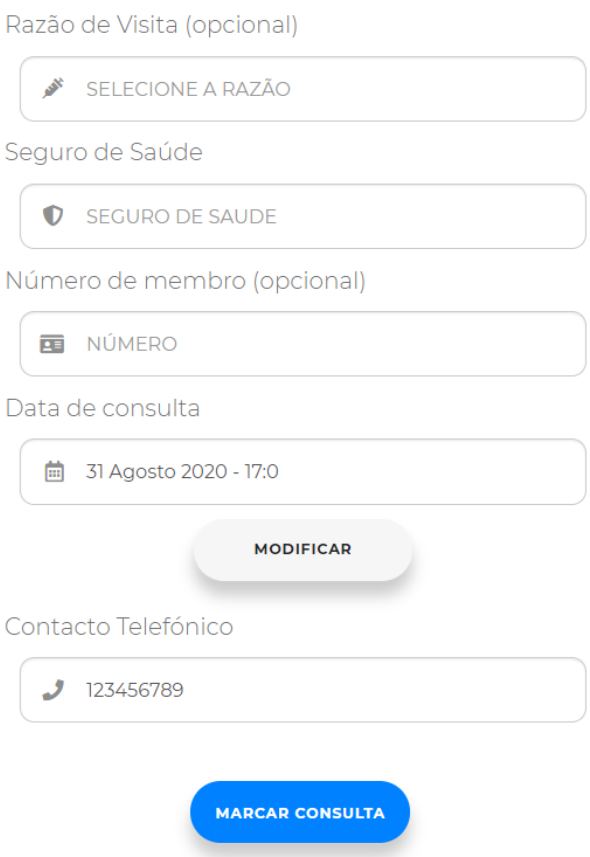


**Figure 4.39:** GuidelineID-63 example: optional and required fields on Medclick's portal


**Figure 4.40:** GuidelineID-68 example: login error on Medclick's portal

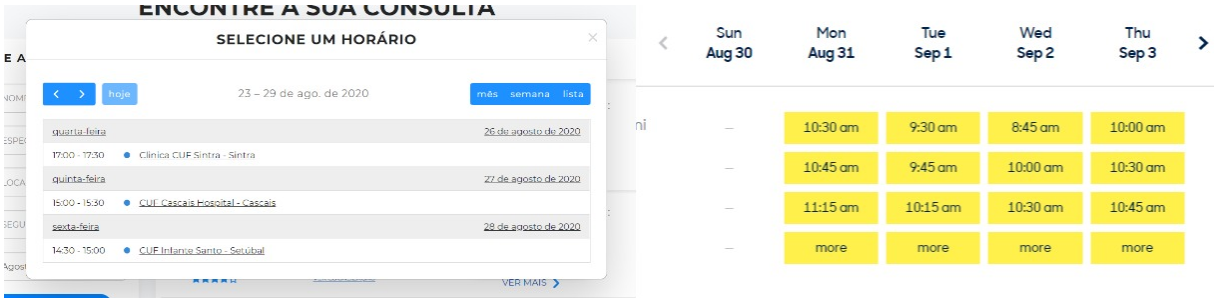


**Figure 4.41:** GuidelineID-88 example: zoc doc week bar vs Medclick's calendar

# 5

# Evaluation

We developed UX-guidelines for healthcare websites, presented on the Implementation chapter. Consequently, we need to evaluate their accuracy. Since we followed a practical case to implement the guidelines, we are going to access if the practical case has good results compared to other solutions that do not follow our guidelines broadly, extracting then the practicability of the guidelines.

The goals of this evaluation are to: access the users' experience during their interaction, by measuring time, clicks and errors, identify problems within the system, by using the expert analysis to get deeper and access the satisfaction of the users and possible improvements through questionnaires. [7].

## 5.1 Expert analysis

As mentioned above, during the design phase, we performed some informal evaluations during meetings with Medclick and others with UX designers and teachers, overall, to access the ongoing design process. However, we need to formally detect flaws in our design and overcome them, consequently adjusting the guidelines. Expert analysis is always subjective, even if following logical walkthroughs since it depends on human factors [7].

The expert methodology we are going to follow, and already applied on previous solutions and described on UX design process evaluation, is the heuristic evaluation. These will assure if the usability of our website, built from the guidelines, is feasible.

### 5.1.1 Heuristic Evaluation

We asked some students and professors from IST to help us provide some heuristic evaluation reports of Medclick's portal. With this, we can identify other mistakes and consistencies, that combined with the user tests could improve our design. The reports can been seen at appendix A, chapter B.

We did not detect any significant flaws in our design, although there is some room for improvement. Notice that we did not develop the entire website, and we strictly imposed the guidelines to the process of booking appointments, since it is the one that we can compare to other websites without significant issues. So, some of the evaluations reports detect issues on areas we did not affect entirely, passing them to future work. Also, the guidelines in general cover the issues detected on the heuristic evaluations, further development on Medclick's Portal to keep the consistency of the guidelines to 100 per cent is required.

## 5.2 User Participation

The heuristic evaluation concentrates on designs and expert evaluators. Even as useful as this method is for refining the design, we still need to access the actual impact on a regular user. This evaluation

tends to occur in the last stages of the UX development process since we need a working prototype. Other methods could be used in the early stages, but since there are a lot of already developed websites like the one we developed, the information we could get from users in early stages was more irrelevant. Websites reviews and users tips online provided what we needed. In this section, we are going to present the evaluation method and results with user participation.

### 5.2.1 Styles of Evaluation

Regardless of the method we choose, there are two distinct styles of evaluation: laboratory and ”on the field” [7]. As Susan Farrel said [29], ”field research is conducted in the user’s context and location. Learn the unexpected by leaving the office and observing people in their natural environment.”. We can get a better insight into the user’s reaction and performance since they do not leave their usual space. This style can be bad when ambient noise, greater movement or interruptions, like phone-calls, come into play [7]. However, this method is preferred, if balanced, to laboratory studies, since we add unexpected behaviours. Regarding our evaluation, ”on the field” is going to be the style chosen.

### 5.2.2 Experimental evaluation

#### Experimental Method

There are two main methods, between-subjects and within-subjects [30]. Since our experiment will include testing multiple websites with multiple independent variables, for a consistent comparison (and since we want to minimise knowledge transfer due to similarities), we are going to use the between-subjects method.

#### Statistical measures

The choice of the statistical analysis depends on the type of data and the questions we want to answer. The following table presented on figure figure 5.1 will help us to decide if we can use a well-known distribution or perform non-parametric tests [7].

### 5.2.3 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 Medclick, Doctoralia and 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. The table has four columns. The first one represents the guideline id, associated with the number of the guideline presented on chapter 3. The following columns represents

| Independent variable | Dependent variable | |
|---|---|---|
| *Parametric* | | |
| Two valued | Normal | Student's *t* test on difference of means |
| Discrete | Normal | ANOVA (ANalysis Of VAriance) |
| Continuous | Normal | Linear (or non-linear) regression factor analysis |
| *Non-parametric* | | |
| Two valued | Continuous | Wilcoxon (or Mann–Whitney) rank-sum test |
| Discrete | Continuous | Rank-sum versions of ANOVA |
| Continuous | Continuous | Spearman's rank correlation |
| *Contingency tests* | | |
| Two valued | Discrete | No special test, see next entry |
| Discrete | Discrete | Contingency table and chi-squared test |
| Continuous | Discrete | (Rare) Group independent variable and then as above |

**Figure 5.1:** Choosing a statistical technique [7]

the three portals to test, containing the value "x" or "-", to represent respectively if they do (green) or do not (red) fulfil the guideline. See table 5.1.

| Guideline-ID | Doctoralia | MyCuf | Medclick |
|---|---|---|---|
| 1 | x | - | x |
| 2 | x | x | x |
| 3 | - | x | x |
| 4 | - | - | x |
| 5 | x | x | x |
| 6 | - | - | x |
| 7 | - | - | x |
| 8 | x | x | x |
| 9 | - | x | x |
| 10 | x | x | x |
| 11 | x | x | x |
| 12 | - | x | x |
| 13 | - | x | x |
| 14 | - | x | x |
| 15 | - | x | - |
| 16 | x | x | x |
| 17 | x | x | x |
| 18 | x | x | x |
| 19 | - | x | x |
| 20 | - | - | x |
| 21 | x | - | x |

Table 5.1 continued from previous page

| Guideline-ID | Doctoralia | MyCuf | Medclick |
|---|---|---|---|
| 22 | x | x | x |
| 23 | x | x | x |
| 24 | - | - | x |
| 25 | x | - | x |
| 26 | - | x | x |
| 27 | x | x | x |
| 28 | - | x | x |
| 29 | x | x | x |
| 30 | x | x | x |
| 31 | x | x | x |
| 32 | - | x | x |
| 33 | x | - | x |
| 34 | x | x | x |
| 35 | - | x | x |
| 36 | - | x | x |
| 37 | - | x | x |
| 38 | - | - | x |
| 39 | - | x | x |
| 40 | x | - | x |
| 41 | x | - | x |
| 42 | - | - | x |
| 43 | x | x | x |
| 44 | x | - | x |
| 45 | - | x | x |
| 46 | - | x | x |
| 47 | - | x | x |
| 48 | x | x | x |
| 49 | - | x | x |
| 50 | x | x | x |
| 51 | - | x | x |
| 52 | x | x | x |
| 53 | x | x | x |
| 54 | x | x | x |
| 55 | x | x | x |
| 56 | x | x | x |
| 57 | x | x | x |
| 58 | x | - | x |
| 59 | x | - | x |
| 60 | - | x | x |
| 61 | x | - | x |
| 62 | x | x | x |
| 63 | x | x | x |
| 64 | x | x | x |
| 65 | x | x | x |
| 66 | - | x | x |
| 67 | x | x | x |
| 68 | - | x | x |
| 69 | x | x | x |
| 70 | x | x | x |

**Table 5.1 continued from previous page**

| Guideline-ID | Doctoralia | MyCuf | Medclick |
|---|---|---|---|
| 71 | x | - | x |
| 72 | x | x | x |
| 73 | x | x | x |
| 74 | - | x | x |
| 75 | - | - | x |
| 76 | x | - | x |
| 77 | - | - | x |
| 78 | - | x | x |
| 79 | - | x | x |
| 80 | - | - | - |
| 81 | x | - | x |
| 82 | x | - | x |
| 83 | x | x | x |
| 84 | - | x | x |
| 85 | - | x | x |
| 86 | x | x | x |
| 87 | x | x | x |
| 88 | - | x | x |
| 89 | - | x | x |
| 90 | x | x | - |
| 91 | - | - | x |
| 92 | - | x | x |
| 93 | x | - | x |
| 94 | x | x | x |
| **Total in %** | **56,38297872** | **71,2765957** | **96,8085106** |

**Table 5.1:** Guidelines percentage per website

After we detect the number of guidelines the websites follow, we conducted user tests with the same tasks per website so we can have independent values and directly comparable. We identified as test parameters the amount of time users took per task, see tables 5.3, 5.2 and 5.4, the amount of clicks, see tables 5.6 and 5.7, and the amount of errors. The number of errors gave no relevant values. The maximum amount of error we registered was one in a tasks so we cannot make inferences upon that amount. Also, we tested with ten different users per website, making a total of thirty users. With these results, we can try to correlate the effects of the guidelines. Notice that in both tables of MyCuf results, we did not measure the task ”Search for available appointments and order by doctor rating” because the doctors in their portal do not have that attribute.

**Time Results** First, we start by analysing the time results. We immediately notice a big difference between Medclick and the other solutions. Also, notice that for more complex tasks, MyCuf got a better average time than Doctoralia. Since MyCuf follows more guidelines than Doctoralia, it also provides confidence in our guidelines. By analysing the average time chart, figure 5.4, we see that Medclick got a noticeable difference from the other solutions. Proving that users take less time to perform significant

| TASK-ID | Tasks - Doctoralia | AVERAGE TIME / S | STANDARD DEVIATION |
|---|---|---|---|
| 1 | Search for any available appointments | 13,30 | 2,406010991 |
| 2 | Book any appointment | 58,00 | 14,67424047 |
| 3 | Search for a Dermatology appointment | 18,70 | 18,90943327 |
| 4 | Book any appointment at least for a month from now | 51,20 | 15,0981971 |
| 5 | Search for available appointments and order by doctor rating | 49,40 | 15,6432449 |
| 6 | Book the earliest available appointment | 46,70 | 23,5893102 |
| 7 | Book a Ginecology appointment at least 3 days from now in Lisbon | 33,60 | 10,87504789 |

**Table 5.2:** Doctoralia time results in seconds per task

| TASK-ID | Tasks - Medclick | AVERAGE TIME / S | STANDARD DEVIATION |
|---|---|---|---|
| 1 | Search for any available appointments | 6,30 | 2,162817093 |
| 2 | Book any appointment | 24,50 | 5,1261855 |
| 3 | Search for a Dermatology appointment | 7,45 | 4,112649862 |
| 4 | Book any appointment at least for a month from now | 33,70 | 7,789594199 |
| 5 | Search for available appointments and order by doctor rating | 11,60 | 7,058485831 |
| 6 | Book the earliest available appointment | 17,40 | 4,452215429 |
| 7 | Book a Ginecology appointment at least 3 days from now in Lisbon | 24,90 | 5,646040894 |

**Table 5.3:** Medclik time results in seconds per task

| TASK-ID | Tasks - MyCuf | AVERAGE TIME / S | STANDARD DEVIATION |
|---|---|---|---|
| 1 | Search for any available appointments | 44,00 | 13,19932658 |
| 2 | Book any appointment | 38,70 | 16,02810032 |
| 3 | Search for a Dermatology appointment | 34,20 | 16,55160281 |
| 4 | Book any appointment at least for a month from now | 37,10 | 9,926955447 |
| 5 | Search for available appointments and order by doctor rating | 0,00 | 0 |
| 6 | Book the earliest available appointment | 34,60 | 13,07414752 |
| 7 | Book a Ginecology appointment at least 3 days from now in Lisbon | 35,00 | 17,7263144 |

**Table 5.4:** MyCuf time results in seconds per tasks

tasks using Medclick. One major flaw the other websites had that affected the time performance was the calendar design and filter/order options. To better explain our results, by following figure 5.1, 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 5.2 and 5.3. Notice that the results are represented per task.

By analysing figure 5.2, 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. Although the third task, since it is a subset of the first one, did not present a meaningful value. That means both solutions were sufficiently learnable for the user to repeat some steps.

In contrast with Doctoralia, MyCuf got better results. Nevertheless, Medclick still got a substantial advantage in the overall, proving that our guidelines had an impact on users' time performance. Also notice that since MyCuf follows more guidelines than Doctoralia, this was an expected result.

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 correlation, we got three solutions that follow a significant difference of guidelines. By analysing table 5.5 and figure 5.5, we notice that the correlation was, in fact, strong, 0.998877, also we got a good fit

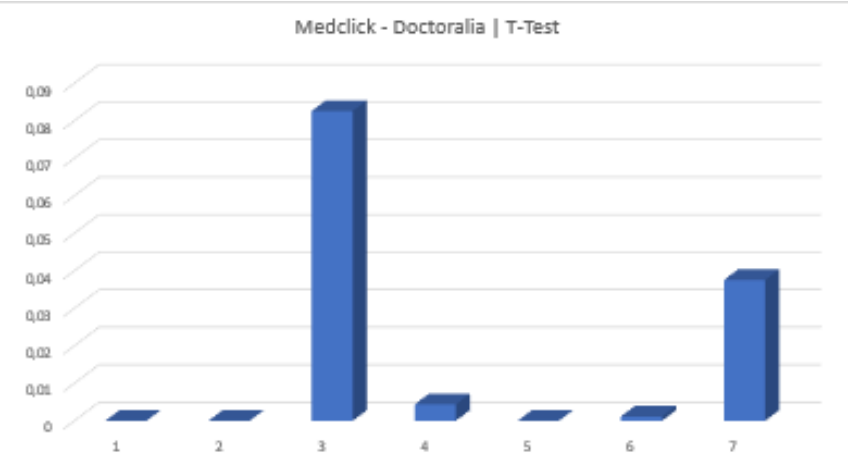


**Figure 5.2:** T-Test Medclick - Doctoralia results per TASK-ID

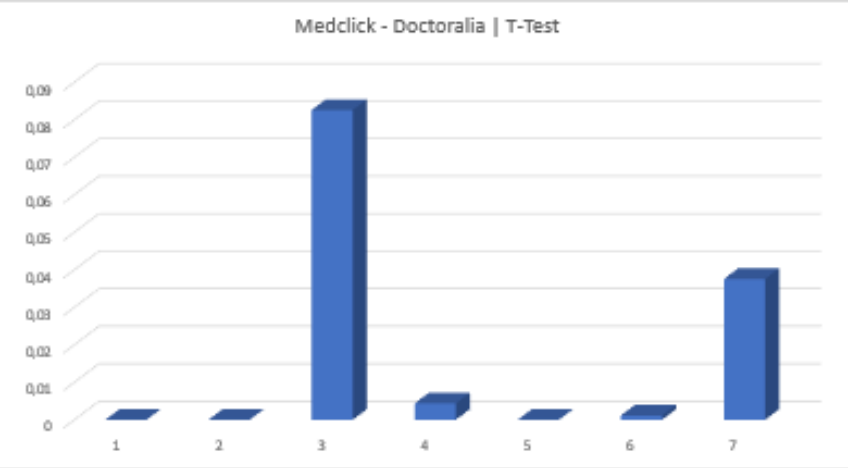


**Figure 5.3:** T-Test Medclick - MyCuf results per TASK-ID

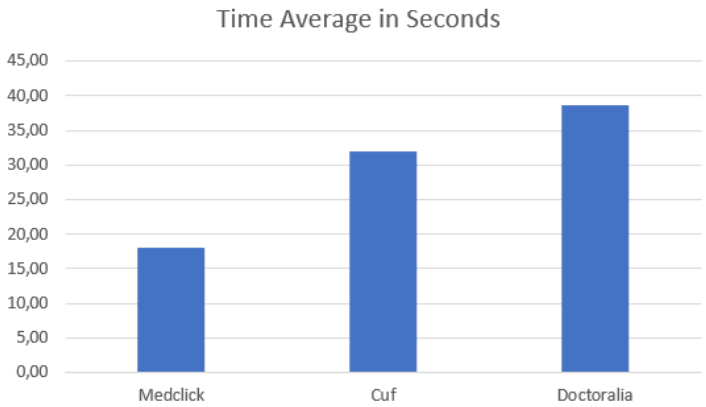


**Figure 5.4:** Time average results per website

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.

**LINEAR REGRESSION - AVERAGE TIME X %GUIDELINES**

**SUMMARY OUTPUT**

| Regression Statistics | |
|---|---|
| **Multiple R** | 0,998877208 |
| **R Square** | 0,997755676 |
| **Adjusted R Square** | 0,995511352 |
| **Standard Error** | 1,369743268 |
| **Observations** | 3 |

**ANOVA**

| | df | SS | MS | F | Significance F |
|---|---|---|---|---|---|
| **Regression** | 1 | 834,097849 | 834,097849 | 444,5685 | 0,030170707 |
| **Residual** | 1 | 1,87619662 | 1,87619662 | | |
| **Total** | 2 | 835,9740456 | | | |

| | Coefficients | Standard Error | t Stat | P-value | Lower 95% | Upper 95% | Lower 95.0% | Upper 95.0% |
|---|---|---|---|---|---|---|---|---|
| **Intercept** | 131,9096593 | 2,820625232 | 46,7661063 | 0,013611 | 96,07021766 | 167,749101 | 96,07021766 | 167,749101 |
| **X Variable 1** | -1,932499799 | 0,091653727 | -21,084792 | 0,030171 | -3,097070824 | -0,767928774 | -3,097070824 | -0,767928774 |

**Table 5.5:** Linear regression time x guidelines percentage followed results

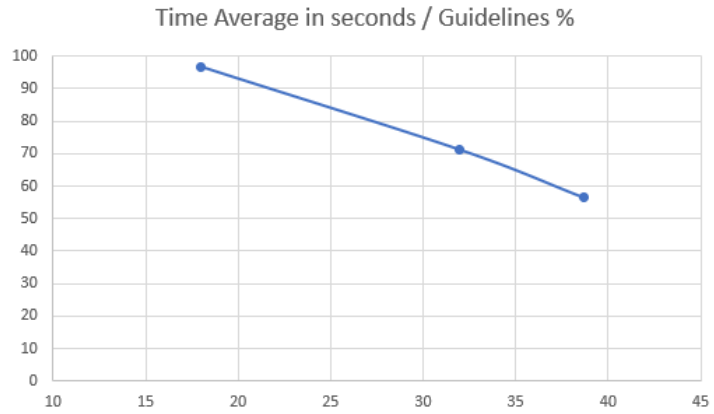


**Figure 5.5:** Linear regression time x guidelines percentage followed graph

### Clicks Results

Now, we move to the evaluation of the click test results. Again by analysing the different solutions, tables 5.6 and 5.7, Medclick had a significant difference, not just statistically, but also during the tests. Users complain about other design flaws that made them confused and frustrated, making them click on unnecessary items.

Then, 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 5.7 and 5.6.

| 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 5.6:** 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 5.7:** Poisson distribution test Medclick - MyCuf

### 5.2.4 Query techniques

We used an experimental design to access our primary goal, assert if our guidelines are practical and give the user the most comfortable design to address his healthcare needs. For simplicity, has shown above, we only compared the response times the users took to perform their tasks. Now, we will address this technique to get more feedback about our design, from the perspective of the user, regarding visual concepts.

This technique relies on asking the user about the interface directly, getting a more detailed view of the system, by the user. The philosophy, ”ask the user”, is stated as the best way to find out if the system meets the users’ requirements. Consequently, this technique gives us the advantage of getting the users’ viewpoint directly that could give us issues that were not considered. Query Techniques are a supplementary approach since the feedback is always subjective and dependant of the users’ knowledge of this kind of systems [7]. There are two types of query techniques: interviewees and questionnaires. We are only going to use questionnaires since we want to do it in a larger group and a direct and straightforward way to analyse the results. This method is less flexible, but it can reach more users, and it is easier to administer.

#### Purposed Questionnaire

The full proposed questionnaire can be found on Google Forms.

The main objective of this questionnaire is to catch the feeling of the user and the usefulness of Medclick's website. Also, trying to understand which functionalities would be valuable for the user, such as paying with MbWay or an automatised contact (BOT).

**Questionnaire Results**

From an overall reaction, we got good results. Medclick's portal was enjoyable to use; around 80 per cent felt very satisfied with it and could find exactly what they were looking for, see figures 5.6 and 5.7. The easiness of navigation was much higher than expected, although the accuracy of information still needs to be improved. Regarding the design, the majority voted above the expected, but some still think there is some work to do, from the suggestion below regarding the design a user refers that the website should look ”younger”. Nevertheless, the majority liked the new design of the calendar and the efficiency of booking appointments, also proven in the user tests. Regarding the functionalities, we cover the majority of what the users considered the most important, lacking the automatised contact that Medclick is already developing and can be inserted in this portal, see figure 5.8. Regarding the filter options for the availabilities, we also covered what the users considered crucial, also noting that a ”special hours” filter can be added, but it is not considered a must-have, see figure 5.8. Around 70 per cent of the users consider to use Medclick to book their appointments, so we got what we wanted with this work, a useful and enjoyable website that makes people want to use to ease their lives, 5.9. Considering the functionality of having Medclick processing the payment of the appointments, we asked the users the preferred method. They gave more value to pay with MbWay, 70 per cent, and the other options were even. Overall we got a very impressed first reaction, 80 per cent, and the users felt familiarised with the portal. An essential measure is if the users felt in control, and we got 90 per cent of users that felt it, proving that the website is user friendly along with the time and clicks the users took on the practice tests. Regarding the text presentation, the users considered pretty much readable, 90 per cent high or very high. Overall the users considered that the easiness of use was the best topic on our website. One of the topics that the users liked less was to register, so a refactor of this page should be considered. Medclick's portal was considered very appealing.

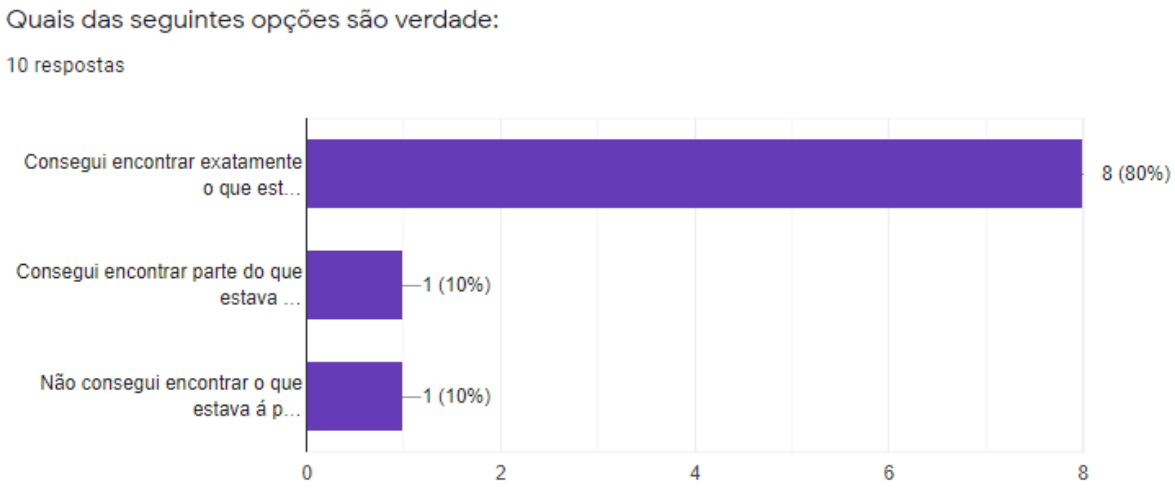


**Figure 5.6:** Users feedback on finding what they were looking for

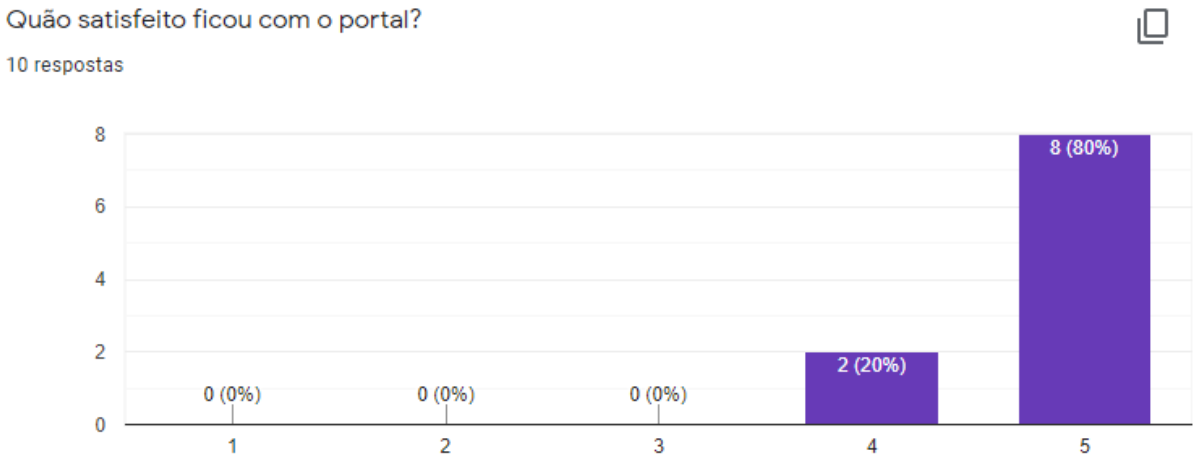


**Figure 5.7:** Users satisfaction by using Medclick

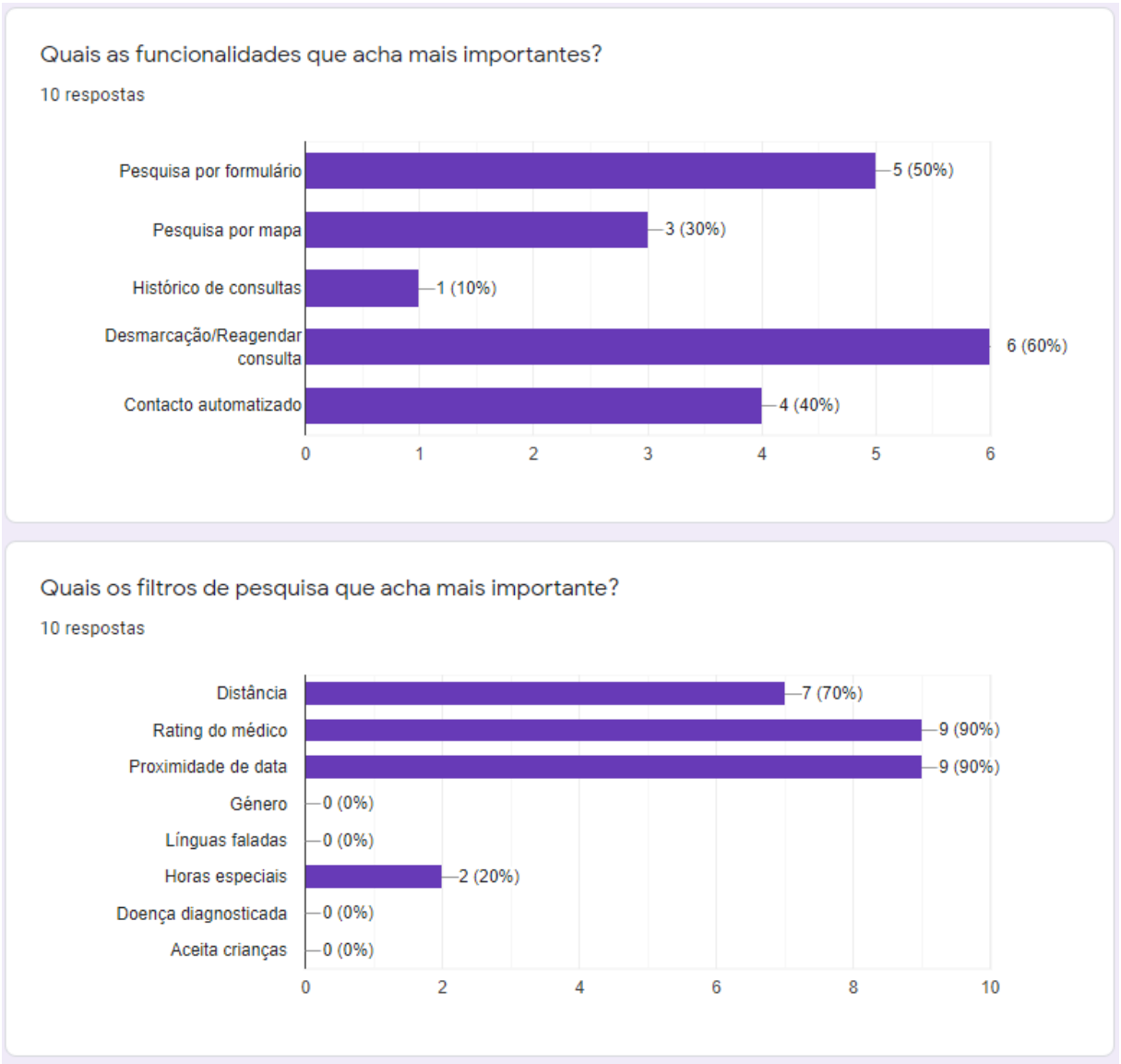


**Figure 5.8:** Users feedback on most important features and filters

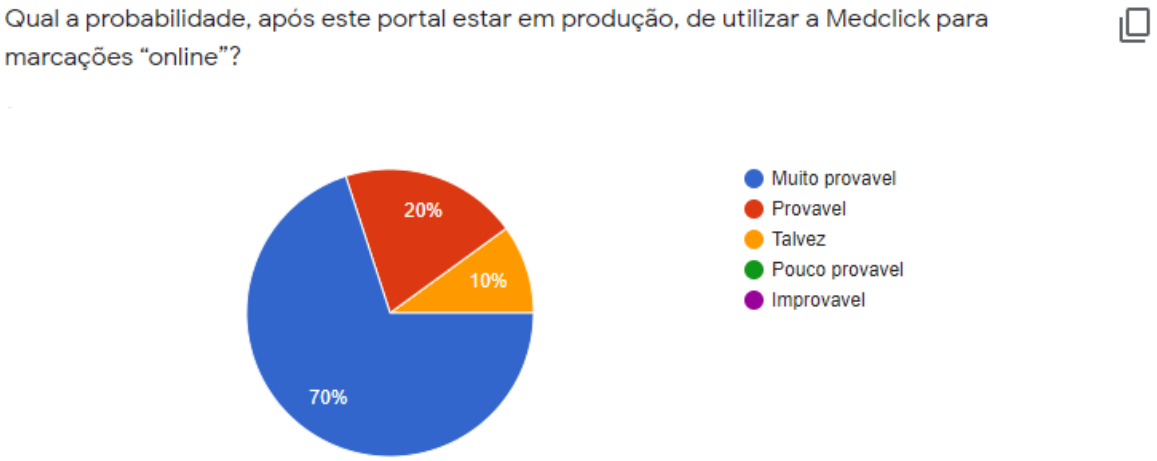


**Figure 5.9:** Users choice of online booking appointments portal

# 6

# Conclusion

## 6.1 Achievements

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 related to UX design concepts, such as ”Page Layout”, ”Text Appearance” ”Content Organization” and more. These guidelines were retrieved by analyzing different healthcare online booking solutions, detecting main flaws and advantages, combined with the UX concepts presented in chapter 2. Also, we took advantage of a published book with already developed guidelines made for public websites with strong evidence of appliance [27]. 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 improve the user experience of it. We redesign the entire homepage and its features, such as menus, navbars, advanced search, call-to-action page. We also built the entire search flow, the available doctors, the calendar, filtering options and more. We also consolidated the booked appointments with the profiles so the user was able to reschedule appointments and cancel. In sum, we redesign all pages affected by the main use case, ”make an appointment”.

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 less time to perform tasks, around forty-four per cent faster than MyCuf and fifty-four per cent faster than Doctoralia. Also, Medclick users took less forty-four per cent clicks to perform tasks in MyCuf and less forty-nine per cent on Doctoralia. 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.

## 6.2 Limitations and Future Work

User experience, although it is not a new concept, is very subjective to some point. Every year new methods and design fashions arise, making it difficult to turn into a scientific perspective. Regarding the testing, we got some limitations. First, we could not test all the features in the solutions used, like reschedule or cancel appointments, that would imply booking real appointments and making real registrations. Also, since we rely on user testing that requires physical presence, we could only test three solutions with ten people per each, due to the current pandemic situation. As mentioned above, the guidelines are volatile, and they need to be put in the production world, so they reach their full potential. Also, these guidelines should be better adjusted to mobile healthcare apps since it is common to have both solutions. A next idea would be to create templates of designs that follow these guidelines and that are customisable. Also, a ”guideline checker” could be a good solution for designers and developers to be flagged on founded issues and decide upon them.

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# A

# Heuristic Evaluation Reports - Related work

Given the terms and process described in the related work section, we will perform here a demonstration of heuristic evaluation with the chosen websites, including Medclick's craft. We only considered this evaluation for the process of making appointments.

### A.0.1 Medclick

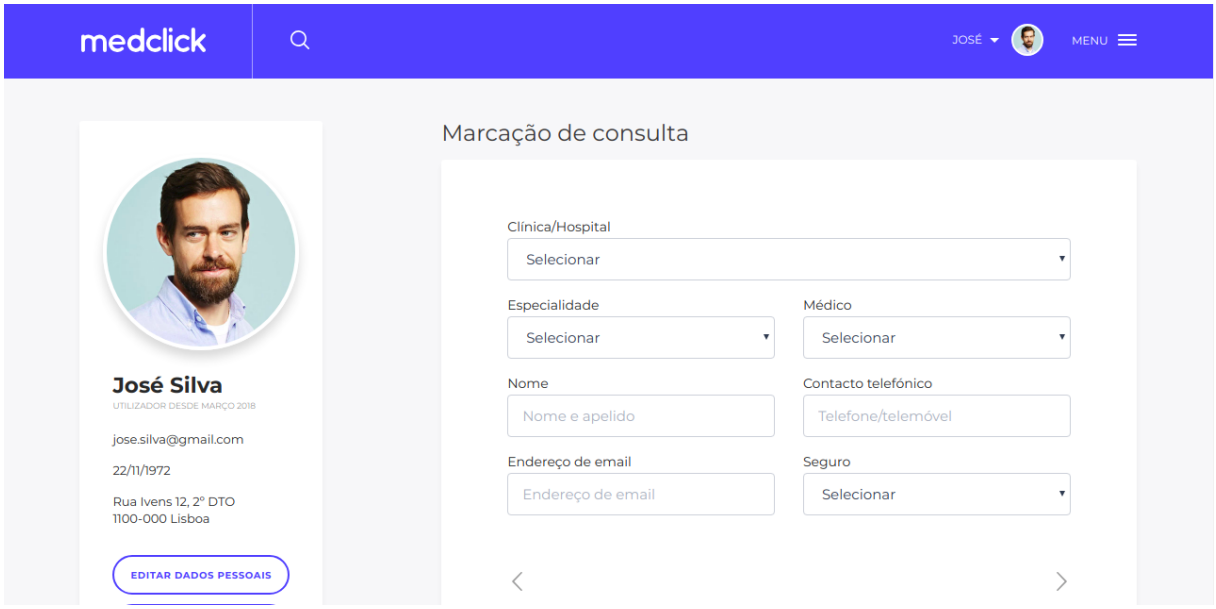


**Figure A.1:** Medclick's page of making an appointment

1. **H1-1**

   (a) Problem

   Information of full success appointment is not provided

   (b) Heuristic

   H1-1 Visibility of System Status

   (c) Description

   When the user completes the appointment form and clicks on ”make appointment”, no information is provided

   (d) Correction

   Change back to the patient page, where the user can confirm that his new appointment is present and also give a pop-up of the successfully booked appointment

   (e) Severity

   2

2. **H2-1**

   (a) Problem

   The process does not follow the conceptual iteration model for making an appointment

   (b) Heuristic

   H2-1 Match between system and the real world

   (c) Description

   Since this is the primary use case and aspires to be a simple, easy to use process, it should be user-friendly, providing the steps that make sense for the user mind

   (d) Correction

   Instead of presenting a form, build an iterated process, that asks the user for the next step, like ”What is the desired speciality?” then ”Witch clinic or hospital do you wish to have your appointment?”, in a way that reduces the cognitive load from the user

   (e) Severity 4

3. **H3-1**

   (a) Problem

   If the user filled the form erroneously and booked the appointment, he cannot recover from that

(b) Heuristic

H3-1 User control and freedom

(c) Description

When the user clicks on ”book”, there is no undo option or some mistake checker

(d) Correction

When the user press book, present a pop-up or a data confirmation page with the possibility to go back

(e) Severity

3

4. **H3-2**

(a) Problem

If for a mistake the user deletes the page in the middle of the process, he has to do it all over again

(b) Heuristic

H3-2 User control and freedom

(c) Description

If the user, for example, is closing browser tabs and, for a mistake, closes the medclick page in the middle of the process, he lost all the process done

(d) Correction

When the user press to close the tab, a pop-up to ensure that he wants to quit should be provided

(e) Severity

1

5. **H4-1**

(a) Problem

Name, email, and phone number should not be needed in the process since the user already logged in

(b) Heuristic

H4-1 Consistency and Standards

(c) Description

If the user is on the step of booking an appointment, he should not have to provide his necessary information since they are already in the profile

(d) Correction

If the user is not logged, then request him to sign up, else, take the information from the profile

(e) Severity

2

6. **H5-1**

(a) Problem

In the search bar, there is no help for the user input

(b) Heuristic

H5-1 Error Prevention

(c) Description

If a search bar is provided, it should give to the user hints of what he is searching for, since it would be related to health care services

(d) Correction

Try to correct spelling or detecting critical values for the search bar

(e) Severity

1

7. **H5-2**

(a) Problem

In the appointment form, there is no format hint for the phone number

(b) Heuristic

H5-2 Error Prevention

(c) Description

If users use phone numbers from different countries, they have no idea how the system wants the number to be given

(d) Correction

Use a placeholder to give a hint to the user

(e) Severity

1

8. **H6-1**

(a) Problem

The Hospitals are presented only as a list

(b) Heuristic

H6-1 Recognition rather than recall

(c) Description

Since the hospitals are only presented as a list, the user needs to recall the location or in fact what hospitals are

(d) Correction

Present the hospitals in a map starting from the user location. Also, give the user the possibility to view in a list or enter the hospital name

(e) Severity

4

9. **H6-2**

(a) Problem

The Doctors are presented only as a default list

(b) Heuristic

H6-2 Recognition rather than recall

(c) Description

Since the Doctors are always given by the same list, the users need to recall the name of some wanted doctor to an appointment

(d) Correction

Present first, for frequency, the doctors that the user already had appointments

(e) Severity

3

10. **H8-1**

(a) Problem

The profile information and edit option are in the same window as this process

(b) Heuristic

H8-1 Aesthetic and minimalist design

(c) Description

Since the user is trying to make an appointment, there is no need for the user information about himself the during this process. This makes the user distract from the primary task and interferes with design

(d) Correction

A drop-down menu in the log icon, providing the options, should be enough if the users want to enter his profile. Alternatively, clicking on the log icon to enter user profile

(e) Severity

4

11. **H8-2**

(a) Problem

Too many options for are presented at the same time

(b) Heuristic

H8-2 Aesthetic and minimalist design

(c) Description

This is, by the functional analysis, an iterative process, not a register form

(d) Correction

Since this is an iterative process, the options should be presented in a simple, user-friendly way, for the user focus the main task will a better design is practised. A more user-driven process is required to this

(e) Severity

4

12. **H9-1**

(a) Problem

The input fields do not provide concrete information if they are valid or invalid

(b) Heuristic

H9-1 Help users recognise, diagnose, and recover from errors

(c) Description

When the user is filling the form and, for examples, writes the phone number in the email field, there is no information about his mistake

(d) Correction

Place a red border or cross around the field for invalid and a green border or check for valid.

(e) Severity

2

13. **H9-2**

(a) Problem

The not found page is an empty state page

(b) Heuristic

H9-2 Help users recognise, diagnose, and recover from errors

(c) Description

When some page does not exist, an empty state of ”not found” page is presented

(d) Correction

Build a page not found with option login or sign up with a brief message of what happened

(e) Severity

1

14. **H10-1**

(a) Problem

There is no tutorial for this process

(b) Heuristic

H10-1 Help and Documentation

(c) Description

If the user does not know how to use this process, do documentation or tutorial is provided

(d) Correction

Build a page describing the process or the design itself helps the user to understand what he is doing or needs to do next

(e) Severity

3

This were the problems founded for the sample page provided, See table A.1 on page 88.

**Hick’s Law**

**Table A.1:** This table represents the heuristics problems founded ordered by type and severity of Medclick's page

| Problem Type | Low | Guarded | Elevated | High | Sever | Total Scor |
|---|---|---|---|---|---|---|
| 1. Visibility of system status | 0 | 0 | 1 | 0 | 0 | 1 |
| 2.Match between system and the real world | 0 | 0 | 0 | 0 | 1 | 1 |
| 3.User control and freedom | 0 | 1 | 0 | 1 | 0 | 2 |
| 4.Consistency and standards | 0 | 0 | 1 | 0 | 0 | 1 |
| 5.Error prevention | 0 | 2 | 0 | 0 | 0 | 2 |
| 6.Recognition rather than recall | 0 | 0 | 0 | 1 | 1 | 2 |
| 7.Flexibility and efficiency of use | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.Aesthetic and minimalist design | 0 | 0 | 0 | 0 | 2 | 2 |
| 9.Help users recognize, diagnose, and recover from errors | 0 | 1 | 1 | 0 | 0 | 2 |
| 10.Help and documentation | 0 | 0 | 0 | 1 | 0 | 1 |
| Number of problems discovered | 0 | 4 | 3 | 3 | 4 | 14 |
| Percentage of problems discovered | 0% | 29% | 21% | 21% | 29% | |

This process presents too many options to the user, such as the profile information (editing and going back to the profile), the form itself to make an appointment (this should be an iterative process), so the user does not waste time with other aspects since this is the primary process and not the advanced search.

**Fitts's Law**

Nothing to report.

### A.0.2 Cuf

1. **H3-1**
   (a) Problem

   When user click on ”quit” option at the middle of the process, the user immediately loses his progress

   (b) Heuristic

   H3-1 User control and freedom

   (c) Description

   When the user chooses the specialty, doctor, and establishment, if he presses ”quit” button, he is redirected to the homepage, losing his progress

   (d) Correction

   Present a confirmation pop-up

   (e) Severity

   2

2. **H4-1**

(a) Problem

In the middle of the process, the button ”back” is changed to ”quit”

(b) Heuristic

H4-1 Consistency and Standards

(c) Description

Every step of this process has a button to go back. After making the first step, the button changes to quit.

(d) Correction

Change the button name to ”back” and action to go back. If still the quit option is desired, give both options.

(e) Severity

1

3. **H5-1**

(a) Problem

When writing the insurance name, no correction is provided

(b) Heuristic

H5-1 Error Prevention

(c) Description

When the user is asked to choose his insurance, if he writes it wrong, there is no correction provided (for similar words)

(d) Correction

Give hint to the user of what insurance the user may be looking for

(e) Severity

2

4. **H5-2**

(a) Problem

When writing the specialty, no correction is provided

(b) Heuristic

H5-2 Error Prevention

(c) Description

When the user is asked to choose the desired specialty, if he writes it wrong, there is no correction provided (for similar words)

(d) Correction

Give hint to the user of what specialty the user may be looking for

(e) Severity

2

5. **H6-1**

(a) Problem

Hospital and clinics are presented as a list

(b) Heuristic

H6-1 Recognition rather than recall

(c) Description

When the user is asked to choose the establishment, the options are presented in a list, without providing their location. The user needs to remember where it is.

(d) Correction

Provide a menu where the user can both see the available establishments and their location

(e) Severity

3

6. **H6-2**

(a) Problem

when the user needs to choose a doctor, the options are not presented by frequency

(b) Heuristic

H6-2 Recognition rather than recall

(c) Description

If the user already had appointments with a doctor and does not remember his name, he will be stuck on trying to remember the doctor's name or searching in the older appointments

(d) Correction

Present the doctors by frequency

(e) Severity

3

7. **H6-3**

   (a) Problem

   The process itself seems to be filling a form

   (b) Heuristic

   H6-3 Recognition rather than recall

   (c) Description

   When users want to book an appointment, they are normally presented with a questionnaire, an iterative process, step by step

   (d) Correction

   Change the flow of the process to seem more simple and intuitive to the user

   (e) Severity

   4

8. **H7-1**

   (a) Problem

   There is no advanced search

   (b) Heuristic

   H7-1 Flexibility and Efficiency of use

   (c) Description

   If the user is already accustomed to the process, he may want to search for appointments with advanced options

   (d) Correction

   Provide advanced options, like the search for popularity, for location

   (e) Severity

   2

9. **H8-1**

   (a) Problem

   The info about the waiting time in unnecessary in this process

   (b) Heuristic

   H8-1 Aesthetic and minimalist design

(c) Description

While booking an appointment, the info about actual waiting time at the moment is unnecessary since is not relative to the appointment being booked

(d) Correction

Only present that information when the user is booking the appointment for the current date

(e) Severity

1

10. **H8-2**

(a) Problem

The side menu, with other services, is not relevant since the user is booking an appointment

(b) Heuristic

H8-2 Aesthetic and minimalist design

(c) Description

While the user is booking an appointment, the menu to enter other services is unnecessary since it deviates the attention from users

(d) Correction

Place a menu icon, with a dropdown menu, on top of the page, or a sliding menu

(e) Severity

2

11. **H9-1**

(a) Problem

If the user badly inputs the insurance, no correction is provided

(b) Heuristic

H9-1 Help users recognize, diagnose, and recover from errors

(c) Description

When the user is asked to choose is insurance and the inputs it badly, the system does not help the user to correct it, only indicates that is a required field and that it is wrong

(d) Correction

Pop-up the available insurances or correction to user input

(e) Severity

1

12. **H10-1**

    (a) Problem

        There is no documentation to help the user performing the task

    (b) Heuristic

        H10-1 Help and Documentation

    (c) Description

        If the user does not, for any reason, understand how the process flows, he might get stuck

    (d) Correction

        A tutorial or a helping page should be provided

    (e) Severity

        3

This were the problems founded for the Cuf page. See the following table of results.

**Table A.2:** This table represents the heuristics problems founded ordered by type and severity of Cuf's page

| Problem Type | Low | Guarded | Elevated | High | Sever | Total Scor |
|---|---|---|---|---|---|---|
| 1. Visibility of system status | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.Match between system and the real world | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.User control and freedom | 0 | 0 | 1 | 0 | 0 | 1 |
| 4.Consistency and standards | 0 | 1 | 0 | 0 | 0 | 1 |
| 5.Error prevention | 0 | 0 | 2 | 0 | 0 | 2 |
| 6.Recognition rather than recall | 0 | 0 | 0 | 2 | 1 | 3 |
| 7.Flexibility and efficiency of use | 0 | 0 | 1 | 0 | 0 | 1 |
| 8.Aesthetic and minimalist design | 0 | 1 | 1 | 0 | 0 | 2 |
| 9.Help users recognize, diagnose, and recover from errors | 0 | 1 | 0 | 0 | 0 | 1 |
| 10.Help and documentation | 0 | 0 | 0 | 1 | 0 | 1 |
| Number of problems discovered | 0 | 3 | 5 | 3 | 1 | 12 |
| Percentage of problems discovered | 0% | 25% | 41,7% | 25% | 8,3% | |

**Hick's Law**

This process presents too many options to the user, such as the side menu options, the form itself to make an appointment (that should be an iterative process), so the user does not waste time with other aspects since this is the main process.

**Fitts's Law**

Options to choose the establishment or the specialty are in dropdown menus. Pop-up menus are preferred as they are used to choose doctors.

### A.0.3 DocASAP

1. **H3-1**

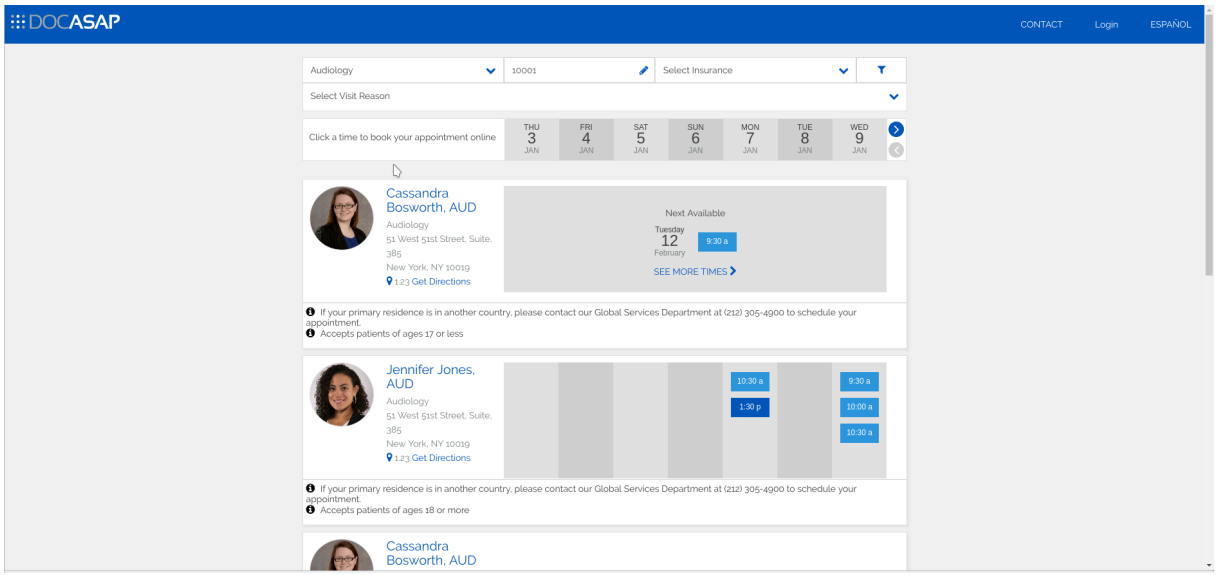


**Figure A.2:** DocASAP's page of making an appointment

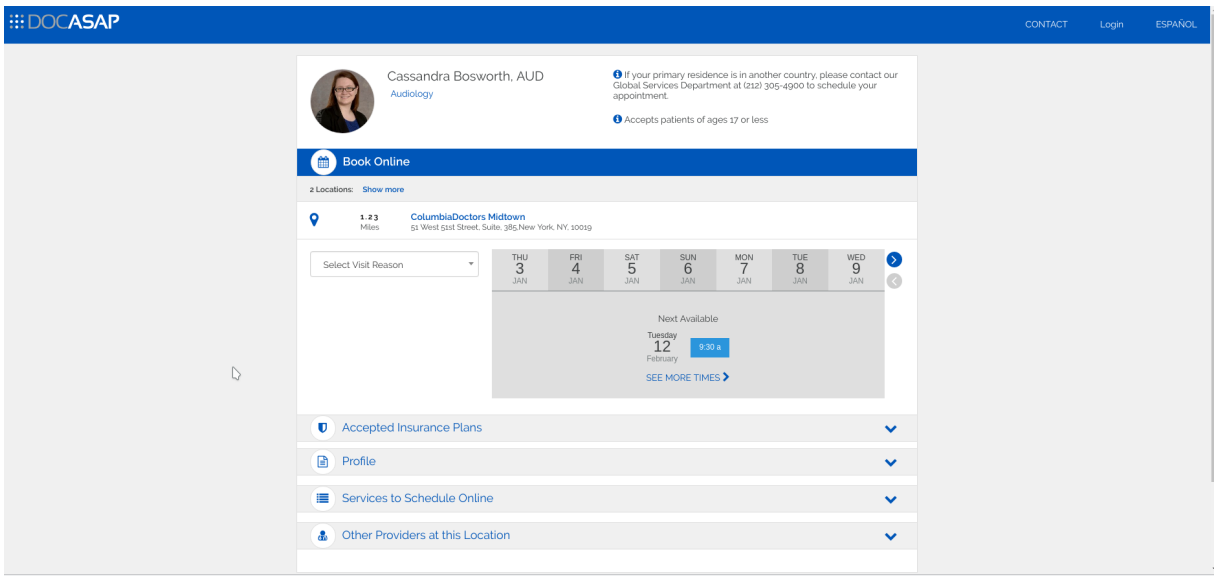


**Figure A.3:** DocASAP's page of making a selected healthcare provider

(a) Problem

There is no way to move backward when the user selects a healthcare provider

(b) Heuristic

H3-1 User control and freedom

(c) Description

When the user selects a healthcare provider, he cannot go to the previous step. The user needs to search again

(d) Correction

Provide some button or link to move backward

(e) Severity

4

2. **H5-1**

(a) Problem

There is no placeholder provided to the zip code format

(b) Heuristic

H5-1 Error Prevention

(c) Description

When the user first enters the process he must provide the zip code for near healthcare providers. The zip code input box does not contain any placeholder

(d) Correction

Provide a placeholder

(e) Severity

1

3. **H5-2**

(a) Problem

There is no label for the input boxes

(b) Heuristic

H5-2 Error Prevention

(c) Description

When the user enters the booking page, there is no label for the input boxes of the specialty, zip code and insurance

(d) Correction

Place labels on top of those boxes

(e) Severity

2

4. **H6-1**

(a) Problem

The user must remember he has to select the time desired

(b) Heuristic

H6-1 Recognition vs Recall

(c) Description

When the user selects the desired healthcare provider, there is no hint about when the user should select the time desired

(d) Correction

Provide some step title or iterate the task step by step

(e) Severity

4

5. **H7-1**

(a) Problem

The first page of this process does not contain the advanced search

(b) Heuristic

H7-1 Flexibility and Efficiency of use

(c) Description

After the user inputs the basic information to search for appointments, advanced search is provided. That does not make sense since an expert user may want directly use the advanced search

(d) Correction

Place advanced search on the first page also

(e) Severity

2

6. **H8-1**

(a) Problem

For each healthcare provider founded, there is too many information being presented related to the available times

(b) Heuristic

H8-1 Aesthetic and minimalist design

(c) Description

Although it is a good thing to provide to the user the available slots in a week, the website takes to much time to load that information

(d) Correction

Make the available healthcare providers appear while the calendar moves.

(e) Severity

2

7. **H9-1**

(a) Problem

When the user enters the doctor's name badly, no options are provided

(b) Heuristic

H9-1 Help users recognize, diagnose, and recover from errors

(c) Description

If the user, by sloppiness, enter the name of the doctor badly, no results are founded

(d) Correction

Provide a "did you mean?" with correction or the results that are similar

(e) Severity

3

This were the problems founded for the DocASAP page. See the following table of results.

**Table A.3:** This table represents the heuristics problems founded ordered by type and severity of DOCASAP page

| Problem Type | Low | Guarded | Elevated | High | Sever | Total Sc |
|---|---|---|---|---|---|---|
| 1. Visibility of system status | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.Match between system and the real world | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.User control and freedom | 0 | 0 | 0 | 1 | 0 | 1 |
| 4.Consistency and standards | 0 | 0 | 0 | 0 | 0 | 0 |
| 5.Error prevention | 0 | 1 | 1 | 0 | 0 | 2 |
| 6.Recognition rather than recall | 0 | 0 | 0 | 0 | 1 | 1 |
| 7.Flexibility and efficiency of use | 0 | 0 | 1 | 0 | 0 | 1 |
| 8.Aesthetic and minimalist design | 0 | 0 | 1 | 0 | 0 | 1 |
| 9.Help users recognize, diagnose, and recover from errors | 0 | 0 | 0 | 1 | 0 | 1 |
| 10.Help and documentation | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of problems discovered | 0 | 1 | 3 | 2 | 1 | 7 |
| Percentage of problems discovered | 0% | 14,3% | 42,9% | 28,5% | 14,3% | |

# B

# Heuristic evaluation reports - Medclick

**H7 (Flexibility and efficiency of use)**
Reason: No shortcut to the top of the page while scrolling through it.

**H8 (Aesthetic and minimalist design)**
Reason: The fourth div on the “PORQUÊ MARCAR AS CONSULTAS COM O MEDCLICK” does not have the same number of lines as the others (n = 3).

**H4 (Consistency and standards)**
Reason: Top right actions do not have the same icon while hovering.

**H5 (Error prevention)**
Reason: Log in email input can verify while the user is typing whether the input is a valid email.

**H1 (Visibility of system status) and H7**
Reason: Birthdate input either prompts the user to click to many times on the << icon or to input by keyboard. Keyboard input format is not defined.

**H3 (User control and freedom)**
Reason: Gender options should include either Other or Prefer not to say.

**H5**
Reason: Register should prompt or signal obligatory fields while the user is filling it, or represent with a symbol, e.g. *.

**H4**
Reason: “USAR PERFIL DE SOCIAL MEDIA” should be “USAR PERFIL DE REDE SOCIAL”.

**H4**
Reason: In upload Picture to register, “...” has the “more options meaning”. In this case, it prompts the explorer to select a picture. Either a picture or + icon can do the trick.

**H5**
Reason: Are there no dimensions for the picture? No required format?

**H1**
Reason: Some fields have a grey background while other keep a white one. Why?

**H4**
Reason: Patient prompt email different from medical prompt. Check the remaining, including Retrieve password.

**H1**
Reason: All register paths should depict the progress. This is especially true to the Clinic Registration, since it has a lot of fields.

**H4**
Reason: Clinic picture input in two distinct approaches.

**H4**
Reason: Clicking on Professionals changes the top bar layout and content. Why?

# Avaliação Heurística

## Página Inicial:

**Problema:** Não aparece opção para apagar o nome do especialista na pesquisa.
**Heurística:** H2.4 - Consistência e adesão às normas.
**Descrição:** Todos os campos de pesquisa têm opção para apagar o conteúdo exceto o campo do especialista.
**Correção:** Adicionar o mesmo "X" que está nos outros campos.
**Severidade:** 1

**Problema:** Uso de da expressão "médico" e "especialista".
**Heurística:** H2.4 - Consistência e adesão às normas.
**Descrição:** O utilizador é levado a pesquisar por especialista, enquanto que as descrições no website dos serviços usam sempre a expressão médico.
Ex: "Pesquisa de Médico: Pesquisa de Médico, com acesso a CV, rating, localização, especialidade, preço e seguradora.". No entanto o input para pesquisar usa a expressão "especialista"
**Correção:** Escolher médico ou especialista e usar em todo o lado só um deles.
**Severidade:** 1

**Problema:** Incoerência entre especialidades.
**Heurística:** H2.4 - Consistência e adesão às normas.
**Descrição:** No input da especialidade parece o nome da especialidade corretamente (ex. cardiologia), mas depois nas especialidades sugeridas aparece o cargo de quem exerce a especialidade (ex: cardiologista)
**Correção:** Não confundir especialidade com especialista e colocar as especialidades sugeridas com os mesmos nomes do input.
**Severidade:** 2

**Problema:** Não há indicação de erro quando o valor num input não existe.
**Heurística:** H2.1 - Tornar o estado do sistema visível; H2.9 - Ajudar o utilizador a reconhecer, diagnosticar e recuperar de erros.
**Descrição:** Em qualquer dos inputs se o valor não estiver incluído na lista, não existe indicação de erro para o utilizador perceber que o valor introduzido não existe/não é suportado e evitar perder tempo a clickar no botão pesquisar.
**Correção:** Ou aparecer uma pequena mensagem a avisar ou pelo menos o contorno do input ficar a vermelho
**Severidade:** 3

**Comentário Extra:**

- Tens um bug no input da data: se escolheres outra data, o espaço entre o dia e o ano desaparece:
    - Default: Julho 22 2020
    - Se mudares: Julho 232020

## Login/Register Page:

**Problema:** Nome da aplicação está sempre a mudar.
**Heurística:** H2.4 - Consistência e adesão às normas.
**Descrição:** O nome tanto aparece "medclick" (no fundo da página) como aparece "Medclick" no texto do login e "MedClick" nas descrições na página inicial.
**Correção:** Escolher "MedClick" ou "Medclick" e usar em todo o lado só um deles.
**Severidade:** 1

**Problema:** Limitar opções nos inputs de registo.
**Heurística:** H2.5 - Evitar Erros.
**Descrição:** Em campos como, por exemplo, código postal e número de telefone, o utilizador não devia poder de escrever mais do que o limite de números, ou seja, ex. no caso do código postal o input só devia permitir 4 dígitos. Se o utilizador tentar colocar mais, o input não deixa.
**Correção:** Limitar input assim que número máximo de dígitos é colocado.
**Severidade:** 3

**Comentário Extra:**

- Pergunta à Professora Sandra se faz sentido ter o website em português, mas depois usar uma expressão com "Login com Social Media", ou seja, se "Social Media" devia ser substituído por "Redes Sociais" ou algo semelhante.

## Appointment Page:

**Problema:** Cor do botão "Pesquisar no Mapa".
**Heurística:** H2.8 - Desenho estético e minimalista.
**Descrição:** Botão branco em fundo branco não é o mais adequado. Utilizadores mais distraídos podem nem se aperceber que está lá um botão.
**Correção:** Adicionar border ou mudar para um tom mais escuro.
**Severidade:** 2

**Comentário Extra:**

- Centra a informação da consulta com a imagem do médico.

# Avaliação Heurística - Medclick

Heurística Violada: H2-4
Severidade: 2
Ícones inconsistentes em moseover

Heurística Violada: H2-4
Severidade: 2
Medclick com minúsculas e maiúsculas sempre diferentes

Heurística Violada: H2-4
Severidade: 2
Nomes das especialidades incorretos

Heurística Violada: H2-4
Severidade: 2
Utilização de termos “médico” e “especialista”. Escolher apenas um.

Heurística Violada: H2-4
Severidade: 2
Utilização de termo “Social Media” num site totalmente em PT.

Heurísticas Violadas: H2-5; H2-9
Severidade: 3 | 2
Input inexistente não dá erro. Deve haver mensagem de erro ou ser evitado o estado de avançar quando input não está preenchido

## Geral

Pacientes (Bug)

Sobre (Bug)

Profissionais (Bug)

Não consigo mudar para Inglês.

Botão "home" por vezes não funcionou.

De onde aparecem as especialidades sugeridas?

## Login

Link "Registar" está um pouco escondido.

Link "Recuperar Password" está um pouco escondido.

Não me deixou registar, logo não consegui testar o login.

## Registar como Paciente

Código Postal: Impedir de escrever mais de 4 dígitos

Telemóvel: O código deve ser preenchido automaticamente de acordo com o país.

Password: Coloco pelo menos 8 carateres, mas ele diz que não.

## Registar como Clínica

Não consegui fazer nada

## Encontre a sua consulta

Não acho boa ideia que o texto "Seguros de Saúde aceites" apresente um balão. Devia acontecer o mesmo que acontece quando carrego no nome do médico.

Quando carrego "Consultar CV" e "Enviar Email" não vou para as páginas certas, acho.

Deve ser possível apagar facilmente as opções de filtragem.