Aesthetic and Functional Particularities in the Design of Graphical User Interfaces for Mobile Devices

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Abstract: *Graphical interfaces can be defined as a form of visual communication. They establish a link between creators and the audience by using different graphic components to convey ideas, opinions and messages. The goal of this study is to analyse the relevance of mobile UI/UX design in the context of scientific research by reviewing and interpreting the literature in different fields. At the same time, the focus is on UI and UX design components and principles. Best practices of these design components and principles are analysed with the help of designing a mobile graphical interface for a café: Coffee for Everyone.*

Keywords: *mobile applications, graphical interfaces, user interface, user experience, design principles, UI components, UI/UX design process*

1. Introduction

Among one of the multiple branches of graphic design, the graphical interface for mobile devices has evolved significantly (Putra and Shalaimanda, 2022).

According to Putra Dicky Dwi and Shalannanda Weryan, Mobile Applications are defined as "applications of a software that in operation can run on mobile devices such as

Smartphones, Tablets, iPods, and others, and has an operating system that supports software on a standalone basis"(Putra and Shalaimanda, 2022). They also serve the scopes of communication and socialisation between numerous groups, stand as emergency or help triggers, and can be developed in numerous domains such as, e.g., health, education or commerce based on the public's needs (Astuti et al., 2021; Wu et al., 2021).

The transition between the app's functionality and viewing it on the device screen is provided by the user interface - UI. It acts as a pathway to guide the individuals through the process of obtaining the required information or completing the desired task by using several components and principles of UI (Nugroho et al., 2019; Putra and Shalaimanda, 2022). These components, such as buttons, icons, fonts, and colors, help developers design an intuitive and user-friendly structure (Yusaliano et al., 2020).

On the other hand, during the development process, what needs to be considered is the user experience or - UX. It focuses on user interaction and behaviour with the app design. Also, in this case the focus is on the person themselves as well as on the overall experience. This should be a pleasant one and delivered to users according to their preferences. UX components are creative tools themselves, used throughout the development process (Astuti et al., 2021; Naapuri, 2018).

2. Research questions and methodology

The research questions underlying this study are the following:

Q1 - Is the design of graphical user interfaces for mobile devices relevant, in the context of scientific research?

Q2 - What are the components and design principles used by researchers to design graphical user interfaces for mobile devices?

Q3 - What are the best practices in applying specific stages of the UX/UI design process for mobile interfaces?

In order to answer the research questions Q1 and Q2, I have conducted an analysis of the scientific papers corresponding to the chosen field by using the following research methods: *Data collection methods, Selection Procedure and Identification.*

I have collected scientific articles from the three different databases, IEEE Xplore, Science Direct and Google Scholar. I have examined the paper titles, keywords and abstracts. I have briefly reviewed the full-text articles while employing the inclusion and exclusion criteria to filter the studies. The process is also visible in the Figure 2.1 presented below.
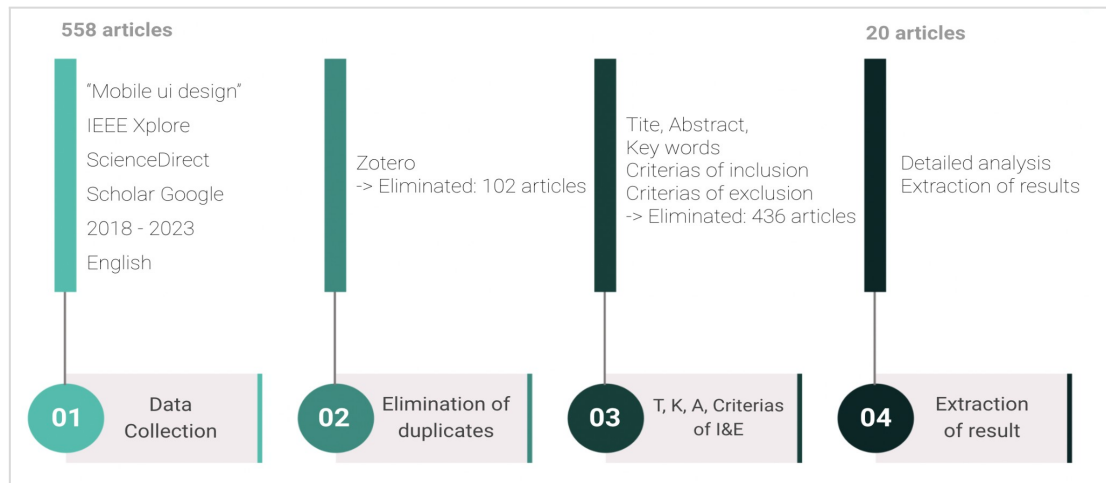
Figure 2.1 : Data collection, Selection procedure and Identification

For research question Q3, I have passed through some steps specific to the design process of UI/UX for mobile devices. I have chosen to conduct a questionnaire for coffee consumers and future app recipients, and I have used the competitive analysis method, all being specific to the research stage of the design process. I have continued by making a user flow map and wireframes, specific to the information architecture stage. Building a visual guide, individual design of the application pages and prototyping, specific to the visual design phase, were the next choices. And finally, I have tested the prototype with the observation method specific to the testing phase.

3.   Relevance of mobile interface design in the context of scientific research

The use of new technologies is becoming increasingly widespread around the world in a variety of fields. They are gradually being incorporated into ordinary users' everyday lives through personal mobile devices. Convenience, accessibility and an abundance of tools are now within reach thanks to mobile applications. They give users access to a wide range of materials and information. As an overview, results gathered from the scientific articles, concerning different uses of mobile applications and their varied aims have been summarised in Figure 3.1 below.
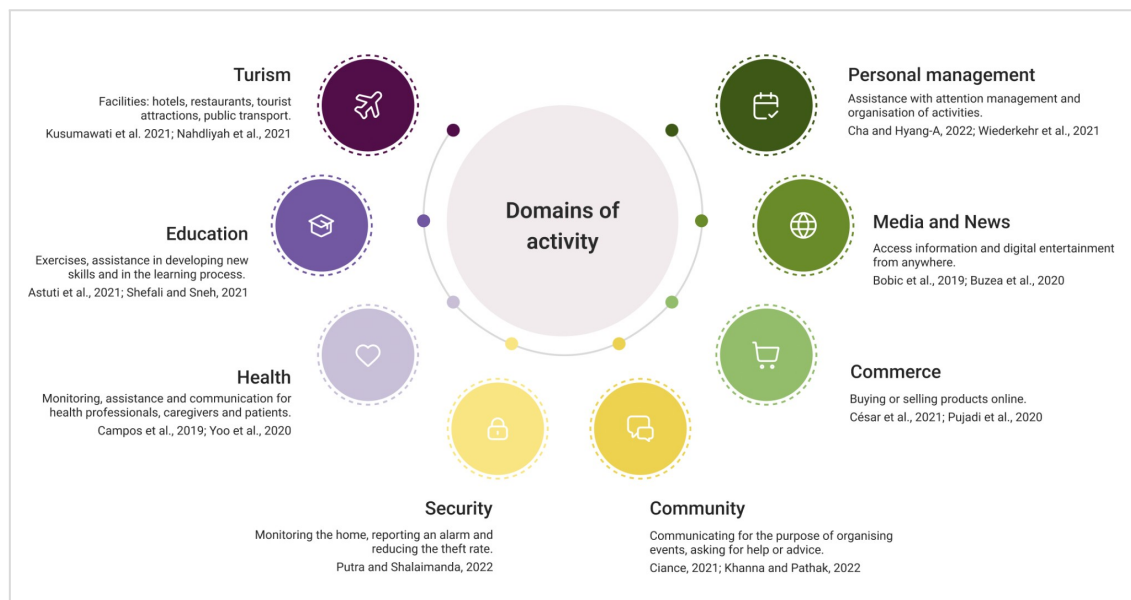
Figure 3.1: Diagram - Applications domain of activity

Mobile interfaces are used and offer multiple benefits for a variety of industries such as healthcare, education, communications, tourism, food and finance. User interfaces for mobile devices offer people an accessible, fast and simple way to receive information, perform tasks and communicate with others. In addition, mobile apps offer more opportunities for socialisation or remote support for outlying groups.

As well as being integrated into everyday life, they are also tailored to the specific needs of the individual recipients. Examples are the simple and easy-to-understand interfaces that have been observed in the healthcare department, with design principles adapted to a specific target group, e.g. the elderly.

In order to prevent pressure ulcers for the elderly or bedridden, an app was designed to improve the overall quality of well-being of patients and their caregivers by Jéssica Campos et. al, 2019. During the design process, accessibility requirements for elderly people were integrated as a main objective, by providing simple functions, messages, and contrasts (Campos et al., 2019). Among the functions, they also provided an emergency button for both the patient and the caregiver, in this way, at any time, they have the possibility to request the assistance of a doctor at any time and in any place (Campos et al., 2019).

With the emergence of the COVID-19 pandemic, new demands and opportunities for mobile health technologies have been generated. A group of students has developed an app with the aim of containing the chaos and fear caused by the pandemic, offering help with social distancing. It is able to map hotspot locations across the city. In addition, it offers options to choose a specific area such as a grocery store, displays the risk of infection relevant to it, offers the possibility to preset the schedule according to the crowding at certain times of the day. In this way, users are able to keep the required distance (Häkkilä et al., 2021).

Combining the functions of health, communication and aid, reference can be made to the video-based donation app D-Eazy, created by Khanna Manan and Pathak Dhruv, which addresses a separate but closely related topic. This specific app has been developed with the initiative to establish connections between donors and recipients or to contact points, in terms of any type of donations starting from food to fight hunger, birthday wishes, cakes and gifts (Khanna and Pathak, 2022). The aim is to bring a sense of happiness to as many people as possible. In other cases, one can also discuss the functions of high-need contributions such as providing medicines, medical assistance to the underprivileged and those in need, or even focus on blood donations in emergency situations (Khanna and Pathak, 2022).

Education-related mobile apps have also been developed. Here, we see a number of apps made with the intention of providing a blended learning solution by merging conventional learning methods with newly evolved technologies (Astuti et al., 2021).

E-commerce is an area that has grown in recent years and is now increasingly used through mobile apps. Shopping online with mobile requires a practical, organised, easy to access and easy to follow design and layout. In addition, it was considered that people should be able to use the interface with one hand (Jinxian, 2020). Gestalt principles have in turn been exploited to establish a close link between graphical interaction and the functionality that will be made available to the users of these apps (César et al., 2021).

Further applications created for more industries have been shown and investigated in Table 3.1 below, in order to provide some additional information based on the accomplished research and the results that have been obtained.

Table 3.1a: Mobile interface development across different domains of activity

Author(s)	Domain of activity	Scope	Keywords
Yoo et al., 2020	Health	Developing a mobile app for people with epilepsy to interact positively with their mental and physical health, providing daily diaries, stress relief exercises, medication and seizure monitoring, and patient details for doctors.	*Epilepsy, Seizure, Medication, Mobile application, Electronic medical record*
Putra and Shalaimanda, 2022	Security	A security app for a smart home, providing real-time notifications, using video monitoring of human gestures, and also offering a SOS button in case of emergency with a pre-selected list of contacts.	*Theft, Mobile app, Smart home, Warning system, User interface, User experience*
Ciance, 2021	Community	Designing a mobile app for the university during the Covid pandemic where students on campus can safely interact with each other, share their issues, fears and concerns, and create social events and gathering	*Covid-19 Pandemic, Social interaction, Mobile application, University campus*

Table 3.1b: Mobile interface development across different domains of activity

Author(s)	Domain of activity	Scope	Keywords
Shefali and Sneh, 2021	Developing of skills/Education	An application that has been developed to provide its users with training and exercises for ambidexterity and better hand coordination.	*Ambidexterity, Hand-switching , Hand dominance, Mobile Application, Prototype, User Interface, Design Thinking*
Pujadi et al., 2020	Commerce	A mobile app developed to combine coffee producers' communication with farmers and stakeholders as well as consumers by providing separate functions and options for each party.	*Application, Mobile, Information Systems, UML, Supply Chain*
Buzea et al., 2020	Media and News	Development of a mobile news app that adapts its content and filters information according to user preferences.	*Adaptive Mobile News Platform, Romanian Corpora, Graphical Representations*
Cha and Hyang-A, 2022	Mental health	Developing a mobile application focused on improving mental health among young people, offering engaging stories, mediation opportunities and an interactive reward system to increase participation and concentration.	*UX/UI Design, Mindfulness meditation, Self-harm behavior, Youth self-harm, App Development*
Wiederkehr et al., 2021	Personal management	Designing an app that will help users manage their attention and productivity through the use of their daily mobile screen time.	*Application software, Behavioral science, Human computer interaction,*
Nahdliyah et al., 2021	Tourism	The mobile app meets the needs of tourists in balance with the practices of the Islamic Halal religion, such as: gender-segregated accommodation, halal food, prayer facilities, etc.	*Halal application, Halal tourism, Design interface, User-centered design, Usability evaluation,*

4. Design components and principles

UI components are the graphic illustrations, which resulted from the UX process used throughout the design cycle. Buttons are used to start activities. Images, colours and graphical elements, such as icons and illustrations, help to make information more understandable and intuitive while drawing attention to it (Campos et al., 2019; Jinxian, 2020). Animations, which provide a more dynamic message to the interaction itself, are another option. In addition, fonts play an important role in balancing the coordination between functionalities, priorities, and the overall look and feel of the interface (Naapuri, 2018). The features of navigation bars, drop-down menus, and sidebars all contribute to increased task attributes and performance, promoting the ultimate goal of the application flow (Shefali and Sneh, 2021).

In addition to the use of UI components, the desirability, accessibility and clarity of an

interface are also achieved by following several important principles or rules that are used during the development process. Design principles include symmetry, proximity, unity, consistency, repetition, alignment, hierarchy, visual balance, white space/negative space and contrast (Khanh, 2022).

The distribution of attention according to the visual hierarchy depends on how significant the data are. In order for more important information to stand out, it may be presented at a larger scale or as the first view at the top of the screen, with less important information appearing later (Khanh, 2022).

The use of contrast is a way of drawing attention to a particular element. This can be done by using different font sizes or colours to draw the reader's interest to, for example, one of the headlines or icons. Colour contrast can be used to emphasise the most important information that is provided on the screen (Jinxian, 2020).

People have traditionally associated symmetry with visually appealing patterns. In everyday life, people are attracted and seek more symmetrical visual features and elements; therefore, symmetry is used as one of the design principles to maximise the user's intentional capture and intuitive power of the design (Khanh, 2022). It is assumed that symmetry presents more stability, which is very useful when it comes to navigation elements (Khanh, 2022).

The use of proximity or, in other words, unity, allows a relationship to be established between elements present on the same display, whether they are positioned at a certain distance from each other, or close together or far apart at an angle. Even though the elements under consideration might have a different colour, assembling them together will indicate that they belong together (Khanh, 2022). A design with a similar style of icons, fonts used, or a repetitive location of elements such as navigation bars will not only make it easier for the user to achieve their goals, but will give the entire app journey a sense of security as an overall picture (Naapuri, 2018).

All these so-called "norms" for UX/UI design can help the app work best and support all the essential features, while being understandable, well organised and appealing to the eye. The information extracted from a part of the scientific articles can also be viewed in the Table 4.1 below.

Table 4.1a: The use of UI/UX design components and principles

Author(s)	UX design phases identified	UI components	Design Principles
Shefali and Sneh, 2021	Research Information architecture Visual design	Animations Illustrations Icons Buttons Logo Typography Navigation Menu bar - bottom Navigation buttons – top	Balance Proximity/Unity Alignment Repetition/ Consistency Symmetry Contrast White Space

Table 4.1b: The use of Ui/Ux design components and principles

Author(s)	UX design phases identified	UI components	Design Principles
Pujadi et al., 2020	Research Information architecture Visual design	Images Icons Button Top navigation features Bottom navigation bar Typography Illustrations Graphics	Balance Proximity/Unity Alignment Repetition/ Consistency Contrast White Space
Jinxian, 2020	Information architecture Visual design	Buttons Icons Illustrations Images Scrolling menu Navigation bar Typography	Balance/Visual hierarchy Proximity/Unity Alignment Contrast White Space Repetition/Consistency Symmetry
Naapuri, 2018	Research Information architecture Visual design Testing	Logo Buttons Illustration s Icons Typograph y Top navigation bar Bottom navigation bar Search bar Images	Balance Proximity/Uni ty Alignment Repetition/ Consistency Symmetry Contrast

After reviewing the different articles, some made full use of the design principles and UI components, which improved the testing results. On the other hand, other applications only partially used the set of guidelines, which led to the identification of possibilities for future development and improvement. It can also be observed that the main UI components, such as buttons, icons, menus and navigation modules, are repeated in most cases.

Another link that can be established from these articles is that animations are frequently used in conjunction with action monitoring tools, such as timers or mechanisms for user reactions or opinions, such as the cheerful movement of the illustration or explosions of confetti after a task has been successfully completed (Cha and Hyang-A, 2022).

Certain UI elements and principles change depending on the particular industry for which the application is designed. At the same time, the target audience for which the application is designed is also taken into account. This is also reflected in the UX stages of the process, but also in the design of UI elements. For example, many health-related apps that target the elderly, carers and patients with various medical conditions place a strong emphasis on the UI principles of consistency, visual hierarchy, contrast and white space. In many cases, the interfaces of these apps become more focused on functionality

than on aesthetic features. As a result, they become less visually pleasing for some people (Campos et al., 2019; Yoo et al., 2020).

Tourism, e-commerce and even education applications are visually connected. Apps in these fields tend to focus on a particular topic and provide a large amount of information. E-commerce applications need to incorporate and repurpose most of the features of a website into a single user interface, while tourism applications need to provide not only descriptions and potential tourist attractions around a city, but also restaurants, hotel reservations, locations, and occasionally public transportation options (César et al., 2021; Kusumawati and Renanda, 2021). To represent data as accurately as possible from a single visual interaction, they primarily use a large number of images, but also provide users with clear navigation paths for training, such as top and bottom navigation bars and occasionally even a sidebar for additional features (Jinxian, 2020; Nahdliyah et al., 2021).

Reference can also be made to applications in the educational sphere. In addition, they use built-in video-based options for detailed tutorials or more in-depth explanations, as well as communication tools such as student chat groups or online conferencing options. These types of information apps frequently include search functions, represented by icons or search bars, to help users and point them in the right direction (Naapuri, 2018).

Overall, by stating the above points and having carried out the analysis of the various articles, the broad relatability, high relevance and impact of the various UI components and principles can be expressed in terms of distinguishing the different areas and functionalities of the applications, as well as the opportunities for detail that they provided for each specific industry.

5. Specific stages of the UX/UI design process for mobile interfaces

Designers adhere to a design process that incorporates UX/UI principles to develop an intelligible mobile interface (Astuti et al., 2021). The UX/UI process consists of the following design stages: Research, Information Architecture, Visual Design and Testing (Yusaliano et al., 2020). To answer the third research question of my paper - What are the best practices in applying specific steps of the UX/UI design process for mobile interfaces - I have chosen to go through the steps of this process. For example, I have chosen the particular context of designing a mobile app for a coffee shop. I have decided to do this because, on a brief passing through the entertainment and leisure areas of Timisoara, I have noticed that these businesses have become numerous. Talking to some of the managers, they stressed the need for such an app and see it as beneficial for their businesses.

5.1 Research
An important aspect of app design is to understand the preferences and needs of potential users. Following the research stage of the design process, I have conducted a questionnaire, assigned to a target group of people over the age of 18. It aims to obtain relevant information about the audience's preferences in relation to the desired application of a café. When

creating this questionnaire, I have taken into account different aspects of the user experience. The questionnaire consisted of 15 questions.

For starters, potential app functionality has been integrated, such as options to check for open spaces and reserve a table in advance, select a drink before arriving at the café, in-app or in-cash payment methods, My Profile option or potential forms of socialising directly from the app. I have then focused on the visual design of the app, for instance font types, colours, preferences in using explanatory images and illustrations, choosing a minimalist or complex design or logo type. Finally, the questionnaire also consisted of 2 open questions, in which different new suggestions and aspects that users would like to benefit from were expressed. Some of the questionnaire results are visible in the Table 5.1 below.

Table 5.1a: Selected questionnaire responses

Question	Responses	Results
Would you like to have the option to check the free tables before entering the cafe?	Vrei să ai opțiunea de a verifica mesele libere înainte de a ajunge la cafenea? 292 válasz	Yes – 95.4%
Do you find the "My Profile" option beneficial, where you can embed your café loyalty card to receive points and rewards?	Consideri benefică opțiunea de "Profilul Meu", unde să poți încorpora cardul de loialitate al cafenelei, pentru a primi puncte și premii? 292 válasz	Yes - 87%
How would you like to pay?	Cum dorești să plătești comanda? 292 válasz	By card -52.7% By cash -47.3%
What should be used in the design of the application? (Representative images ; Illustrations; Both)	Ce crezi că ar trebui în designul aplicației? 292 válasz	Representative images -32.9% Illustrations- 8.9% Both -58.2%
What type of Logo do you prefer? (Wordmark, Symbol or Pictorial or Combination)	Alege tipul de logo pe care îl preferi pentru aplicație: 292 válasz	Wordmark-27.1% Symbol or Pictorial- 24.3% Combination- 48.6%

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Table 5.1b: Selected questionnaire responses

Questio n	Responses	Result s
Choose two of the given color palettes	Alege două dintre paletele de culori, pe care le preferi a fi utilizate în designul aplicației: 292 válasz [bar chart: 1—11, 2—81 (27,7%), 3—73 (25%), 4—68 (23,3%), 5—59 (20,2%), 6—39 (13,4%), 7—104 (35,...) with axis 0, 25, 50, 75, 100]	Option 1:38.4% Option 7:35.6% Option 2:27.7%

In addition to the audience preferences translated and identified in the aforementioned questionnaire, I have decided to continue my research process with a method where I can focus on visual design, namely a competitive analysis.

In order to extract the information in a structured manner, I have created Table 5.1.2, which can be seen in Appendix 1. All of the reviewed apps offer an intuitive and user-friendly interface. Representative images and suggestive icons are common in the design of all. The preference for the combination of the two in creating a café app was also confirmed by the results of the questionnaire. Also, the following basic functionalities were identified from both research methods as necessary or desired: quick pre-order, payment system integration and drink customisation options, "My Profile" page and including the award system.

5.2 Information Architecture

I have started the second design stage, information architecture, in the context of the Coffee for Everyone app, by generating a user flow map. This is shown as an overview in Figure 5.2.1. This method has enabled me to create a visual structure for the actual content of the app and its navigation. In addition, it has allowed me to group and organise the different actions that users will engage in, keep track of the information on display, and arrange everything in an understandable and coherent manner.

Following the progression of this design stage, I have created wireframes, after establishing the user flow and navigation structure of the application. It builds a smooth transition between the user flow map and the final design of the app. In general, this method can also be done in a program, such as Figma, but it can also be sketched manually, even on paper. Personally, to keep a more private but clean touch for better communication, I have decided to create it as a manual sketch, and I have drawn it digitally on my own tablet, visible in the below Figure 5.2.2.
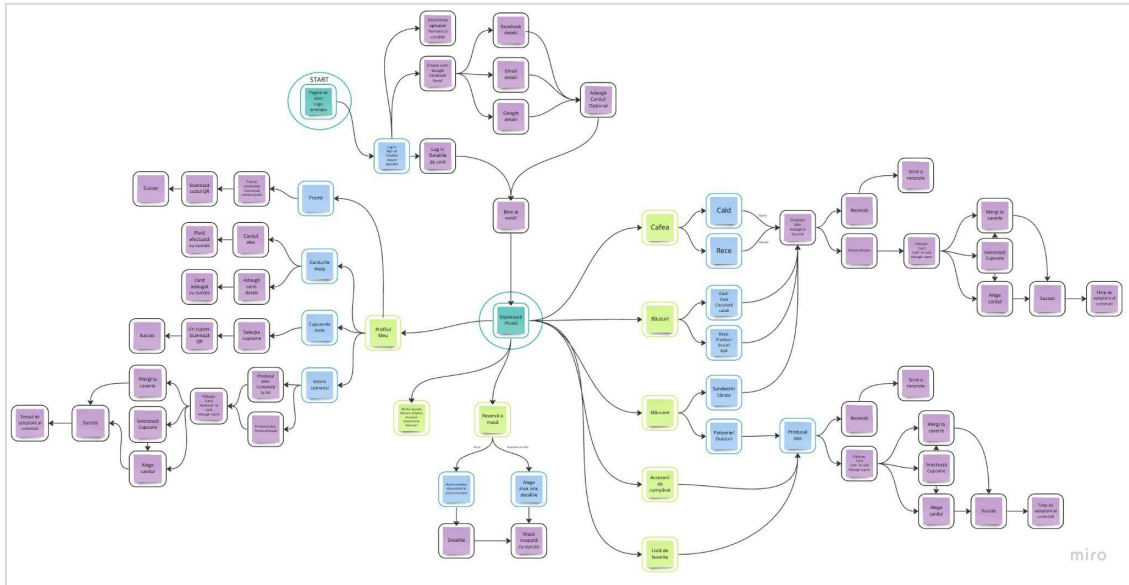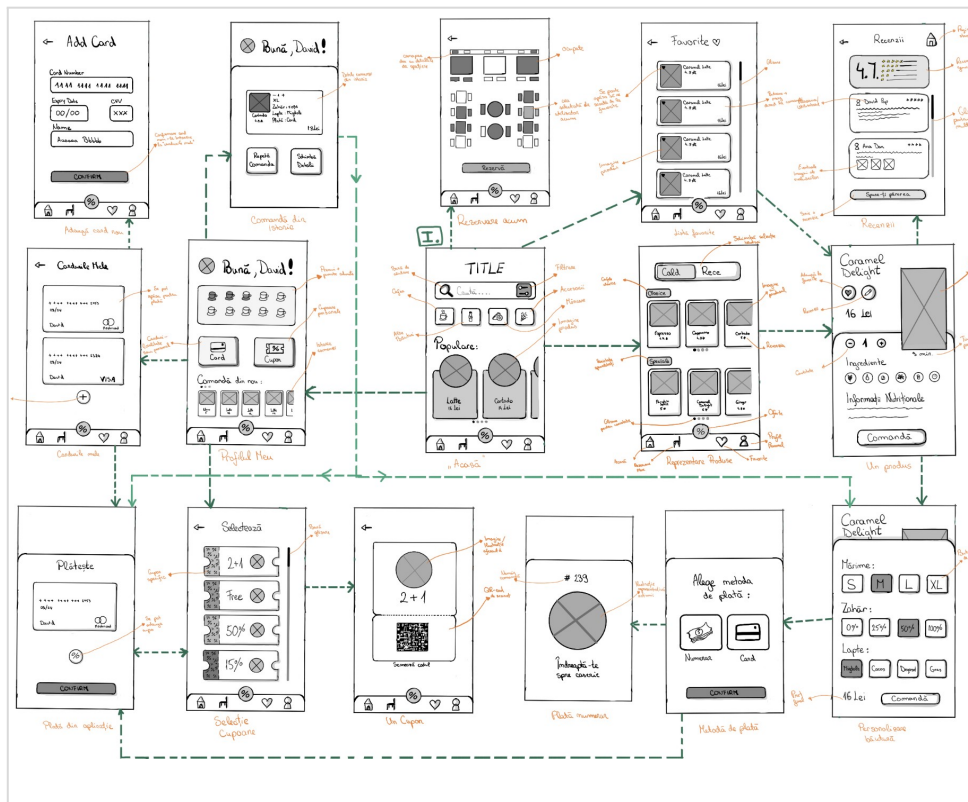
Figure: 5.2.1: User flow map

Figure: 5.2.2: Wireframes

With the help of the wireframes, I have integrated the UI components studied and researched in the previous chapter of my paper, and represented them in a simplistic visual way. In order to give people the chance to always have the security to suddenly change their location in the app or to quickly change their target, they have been designed with accessibility and intuitiveness in mind.

5.3 Visual Design

Following the above process, I have reached the visual design phase, where the described graphic elements will finally be designed. With the help of the previous information, inspiration and suggestions that were collected from the audience during the questionnaire, I have developed a suitable visual guide. This will be used as a so-called instruction manual for application. All the provided elements will be combined and used during the development of the individual pages.
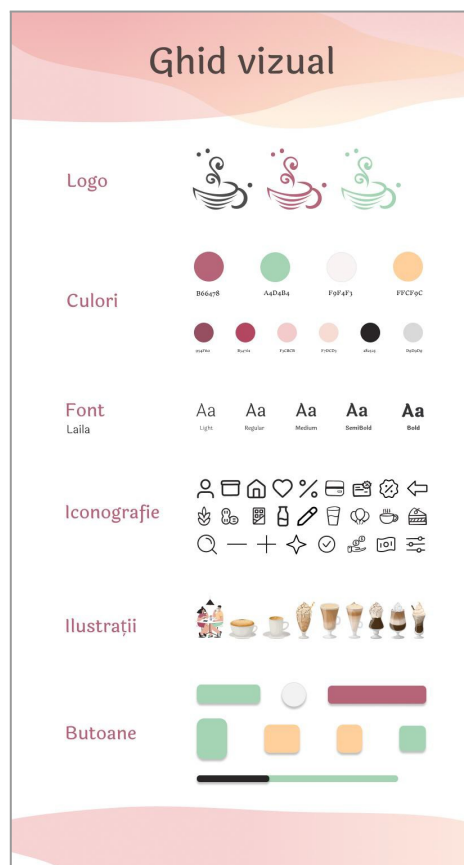

Figure: 5.3.1: Visual Design guide

Based on the UI elements presented above, the individual page designs of the application were created using Figma. Figure 5.3.2 has shown the overview of the UI design that has been developed so far.

The design principles extracted from the analysis of the scientific papers in the previous chapter were used in the creation of the graphical interface design of the Coffee for Everyone app. These can be noticed throughout each page, e.g. all similar elements have been grouped together or are of an identical colour, such as the rectangular shapes in

which the coffee products are presented or the buttons for the options to choose the amount of coffee, sugar and milk. The action buttons for order, write a review or customise were all aligned in the center of the page. Repetition has also been used throughout the button shapes and their locations for better navigation.

Figure: 5.3.2: Individual design of the application pages

The feedback and response elements have been integrated, e.g. during the card payment option to this particular section, a green tick icon from the design guide is used to assure the user that the transaction made has been successfully completed.

As for the reserving table options, it can be seen that, from the colour palette, the most suggestive colours have been chosen to create the map, taking into account the reddish tint, which represents the stop action or, in this context, the fact that the table is occupied. The green colour was used to signify an empty table.

The specific prototype for this application was created with the help of Figma. The aim is to represent the interactions and connections that will be offered by the application to its users. The figure below shows an overview of a part of the prototype of the application that I have developed at this stage. In Figure 5.3.3, the focus is on the Explore/Home page of the application and on the related connections. I have chosen to show it only in this way, as it is the main page, because, due to the amount of connections exposed on the screen, if it were

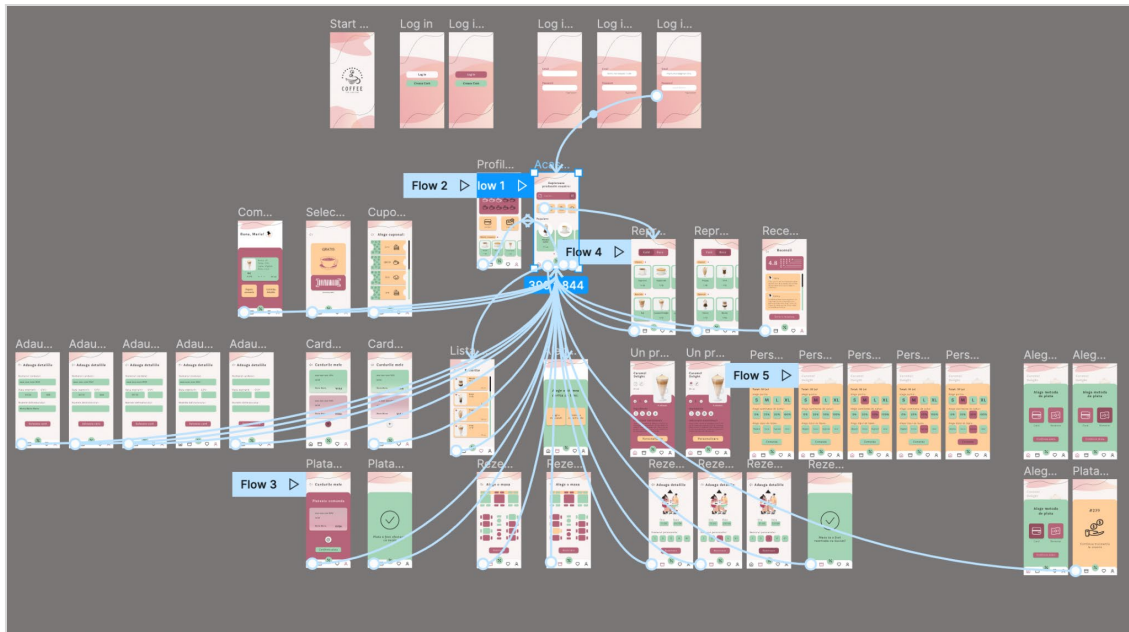shown in its entirety, the image would have become completely imperceptible.

Figura 5.3.3: Application prototype overvice- Explore page

Detailing some of the interactions created, I am able to discuss the scrolling features that can be achieved with Figma. Figure 5.3.4 shows the two menus for hot and cold coffee products. However, in the background there are actually many more coffees that are not visible at first glance. These have been grouped and added into a separate frame, being presented as the selection framed with blue borders.
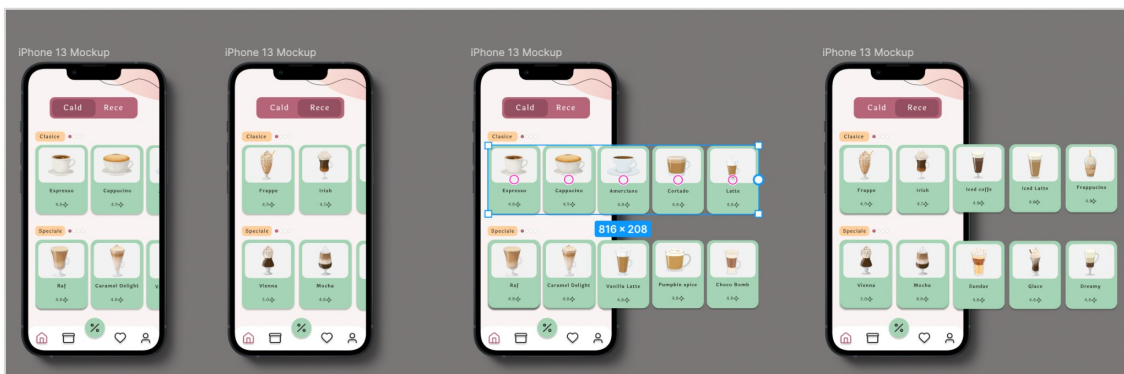

Figura 5.3.4: Scrolling feature creation

The frame can still be embedded within the page as a component. Once it has been embedded into the screen page, using the keyboard 'Ctrl' command, elements that are only to be visible after the scroll action can be hidden inside the frame and adjusted to the screen size. Once the action is complete, Figma offers a function called "Scroll with parent" in the prototyping area. This will trigger the scrolling of the created coffee products and keep them in place along with the so-called parent page, which is the initial home screen. Many such interactions, as exemplified in this chapter, were used during the prototyping phase for the Coffee for Everyone app.

5.4 Testing

As part of the testing phase, specific to the UX/UI design process, I have decided to use observations as a testing method. The reason this method was chosen was to monitor the users' interaction with the developed application design, especially in terms of the level of intuitiveness and accessibility of the actions and information presented.

I have paid high attention from the familiarity of the representative icons, to the most evocative information that stood out and also to how users will go through the process of ordering the desired drink. Will participants check the reviews first before ordering, or will they also read the ingredients? Also, will they be able to understand the buttons and their placement on the screens, will they use the navigation bar at the bottom throughout the process to move through the flow of the app? These were all points I sought to answer during my testing session. I have created Table 5.4.1 shown below to track and summarise all the information from the test session and the data collected.

Table 5.4.1: User Testing

Participant	Observations	Positive experiences	Negative experiences
Lungu Mădălin	Tried the search bar Before ordering a coffee clicked on reviews Read the ingredients Paid with card Added a new card Ordered from the favourites list	Used the navigation bar Scrolling was intuitive Successfully added order to favorites list. Drink customization was done extremely quickly Coupon scanning is intuitive Successfully selected a table	He missed the payment confirmation button and hit the card select button twice before he figured it out. The representative icon for reserving a table in the menu bar created a slight confusion in gestures.
Craia Andreea	Tried to use the search bar. Read the reviews didn't read the ingredients Decided to pay with cash. Booked a table using the map	Scrolling was intuitive Representative icons were understood. Used the navigation bar correctly Added drinks to favorites successfully Chose the free table successfully. Coffee customisation was quick.	The representative icon used for the accessories category created slight confusion. The representative icon for booking a table in the menu bar created slight confusion in gestures. Used the back arrow only once, otherwise only used the navigation bar.
Takacs Alexandru	Went straight for the coffee category icon. Checked all the coffee options Read the reviews Added the coffee to favorites. Paid by card	Used the scrolling without hesitation Used and understood the order history section Successfully added a coupon during payment The coupon was intuitive. Free table was successfully selected	The representative icon used for the accessories category created slight confusion. Within the success response screen, tapped the middle several times to return to the app. After a few attempts, he noticed that that action was done using the navigation bar at the bottom of the screen.

6. Conclusions

I will be concluding this work by presenting below an answer to each of the research questions that were raised.

Q1 - Is the design of graphical user interfaces for mobile devices relevant, in the context of scientific research?

Mobile UI design is relevant in the context of scientific research because with the help of the aesthetic and functional components it offers, it can be adapted to the needs of different domains such as education, health, commerce, etc. At the same time, the UI can be designed taking into account multiple users or multiple parties that are involved in the domain itself and individually serve the purposes of each.

Q2 - What are the components and design principles used by researchers to design graphical user interfaces for mobile devices?

The design components used by researchers can be listed in the following categories and more: illustrations, icons, images, animations, fonts, buttons, menus, media, search bars, navigation, swipe, logo. The design principles used when designing graphical user interfaces are the basis of the visual hierarchy or balance. These are created using the principles of: proximity, symmetry, contrast, whitespace, alignment, and repetition.

Q3 - What are the best practices in applying specific steps of the UX/UI design process for mobile interfaces?

In this UX/UI design process, the following stages can be found: Research, Information Architecture, Visual Design, Prototyping and Testing. For each stage, there are different methods to achieve the desired results. For example, in the case of the research stage, questionnaires, interviews or observations can be carried out to gather audience preferences in the given context. In the information architecture stage, all the data and messages that the application needs and wants to convey are built and structured, starting with methods such as flowcharts, mindmaps, up to the construction of wireframes to get an overview of the information in the pages of the application. Based on these during the Visual Design phase, a visual guide will be developed. Using the guidelines: colours, fonts, icons, chosen illustrations, and also the previously created wireframes, the individual page designs will be projected and finally the prototype of the application will be designed using different programs such as Figma or Adobe XD. This prototype will be tested in the final stage of the process, using various methods e.g. observations, focus groups, A/B testing.

In the context of my work and the design of the Coffee for Everyone app, I have encountered some limitations in the UI/UX design process. The prototype was developed in a short time frame and for an app that serves multiple uses and products. I was not able to fully design the prototype for all the pages that would be included in the final version of the app, but I have limited myself, due to the context and this work, to focus

on the branch for coffee products. An entire user flow was still developed, with the aim that it could be presented for testing purposes. However, in the future, other product categories and functionalities of the application can be adapted and added, based on the same design and structure I have created for the coffee branch.

At the same time, it is important to point out that, only common potential users of similar ages participated in the testing phase of the UX/UI design process. In the future, for more detailed testing and results, I would also suggest testing conducted with UX/UI people, who could provide more insight into details that are not visible to non-professionals. I would also use a focus group method instead of observations for this procedure, to trigger a more open discussion and collect more results.

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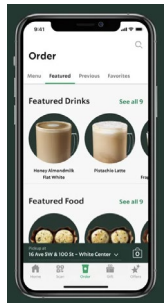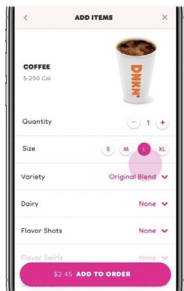
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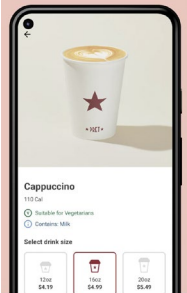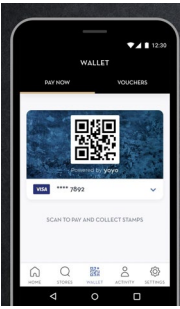
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Appendix 1

Tabel 5.1.2a:Competitive
Analysis

Application	Design	Key functionalities	Feedback	Accessibility	Reviews
Starbucks	Modern and clean design Representa tive images Intuitiv e icons Colours in line with the brand	Fast and pre-order drinks Starbucks Rewards loyalty program Personalised drinks Integrated Starbucks Card for in-app payment Option to add products to favorites	Direct interactio n after pressing buttons Notification s in case of offers or full reward	Navigation bar menu for quick access Intuitive search icon for direct interaction	Positiv e ratings Small issues that are more related to the communica ti on of the app with the cafe itself: wrong order etc.
Dunkin' Donuts	Colourful and vibrant design Representa tive images Suggestiv e icons	Separate menus by category: drinks, food, donuts Integration of personal card and payment directly from the app Rewards and offers system Option to customize the drink in the details of each ingredient Pre-order from the app "My Profile"	Prompt interactio n. Order preparatio n notification s Notificatio ns of offers and discounts Error messages in case of problems	Provides options to enlarge text Navigation bar menu Provides voice assistance	Positive reviews with minor complaints about the system

Application	Design	Key functionalities	Feedback	Accessibility	Reviews
Pret a Manger 	Simple and friendly design in line with the brand Representative images Suggestive icons	Menus structured according to food preferences: vegetarian, vegan, etc. Integrated reward system Varied payment options Quick pre-order Easy personalisation of drinks	Visual response Notifications about offers or order	Navigation bar menu	Positive reviews with minor complaints about the system
Costa Coffee 	Brand consistent friendly design Representative images Suggestive icons	Menu navigation bar Personal order history Integrated award system "My Profile On-location booking options Integrated payment system Drink customisation	Direct interaction Confirmation messages	Navigation bar menu Filter options Search options	Positive reviews with minor complaints about the system
Caffe Nero 	Design using predominantly black and white with a tinge of blue Representative images Suggestive icons	Category-structured menus: drinks and food Integration of personal card and payment directly from the app Rewards and offers system Save your favourite drinks Quick pre-order "My Profile"	Fast interaction Confirmation messages	Provides options to enlarge text Navigation bar menu Provides voice assistance	Positive reviews with minor complaints about the system