Emotional design: Creating user interfaces that evoke emotions

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This thesis examined emotional designs in user interfaces of mobile applications. This study was conducted to analyze the positive impact of emotional design elements that how they evoke emotions in user interfaces of mobile applications and affect user engagement and satisfaction.

The study is based on various user interfaces of mobile applications. Some parts of the thesis is covered with the background of user interface, emotional designs, design key elements, and some psychological theories. Other parts are based on the user surveys and designer analysis of user interfaces of some specific applications. To analyze the positive emotions on the basis of research questions, case studies from different industries, such as social, educational, and health industries, would be examined through surveys. These surveys are based on three levels of emotional designs that how these levels would align with the enhancement of user engagement and satisfaction. The data collected through the surveys also provided some feedback and opinions on the user interface according to user perceptions.

The results of this study contributes an experience in mobile application development. It helps designers to create more engaging and satisfying mobile applications user interfaces by fullfilling the user requirements on the basis of emotional designs which stands out from the competitive market.

Keywords: Emotional design, user interfaces, mobile applications, design elements

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1 Introduction

In this techno-savvy era, the growth of user experience (UX) and user interface design (UI) is rapidly increasing in the mobile and software industry by prioritizing functionality and usability of the apps or websites, but emotional aspects are crucial in user engagement and satisfaction which is often neglect by the firms or software companies. Emotions are divided into two events positive and negative which can be changed according to the situation. Positive emotions are happiness, and pleasant, such as enjoyment, hope, pride, and relief. Negative emotions are unpleasant, such as anger, anxiety, hopelessness, shame, and boredom. In 2004, Donald Norman who is a famous psychologist introduced the emotional design concept (Norman, 2007). In his book, he categorizes the design theory into three levels: Visceral, Behavioural, and Reflective.

Visceral belongs to the first aesthetic appearance of the application or any software. Behavioral design refers to interaction and usability. Reflective design belongs to high level of emotional connection and brand loyalty. Emotional design is vital because users need more excitement and emotional attachment than functionality while using mobile applications or software. If the product or mobile application does not meet the user's emotional needs, perceptions and satisfaction then the user will start looking for another mobile application that meets the user's excitement, joy and trust level. The user satisfaction level leads to the long-term success of the software organization or firm.

1.1 Problem Statement

Emotional design is effective for user experience to enhance user satisfaction, customer loyalty, trust and increasing revenue showing the positive emotions towards product. The absence of emotional design in user interfaces can lead to reduced user retention, lower brand loyalty, and diminished overall satisfaction. Emotional design is the process of designing user interfaces to evoke emotional responses such as delight or excitement from a user. So users can find valuable, usable, and desirable software products.

The aim of this thesis to explore how emotional design affects user interfaces to create meaningful and memorable experiences with user engagement by using design elements or frameworks. The design elements such as color scheme, micro-interactions, typography, sounds, visual and imagery to enhance user engagement and evoke positive emotional responses.

1.2 Research Questions

During the design and development process of complex Mobile Applications it is essential to engage the users emotionally. This thesis is based on the research questions that are linked to Dornman's emotional design three level principles, UX, UI design elements.To study the impact of emotional designs on mobile applications there are several research questions below in this thesis:

1. How do emotional design and psychological theories influence user engagement, perception and satisfaction in user interfaces?

2. What are the key design elements and feedbacks that evoke positive emotions in user interfaces or UI/UX designs of mobile applications?

3. How can emotional design principles be applied across different industries, such as healthcare, education, and social industry?

4. How can UI designers compare, measure, and evaluate emotional responses to various interfaces of mobile applications?

1.3 Research Methodologies

Research methodologies are the techniques used to collect and analyze the data in the study of research. The methodologies of quantitative and qualitative research approaches will be used to find out the effect of emotional design on user experiences with the mobile applications. Every methodology would be used based on the research questions, and the type of data which would be needed to analyze and compare for meaningful consequences.

1.3.1 Design Surveys

A survey is an empirical examination method that is used to collect data from a large number of users (Kasunic, 2005). Dawson (2009) adds that "surveys draw either qualitative or quantitative data from the population". Design surveys would be done to find the answers of research questions. Likert Scale surveys are used to find the user's emotional perception, satisfaction, and engagement with the mobile applications. A Likert 5-point scale will be used to identify the emotional impact of users' interaction with various mobile applications. A Likert questionnaire scale is a measurement method to make the evaluation of user's opinions or perceptions. The second approach in design surveys would be the qualitative open ended questions. User feedback is an essential component to understand user experiences, emotions, perceptions and their interactions with the mobile applications deeply. It belongs to qualitative research in which the UI designers identify users' emotions and how

they interact with a mobile application by analyzing open-ended surveys and forum discussions.General surveys and case studies such as Instagram, Duolingo, and MyFitnessPal would be analyzed seperately. The surveys will be done through the participants who are volunteers such as classmates, friends, and relatives. They will then be stimulated to share the design survey with their network of people. This approach will help to figure out the diverse range of user'sperceptions and the emotional consequences of mobile applications.

1.3.2 A/B Testing

An experiment is done by creating two groups: a control group and a treatment group, which is called an A/B test. Which is also known as split testing (Auer et al., 2021), (Kevic et al., 2017). A/B tests are commonly used for online experimentation (Ros & Runeson, 2018). The groups two groups in A/B testing are called variants.A/B testing will used to evaluate emotional design by comparing different UI versions and design elements. This will help designers to analyze UI versions that have a stronger emotional impact on users. Case study Duolingo mobile application would be analyzed by comparing the two version of user interface as Group A and Group B to find out the best emotional response. This helps designers to make focus on the design elements such as colors, typography, animations, microinteractions, and overall aesthetics to enhance user engagement and satisfaction.

1.3.3 Case Studies

Case studies are common methods in software engineering, and guidelines are provided by Runeson (Runeson et al., 2012). Runeson defines that Case study in software engineering as an empirical examination on multiple sources of evidence to investigate one instance within its real-life context.A case study in qualitative research is an in-depth exploration of a specific individual or a group within its real-

life context. By focusing on understanding the emotional designs and relation of the emotions of users with mobile applications, the data would be identified through multiple sources such as observations and documents. UI interfaces of Instagram, Duolingo and MyfitnessPal mobile applications would be analyzed by designers. This helps designers to make focus on the design elements such as colors, typography, animations, microinteractions, and overall aesthetics to enhance user engagement and satisfaction.

1.4 Declaration of Generative AI

During the research Stealth writer and ChatGPT were used to improve the writing and lengthy texts. However, AI-generated content is completely reviewed, emended, and approved by the author to make sure that data is correct and relevant and aligned with the research objectives, methods, and testing. This usage of AI tools applies mostly to the literature sections.

2 Background

Emotional design has gradually come to function as an important factor in design and human-computer interaction in the past few years. Over recent years, the spotlight has shifted from the traditional design concepts, human-computer interaction concepts to a more emphasis on emotional design. On this theory, emotions are key for establishing how experiences are constructed. At present, users expect to have and desire seeing genuine and immersive experience. Emotional design, therefore, is very important in developing products which inspire emotions and establish personal interactions with users. There is obvious evidence of the development of design practices over time. At first, focus was placed only on the effectiveness and efficiency of operation of products. Design goals are broadening to prioritize equally User Experience UX/UI and establishing emotional bonds. In design the emotional burden is as important practical usability. Emotional design has been adopted as a key strategy using human emotions to create perception on the way people think about their interactions with products, services, and environments. Examples are usually given in the forms of emotions like happiness, frustration, trust, or attachment.

Emotional design aims to provide experiences that touch normal users emotionally rather than functionality or aesthetically. This approach considers cognitive and emotional factors of users and acknowledges the ability of emotions aroused through design to play a major role in how products are visually assessed, used, and remembered. Because of this, emotional design has great influence in enhancing

the general experience of the users. Better communication, increased satisfaction and strong relationships were established between users and products.By focusing on emotions, designers can ensure that their creations leave a deeper and more meaningful impact on users experience UX, encouraging continued engagement and satisfaction.

2.1 User Experience Design

There is no definition of UX design, however it can be define as the interaction between a mobile application or any website and target users is the user experience design. User experience is also an cognitive response of user towards products, systems or services that user would engaged themselves. UX design gives significant experience to users by elevating customer satisfaction, loyalty, ease, and joy in the interaction between the user and the product including aplication or websites. Experts of UX design create products that are easy to use and they concentrate on interaction engagement, efficiency, and joy. It would be a well design user experience if user needs fulfill while interacting with the product such as mobile application or website interface.UX designers come from multidisciplinary fields of backgrounds such as visual design, information design, programming, technical writing, psychology, or interaction design (Gray, 2016). Every UX designer follows a user-centered workflow, continually applying well-informed effort until every relevant problem and user requirement is addressed in the best possible way. UX design boosts customer satisfaction and fosters loyalty by making interactions with a product or service more intuitive, enjoyable, and hassle-free. It reaches far beyond simple usability, delving into users' goals, motivations, and behaviors to craft a smooth, satisfying journey. To verify that the solution truly aligns with real-world needs, UX practitioners employ methods such as user research, persona creation, wireframing, and prototyping.

2.2 User Interface design

The user interface is the part of a product that users interact with to complete their tasks quickly and efficiently. This term is commonly used in the context of software and digital devices. UI Design refers to all the elements a user can interact with on digital platforms. It influences how users perceive and interact with a product. UI design covers a product's visual appearance and functionality, including the screen, touch interface, mouse, keyboard, sounds, and even lights. It involves everything users interact with on a digital device. UI design plays a crucial role in whether users stay on a platform or leave. Today, UI design is applied across many media types, including computer interfaces, mobile devices, virtual reality, and even invisible interfaces. Ultimately, UI design helps users connect with a computer or software in a way that they can see, hear, and understand. A good UI should be simple, intuitive, and satisfying to interact with, rather than just focusing on the design itself. To achieve this, designers must consider factors like usability, eliminating frustration, reflecting the brand's values, and building trust with users. In recent years, the rise of mobile and web applications has made many companies realize the importance of UI design in enhancing the overall user experience.

In the case of mobile apps, it typically refers to the way the app looks and behaves on the screen. UI design mainly focuses on the visual and interactive elements of the app. Unlike visual or graphic design, UI design is more about creating a smooth conversation between users and the product, helping them perform tasks and achieve their goals (McKay, 2013). In a mobile app, a well-designed UI ensures that the app works well, is easy to use, performs smoothly, and provides adequate support (Qasim et al., 2018). UI design also includes the overall layout, colors, typography, and even icons and components that make up the app's interface. A great UI combines thoughtfully chosen color schemes and fonts to create a visual identity that matches

the app's brand and purpose. It should also consider how the interface will appear on different devices, ensuring the design is responsive and adaptable.

2.3 UX/UI Design Process

To refine and enhance product innovation activities UX professionals and practitioners use the UX design process which is an iterative method (Dove et al., 2017). Verification and validation at each design stage is necessary in UX design process used by business managers and UX teams. Decision-makers and stakeholders get involve at each stage of the design process to make sure about rhe products feasibility and usability.The UX design process is categorize into six stages: understand, research, sketch, design, implement, and evaluate.

Stage 1: Understand. The product UX design team should understand the specific problem according to customers requirements and satisfaction. In this stage stakeholders, design team, business managers, and the product manager work together and go through the analyses and requirement specification. To analyze the requirements business managers closely work with the users to understand and analyze the needs. Design specification are made by the product UX design team after analyzing the requirements of the users (Sundt & Davis, 2017). One-on-one interview method is the standard method for observing the requirements for the customers individually. Based on the specified customer needs, product managers and design team work together to make user personas and use-cases or user stories. A persona is define as a representation of similar traits of an individual user or a group of users based on the users specific requirements, goals, and interests. Design personas refers to user goals, user needs, current behavior, and main points. Design personas help you share key research insights and highlight real users' goals. Use case is define as a user story or scenario which makes all the interactions and engagement between the focused users and the product such as mobile application or website.

Use case includes the different process such as task definition and task grouping, user steps, user expectations and possible failures, iteration and refinement, and the documentation of the use case (Gebhardt et al., 2016).

Stage 2: Research. To design the user experience research stage is necessary. On the bases of predefined UX design guidelines use cases and users needs would be explore by the UX design experts and the IAs research. Stakeholders and UX team works together in research stage to understand the market, to position the company in the competition, and learning from the competitors. The consequences of this stage would be the specific pre-established ideas and research to create the real UX design. UX researchers should learn and understand market competitors worldwide, and obtain motivation and refelections from competitors. During the research phase, track current graphic-design trends, note new user behaviors and interests, review proven product-design principles, study lessons from past products, and consult existing UX guidelines (Hussain & Mkpojiogu, 2015). To provide the desired experience UX designers should perform a preliminary study of feasible layouts and alternatives for the product.

Stage 3: Sketch. In the sketch stage, UX design experts explain the user interface elements to design features by using paper sketches, whiteboard flows, and wireframes. Sketching and wireframing are used to create and test a useful product mockup design. Stakeholders, UX experts, the design team, the IAs, and the information designers play a vital role in the sketch stage. The product UX design team test and validate the interactive design mockups. In the consequences and benefits of the sketch stage UX team can make an elimination of the unnecessary design features, make an outline and document the user interface elements, provide supply visual prompts which helps in creating mockup (Perdomo et al., 2017). To achieve end-user satisfaction, mockup would play a vital role in the UX design process by keeping UX goal in mind and create the design accessible and user friendly. The re-

sult of the sketch stage would be wireframing and mockups for product prototyping with variations.

Stage 4: Design. UX design team apply images with themes and styles to the accepted sketches and mockups of the product. The design should follow the guidelines, colors, typography, and iconography for the product. Stakeholders, design team and the technical experts work together in primary stage. The product managers and the business managers control and validate the graphical elements for the user interface. The design stage ivolves user interface elements: icons, images, colors, style, theme, and guidelines. After the approval of graphical content from ux experts its time to convert the black and white wireframes mockup into the visual colour interfaces. The alignment of the GUI elements with the brand's identity, theme, style, design trends, user expectations, and user behavior would be settle. The outcomes of the design stage after the verified UI elements should be handover to the development teams for the implementation of the product.

Stage 5: Implement. Development and product UX design teams are invovled in createing the coding possible to make the back-end functions work and blend them with the user interface. Development team also have the right to give feedback and improvement recommendations for the product UX design team for the enhancement of the design phase. The all features of the user interface and experience are the consequences of the implementation stage. Before this stage, you can't get any feedback from real users. Only once you release a test version and let visitors or testers fully use the interface can they start sharing their input. When UI is ready and implementation is done with the functions, at an early stage the UX team start gathering feedback and overall user experience from designers to make the UX design effective.

Stage 6: Evaluate. According to use cases and user experiences, evaluation, verification and identifying the product by product managers and other stakeholders

with the design team to tests and validates the product to make further improvements for the end-users. Testers would perform comparisons of implementation and user interface. The consequences of the evaluation stage would be the feedback the test reports. The evaluation is an iteration process which means the actions can run the feedback loop one round after another. When UX team collect enough data from the interaction tests, the product would be ready for delivery after accomplish the desire of user experience and satisfaction.

2.4 Importance of UI/UX Design

The integration of UX design into the process of development of the product provides some significant improvements, and its importance to the innovation of product is incalculable.The products are capable of functioning effectively and better meeting user needs when UX design is enhanced. Therefore, improving the value of the product also increases its worth in the eyes of the client (Bilgihan, 2016). The integration of products with UX innovation can support better relations between products and customers and allow businesses to reach leadership in their markets (Deng et al., 2010). Good UX design will help in better performance of the product in various ways. Improved UX has (a) better customer satisfaction, (b) reduced costs for the user as its effects (Shin et al., 2017). That kind of alignment helps businesses design products that are very attractive to users and fulfilling a needs, which in turn increases sales and creates consumer trust (Bilgihan, 2016). The more a brand's products meet the emotional needs of a customer, the more they forge an emotional bond with the brand. According to (Gray, 2016), customers who have positive experiences with a brand are more likely to remain engaged, actively seeking out new products, visiting the brand's website, and following the company on social media. When product managers understand how customers interact with their products, they can optimize the user experience, reduce costs, and improve

overall product quality. In doing so, the company not only enhances its market position but also builds lasting connections with users, securing long-term growth. Incorporating UX design into product innovation ultimately benefits the company by improving product performance, reducing production costs, increasing customer satisfaction, and driving sales. For leaders and product owners, understanding how users interact with products and applying UX principles is key to ensuring the success and sustainability of their products in the market.

In the competitive mobile app market, effective UI design leads to higher user retention, better ratings, and greater success. By creating an app that is easy to use, visually appealing, and functional, businesses can increase their chances of standing out and succeeding in a crowded market. A well-designed UI helps prevent the need for constant redesigns, saving both time and money. When a designer invests time in creating a strong UI, there are fewer issues during and after the app's launch, as users will experience a seamless interaction with the interface. A flawless interface requires minimal maintenance and updates, making the product more efficient and sustainable in the long run. Charles Eames once said that a designer's role is like that of a gracious host who anticipates the needs of their guests. A good UI grabs the user's attention and keeps them engaged. However, it's only an intuitive UI that will maintain their interest. When users first interact with an application, the goal is for them to feel compelled to return as often as they like. The main purpose of UI design is to make the content such as images, text, and other elements more engaging while simplifying navigation. This, in turn, enhances user understanding and satisfaction. A happy user is more likely to return to the app and recommend it to others, which can lead to positive reviews. These positive evaluations inspire designers to continue improving the app's usability, which increases its value and helps it outperform the competition. Moreover, when users can easily navigate and interact with a consistent interface, they don't need to learn anything new. This encourages

more interaction and improves the app's usefulness. A unified UI ensures that the design is aesthetically consistent, making the content more accessible and helping prioritize key elements. By emphasizing important aspects of the app, designers can guide users smoothly through the experience.

2.5 Emotional Designs

Emotional design is a user-centric approach that aims to evoke particular emotional reactions from users by focusing on how they feel while interacting with a product. It operates on the basis that emotions significantly influence decision-making and perception, which in turn shape user engagement and satisfaction (Yang & Chen, 2008). Emotional design is not only about making the users feel good, but also more about creating a consistent and meaningful experience that resonates with them on a personal level. Emotional design is focused on the emotions of users for investigating a positive impact of design interactions on sentiments and behavior of users. Satisfaction and happiness emotions can enhance user engagement and loyalty, while as negativity emotions includes dissatisfaction which lead to disappointment and rejection. Information from psychology and neuroscience contribute much to the development of emotional design. Results of the works indicate that some design decisions can elicit emotions related to cognitive functions such as memory, problem-solving, and decision-making (Picard, 1997). Our mental activities and physical movements are connected as explained by the theory of represented cognition. Even in digital interfaces, features like motion, shape, and texture can simulate these interactions and create emotional resonance. Although mobile apps lack physical form, designers can leverage unique aspects like interactivity and visual feedback to build deeper user connections. A core framework in this domain is Donald Norman's model of emotional design, which categorizes user interactions into three levels: visceral, behavioural, and reflective (Norman, 2007):

Visceral

It is the user's initial response to a product or visual design based on its aesthetics and visual impact. In this phase, quick emotional responses are created by the users toward the design based on the user's interactions and perceptions (Norman, 2007). This is the human nature, their instinct regarding to something new. This is how humans naturally respond to something new. People have their own perspectives shaped by their past experiences. These experiences are influenced by the senses, like seeing, hearing, and touching. According to some studies, this phase is called the "physical action" phase, which is connected to feelings of joy, appealing, and comfort when using a system. Other researchers, like Yan and Cheng, describe this as the way we perceive the outside world. The visceral phase focuses on things like color and overall look and feel. In the UX process, the visceral level is important for conducting user research. This research aims to understand users' sensory responses, rather than just their current behaviors. According to Kamil and Abidin, interacting with the visceral level can make users feel more satisfied with their sensory experience.

Behavioural

It refers to the usability and functionality of the product or user interface and how users can conveniently complete activities and how much joy they feel about the process (Norman, 2007). The behavioral phase is about actions that are influenced by psychological factors (Peng, 2022). In this phase, users make decisions and perform tasks with their conscious mind. It's all about how the system functions and how easy it is to use. Researchers Yan and Cheng call this phase "cognition of product use". Prototyping is used to connect the user's mind with the system created by the designers, letting users imagine how they would feel while interacting with the system. There are also tools, like hierarchical task analysis (HTA), that help

define tasks, and cognitive walkthrough (CW) is used to understand how users feel when interacting with the system. CW is based on cognitive science and psychology.

Reflective

It involves an evaluation process and conscious cognition, where users make reasons and conscious decision and assess their overall experience which helps the users to develop long-term impressions towards the product or user interface (Norman, 2007).The reflective phase focuses on how users think about their experiences after interacting with a system. From a psychological standpoint, people react based on what's happening in their lives at the present time. In this phase, users compare their beliefs and feelings before and after using the system. Yan and Cheng call this "product reflection." Users are asked to share their thoughts about their experience. This phase is related to personal experiences and stories (Huang & Tian, 2018). To evaluate the results, heuristic evaluation (HE) is used. HE is a common method to inspect and improve the design. Some researchers, like Quinones et al., have reviewed HE in detail (Norman, 2007). There's some debate about how well HE fits into emotional design, but experts suggest focusing on areas like playability, security, and adaptability. Nielsen and Molich also suggest ten principles for design. Heuristic evaluation measurement is based on usability principles (Oyedele et al., 2018). Heuristic evaluation should be easy to use, well-designed, and focused on solving specific problems.

Positive emotions in Mobile Application Design

Positive emotions such as delight, trust, and satisfaction are essential in keeping users engaged with an app and fostering long-term brand loyalty. When users feel good while using an app, they are more likely to continue using it, recommend it to

others, and remain loyal to the brand over time. Research shows that when an app looks appealing, users feel more satisfied and believe that the app performs better. Small design details, like color choices, text style, and sound, can also influence emotions and enhance the overall user experience. The emotional design strategies used in apps may help to support the mental health of the users. The concept of positive computing is to incorporate design approaches in technological products with an aim of improving user's mood and health. Africa-apps, with a preference given to emotional design, provide a more rewarding experience and more satisfied users in a closer relationships with the apps. Developing this emotional relationship improves user's engagement, satisfaction and loyalty.

Negative emotions in Mobile Application Design

Negative sentiments include frustration, confusion, dissatisfaction, the effect of which may affect the user experience and make him/her leave the app. Poorly designed layouts, confusing sections of navigation menus and slow responses generate this kind of emotion, and leave users leaving the app. On top of that, annoying audio cues or excessive visual clutter will only make the experience worse and lower user satisfaction. To overcome such feelings, developers need to understand the points where the users experience difficulties and act for overcoming of these difficulties. Using a simple and convenient design makes the app more usable and pleasant. Overcoming these problems reduces frustration tremendously and converts negative emotions into positive interaction thereby making the app experiences more enjoyable to the users. This positive shift in experience draws users to come back and use the app.

Importance of Emotional Design

Emotional design greatly improves user experiences by creating a real and enduring connection to users. It goes beyond its functional implications altering how users think and act towards an object. Positive emotional reactions to products create more memorable and engaging experiences for users, which has positive applications for brand recognition, and subsequently, future success. Essentially, emotional design's value resides in how it is able to generate greater and deeper impressions on the users and the products. The relevance of emotional design is based on the fact that the users need products not only for the welfares but also for the emotional needs. User emotions play an important role in determining how users relate to a product and if they will come back to a product or not.

Products failing to meet users' emotional needs have a risk of being replaced by alternatives that promise a superior emotional experience. Additionally, emotional design makes sure that users develop a better bond emotionally to the use they make of products. The formation of an emotional bond with a product helps make users trust the product and enjoy their experience more. Developing such emotional bonds results in increased user loyalty, one of the important factors of a product's long-term performance. Emotional design provides companies an advantage over the marketplace because the emotional benefits will generate a better brand loyalty, more satisfied customers and a better brand commitment. Such an approach is also beneficial to users to make products more applicable, promote emotional involvement and stimulate frequent interaction. Through the use of emotional design, designers become more aware of human needs and values and therefore are able to understand their audience better as they get to know them more. Through the synthesis of findings in emotional design and emotions research, designers are on the verge of manufacturing products that meet elementary functionalities, further enhancing deeper emotional attachments and consequently increasing user satisfaction.

2.6 Phsycological theories

Cognitive Load Theory: The concept of cognitive load sums up the linkage between the information processing effort and the effect on the learning and remembrance of new things. Cognition psychologist John Sweller presented the theory in the 1980s, which shows how the processes of processing information can hinder or support us being effective (Ayres, 2006). The idea of cognitive load represents the strain placed on working memory as it assimilates information as it operates on problems. Cognitive load is essentially the strain placed on working memory when trying to understand and solve problems. This load is divided into two types: intrinsic and extraneous cognitive loads. Intrinsic cognitive load refers to the inherent difficulty of the material being learned. This load is considered fixed and depends on the complexity of the subject matter itself. It represents the portion of memory needed to grasp the core concepts of a learning process and arises from the properties of the information, not the individual's ability. Extraneous cognitive load refers to the mental effort required to process irrelevant or unnecessary aspects of a task, such as confusing fonts, small actions, or unclear directions. It involves the mental resources used by parallel processes that do not contribute to the learning objective. This type of cognitive load is a result of poor presentation or inefficient teaching methods (Ayres, 2006) ,(Bannert, 2002), (Paas et al., 2003).Thus, designers must ensure that the cognitive load is minimized to enhance understanding and user experience.

Cognitive Load Theory is crucial in understanding how emotions and UI/UX design come together to impact the user experience. A good UX design considers cognitive load limitations in the process of designing interfaces that turn content into an accessible and easy to understand format. The goal is to ensure that the users can assimilate and apply information at a fast rate, ensuring that they do not get mentally tired. If the user finds how much mental effort is required to understand

and interpret information over their comfort zone, they can abandon the product. For one to easily comprehend what cognitive load does, there is the need to have a good understanding of cognitive psychology focusing on the storage of information in the long term memory. Cognitive Load Theory teaches that interfaces should be focused on ease of use, bearing in mind that the users have limited capacity to deal with information. To reduce cognitive load, designers frequently simplify challenging tasks, employ intuitive approaches to organizing, and take advantage of visible cues that are straightforward. In this way, the users are able to accomplish things without anxiety and annoyance, enhancing user experience and interface usability. Simplified designs help the users remain concentrated, perform their actions effortlessly, and more easily like to use the interface.

Gestalt principles: TGestalt is German for "shape," "form," or "figure". Fundamentally, Gestalt psychology explores the way the human brain works to process the visual information available, grouping the singular shapes and figures that compose said information into understandable patterns. Understanding how the brain arranges visual input enables designers to create interfaces fittingly corresponding to human perception.Designers can create interfaces that are at the same time pleasing visually and easy to use using the follwing principles:

1. **Proximity:** The elements are close to eachother of the same category. For instance, items in menus of mobile app are grouped together with minimum spacing belong to the same category.

2. **Similarity:** The elements looks similar on the basis of shape ,color,size etc from the same group in user interfaces.For instance, The same color and style buttons having similar functionality across the app, like primary function performed by all blue buttons.

3. **Continuity:** From the figure-ground principle, users can determine what goes

into the foreground and background. It is a useful way to highlight important details, as well as provide a range of contrast and increase the visibility of content, especially on light or dark backgrounds.

4. **Closure:**The closure principle is based on the ability of a brain to fill in the missing parts in order to make a full visual information perception. This principle is often implemented into the logo and icon design, allowing to perceive partial shapes or depictions as complete ones which positively supports visual branding and recognition level.

By incorporating these principles, designers can guide a user where they look, illustrate connections between components, and strengthen a design hierarchy. Using these principles, users can understand better how an interface functions and is arranged, irrespective of its complexity to navigate more easily and to engage more.

Pattern-recognition design theory: Our mind uses pre-existing knowledge to interpret any new input. We simply have learned from constant exposure to online content to expect a number of things visually from elements, or web pages. When we meet an unknown shape, our brain searches for existing patterns immediately. A pattern is a design idea that effectively solves a given usability problem causing other designers to incorporate the pattern into their design work. For example, one of the most recognizable elements of the internet's interface is a search bar. When asked to describe it most people would come up with an automatic image of an input field with search and a magnifying glass image. This universal design came after multiple encounters with search bars across multiple sites, which all held similar functionalities even though they differed in appearance a little.

By altering an iconic design, if designers decide to replace the magnifying glass with a lighthouse icon, if they change the name 'search' to 'find it if you can', users are likely to become disorientated. Such a change can cause users' frustration and harm trust users have in the website or app, which can make them leave the page.

Designers must ask whether they should use these patterns in guaranteeing ease of use. These patterns can make the navigational and task-fulfilling activity of users easier and with no cognitive load.

3 Design Elements

Design elements are visual components which creates an interactive user interface of mobile applications. These elements evoke emotional responses by user engagement with user interface like joyness, calmness, comfort, or excitement. These elements enhances usability, engagement, and satisfaction of the user.

3.1 Colors

Color Theory: Color theory has its roots in the 18th century, with major contributions like Johann Wolfgang von Goethe's Theory of Colours (1810) and Michel Eugène Chevreul's The Law of Simultaneous Color Contrast (1839). Color theory is essential for creating cohesive and aesthetically pleasing designs, particularly in advertising, by using a universal color scheme. It is based on the color wheel, as shown in Fig. 3.1, showing how all colors can be derived from three primary colors in an additive color system.

It involves the mixing and application of different colors in design and composition. Color enhances the aesthetic appeal and energy of a design, while also conveying emotions.These three primary colors—Red, Blue, and Yellow—serve as the foundation for all other colors and cannot be created by mixing other colors. When combined equally, these primary colors create black. Secondary colors are created by mixing two primary colors, such as violet (Red + Blue), lime (Green + Yellow), and turquoise (Blue + Green). Tertiary colors come from mixing a primary

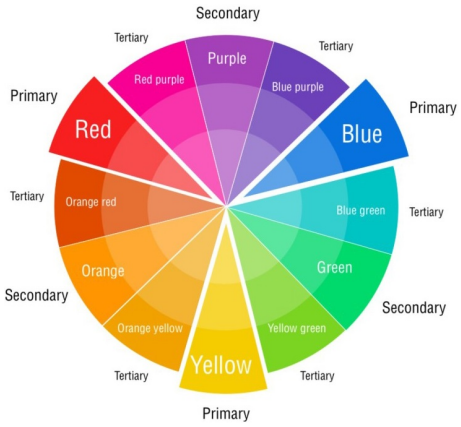


Figure 3.1: Color wheel

color with a secondary color. There are six tertiary colors: lime, lavender, saffron, purple, amber, and turquoise. Adding black or white to any of these colors results in shades and tints, while tones refer to the depth of a color. Neutrals, like cream and beige, are subtle shades that help balance out vibrant colors. Colors can be classified into warm and cool groups. Warm colors, like red and yellow, are energizing and happy, while cool colors, such as blue and violet, have a calming effect.

Color psychology is the study of hues colors influence human behavior, focusing on how they affect emotions and perceptions. By understanding color psychology, designers can use color to shape users' emotional responses to a mobile user interface (UI). Choosing the right color scheme is a critical part of mobile design, as colors have a powerful psychological impact. For example, warm colors like red and orange create feelings of energy and excitement, while cooler tones like blue and green evoke calmness and trust. Companies carefully select colors to evoke specific emotional responses from users. For example, Facebook and LinkedIn both use blue, a color associated with reliability and professionalism. On a visceral level, colors immediately affect emotions. As a basic element of design, color plays a major role in triggering direct emotional responses (Muratbekova & Shamoi, 2024). On the behavioral level, color helps guide users' interactions, influencing usability and readability and affecting decision-making (Wen, 2021). On a reflective level, colors can

contribute to a brand's identity and shape how users perceive the product over time (Aftab & Rusli, 2017) . It is shown in Fig. 3.2.

Figure 3.2: Color scheme

When designing a mobile app, it's important to consider the app's purpose and its target audience (de Sá & Carriço, 2008). Some components may not need to match the main theme color exactly (Wen, 2021). For example, blue can be used for confirmation buttons to convey trust, while red may be used for alerts to signify urgency or danger. These colors can coexist within an app that has a different main color, like green in an education app. Choosing colors that work well together to create a balanced palette can be challenging (Raspberry, 2019) Raspberry, Hossein. 2019), especially when colors are closely tied to the app's logo and brand identity (Labrecque & Milne, 2011). Before testing different color combinations, designers must understand how colors influence users' emotions. This knowledge helps create an effective and engaging design. Readability also plays a critical role. The color of the text should contrast well with the background to ensure easy reading. For users with color blindness or impaired vision, designing for accessibility ensures that everyone can interact with the app comfortably. Poor readability often becomes noticeable when users struggle to follow the content, making the experience frus-

trating (Jakob, 2015). When the text blends in with its surroundings or appears less important, it leads to poor readability. This can be problematic, especially when the content is essential for users to understand and follow, helping them navigate the app or website towards their intended goal. Clear, distinguishable text is crucial for guiding users effectively through important tasks. For instance, when booking a doctor's appointment or finding instructions online, users need to easily read and follow the information.

Consistency in design means ensuring all elements align with the goals set by the designer and avoiding redundancy. This involves using consistent color patterns throughout the app. This means that all elements are designed to guide the user through a sequence of actions, helping them achieve the goal that the designer intended. A cohesive color scheme helps users become familiar with the interface, building trust and making them feel comfortable exploring the app. Familiarity with the app's design elements creates a sense of confidence and encourages users to navigate with ease. Color consistency also enhances the user experience by making the app intuitive. When users see consistent colors, they instinctively understand how to interact with the interface, improving usability and satisfaction. Designers can also identify which elements of the app are effective and which need improvement, making consistency a powerful tool for creating user-friendly designs. This method not only helps users navigate the app but also builds trust between the user and the product, resulting in a better overall experience.

3.2 Typography

Typography is a crucial aspect of design that involves arranging typefaces to stylize the appearance of text. The term originates from the Greek words typos (form) and graphia (writing), which means "writing in accordance with form." Typography is the combination of typefaces, size, line length, spacing, and other related elements

that not only organize and arrange text but also create a visual language for design and communication. Though typography might seem like a small detail, it has a massive impact on how we communicate through text and showing emotion. Bold and large fonts can create a sense of urgency, while soft and rounded fonts often convey a friendly, welcoming tone. For example, Airbnb uses soft, rounded fonts that make the brand feel open and inviting, while Nike uses bold typography to evoke strength and energy. Typography design is essential in visual communication (Yadav, 2014). It influences the mood and personality of the design (Lu et al., 2023), helping to communicate messages effectively to the intended audience. At the visceral level, typography can provoke an immediate emotional response, just like color. It draws attention and leaves a lasting impression on the user's mind. On the behavioral level, typography affects readability and legibility, which directly impacts the user experience. Reflectively, typography plays a significant role in establishing a brand's identity and message over time.

Typography is a powerful design element in mobile apps, not only because it's the primary means of conveying information, but also because it influences the user's emotions. Fonts are visual elements that not only display information or messages but also convey deeper emotional expressions when designed thoughtfully (Li & Yeh, 2010). By applying the principles of typography psychology, fonts can go beyond just presenting text they can evoke specific feelings in users (Shimamura & Niimi, 2022). For example, Serif fonts, which have a traditional and formal look, are often used in mobile applications to convey a sense of reliability and authority.

Fonts with thin strokes are elegant and sophisticated, often evoking luxury. Fonts in the decorative category are playful and unique, typically used for children's products or artistic designs. Fonts that are bold are strong and powerful, often used in headings to grab attention. Fonts that are rounded are warm and friendly, ideal for brands looking to create a personal connection. Beyond the style of the font itself,

other factors such as font color, size, and spacing also influence the overall mood and user experience of an app. Delicate strokes of fonts give a refined and luxurious feeling, which usually is a sign of gaudiness. Fonts serve a double purpose shaping users' emotional life while creating a visual architecture of the content. Using diverse font sizes and styles to title headings and subheadings improves layout and makes navigation and identification of vital information easier to users. This setting makes the content more dynamic enabling to find significant parts by users faster. Notable content can be emphasised by changing size, weight, or colour for a visual distinction. For example, bold or italic forms highlight important information in the text. A recurring use of font helps make the journey of the user intuitive and easy. Usage of styles, sizes, and weights of the font is one of the consistent uses that make the users more at home using the app. Typography is one of the most influential components, which play a role in an overall user experience and contribute to the app's usability and aesthetics. Well-conceived typography, besides enhancing the visual appeal of an app, makes it more practical and user-friendly increasing the pleasure one gets from using it.

3.3 Sound

The use of non-speech sounds in user interfaces has been a topic of exploration for quite some time. Research on this subject is generally divided into three main categories: Earcons, auditory icons, and sonification (or data auralization). Sonification refers to the process of turning non-auditory data or visual events into sound. As defined in (Kramer, 1996), "Sonification is the use of non-speech audio to convey information, specifically transforming data relations into acoustic signals to help with communication or interpretation." This has been applied to complex and high-dimensional data, such as stock market data (Janata, 2004), weather reports, and health care data. Auditory icons and earcons are two strategies for using sound to

represent actions or objects in an interface. Auditory icons are based on everyday, natural sounds. Gaver (Gaver, 1989) defines them as "environmental sounds designed to be appropriate for the virtual environment of the interface." For instance, clicking a file in a graphical user interface might trigger the sound of a notebook being tapped, with the material of the object indicating the type of file and its size. Earcons, on the other hand, are synthetic musical sounds used to represent information in an interface. Brewster (Brewster et al., 1993) describes them as “abstract, synthetic tones that can be structured into sequences of pitches with varying intensity, timbre, and register.” These can be combined in different ways to create sound messages, often supporting navigation through a menu hierarchy.

Sound plays a crucial role in shaping users’ emotions and responses, particularly in mobile UI design. Through thoughtfully designed sound cues like earcons, auditory icons, and sonification, designers can influence users’ moods, perceptions, and behaviors. Earcons, with their musical elements, can evoke feelings of trust, satisfaction, or alertness based on their rhythm, tone, and pitch. Auditory icons, which replicate real-world sounds, create emotional familiarity by linking digital actions to experiences users can relate to, such as the sound of a file being deleted. Sonification translates data into sound, like a rising tone that reflects an increasing heart rate in a fitness app, creating urgency and engagement. When applied effectively, sound can heighten a product’s visceral appeal, enhance behavioral feedback, and strengthen a brand’s emotional identity, leading to a more intuitive and emotionally engaging user experience. Emotional design, through the language used and the sounds employed, helps make the product more approachable. Slack, for example, uses friendly microcopy and playful sounds, making the user experience more enjoyable.

Sound, when used thoughtfully, has the potential to produce positive emotional responses, just as visual elements like color and typography do. Research suggests

that combining engaging sounds with attention-grabbing colors can generate more positive emotions in multimedia applications (Uzun & Yıldırım, 2018). Sounds also serve as guides for user interaction, and on a reflective level, they help reinforce brand identity and aid in memory retention. Despite long-standing research on audio-enhanced UIs, the use of sound in mobile interfaces has remained relatively simple, with sounds mostly offering feedback or basic cues. However, modern mobile devices now support polyphonic sounds, real-time signal processing, and higher-quality sound, presenting new possibilities for more immersive and functional use of sound in UIs. Audio can play an essential role in user interfaces by providing valuable feedback, delivering information, and even entertaining users. However, its use must be thoughtful and purposeful.The audios for mobile phones can be grouped into two major categories: alerting and feedback sounds. Audible alerts remind users on the times of arriving calls, low battery levels or reminders for up and coming events. Examples of feedback sounds include keypad tones and warnings alerts which are enabled as a result of user response.

3.4 Imagery and Visuals

Imagery can convey sense and promote the mood of an experience. In case of an emotional design, it is the visuals that are chosen in alignment to the values of a brand that enables a direct connection with the user. As illustration, mental health apps could include quiet landscape visuals in order to establish calmness and trust unlike travel sites such as Airbnb that are based on welcoming interior shots for excitement and comfort atmosphere. At present, visuals and imagery are crucial for the design of the mobile app because of their powerful emotional sway over app users and the ability of humans to process images faster than written texts (Walker et al., 2017). Relevant visuals deliver information more effectively than written words and increase user satisfaction tremendously. Mobile applications use visuals

to simplify complex ideas (Kopf et al., 2009) and pass language barriers (Ma, 2014), so that users are in a better position to understand difficult information. The use of images and visual elements, moreover, might elicit diverging emotional responses, as demonstrated by a piece of research revealing that the same might generate physiological states of increased heart rate, blood pressure, perspiration, sometimes even nausea (Bernat et al., 2006).

The choice of specific images might decide the atmosphere of the application affecting the sensations, choices, and behavior of users. Dynamic visuals would be ideal for sports apps to increase user enthusiasm, whereas, if not educational, but rather relaxing visuals are better for apps of an educational type (Alshaykha, 2022). The eye processes information in the human eye all the time and it has been shown that people are able to recognize images in as little as 13 – 80 milliseconds (Potter et al., 2013). Mobile app designers should keep in there minds about visuals, because nowadays, users prefer to avoid reading long paragraphs of text. The impact of design visual has become key to the realm of mobile design because it is a factor of the digital application as well as tangible media such as print. Emotional Design research indicates that images are likely to appeal better to users than words because they evoke more engagement and allow users to relate to the content more instinctively. In some situations, this enhanced recall may encourage the app's higher user trust (Li & Yeh, 2010).

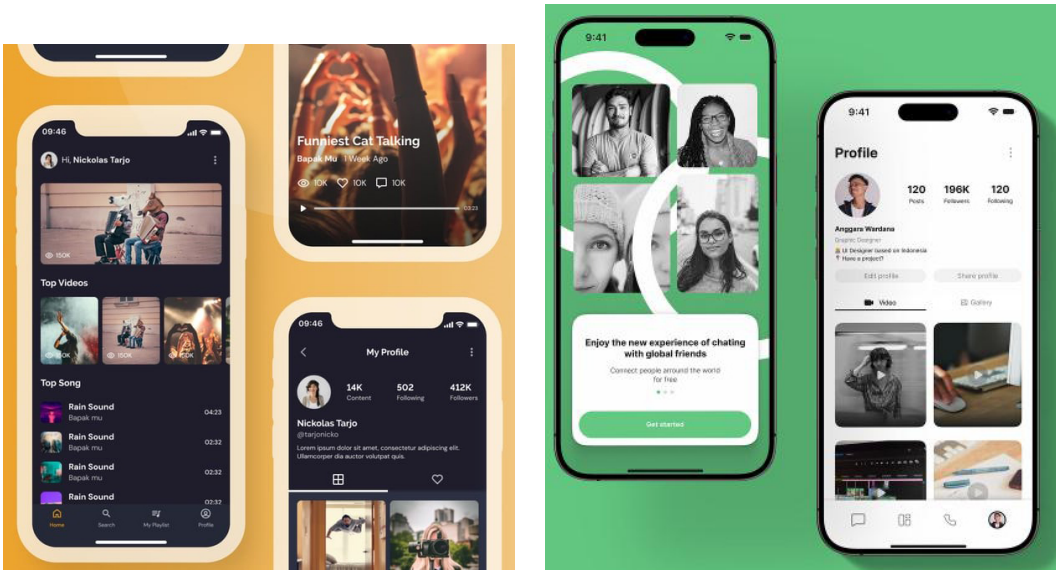
During the app designing process, extensive user research should be undertaken to choose the most appropriate visuals. It is essential to make the research able to discover the preferences and cultural background of the target users (Schuster, 2021) and for the results to support the fundamental motive of the app (Flora et al., 2014). Consistency, accessibility and inclusion ought to be first among the considerations for the designers when choosing visuals that simulate the same theme as in the app along with the font and color choices. What is more, using high-res

images that work great on any device is essential when it comes to providing a stable usability of system for users. A design's form and shape have the capacity to evoke strong emotions in users, via the meaning carried or their visual appearance; and at the same time, it is able to fuse practical use-of the product by users. Analyzing the design at a higher order, reflective sense, the form and the shape help to form the product's sense of story and self, affecting the users' lasting engagement and perspectives (Norman, 2007).

Imagery and visuals are powerful tools in emotional design, shaping how users feel and connect with a product or interface at a glance. Through color, composition, style, and symbolism, visuals can evoke a wide range of emotions from calmness and trust to excitement and urgency. For example, soft color palettes and rounded shapes can create a sense of comfort and friendliness, while bold contrasts and sharp lines may suggest energy or precision. Illustrations, photographs, and animations can humanize digital experiences, making them more relatable and emotionally engaging. Visual metaphors help users quickly understand complex ideas, while consistent visual branding strengthens emotional attachment and trust over time. When thoughtfully designed, imagery and visuals go beyond aesthetics—they become central to how users emotionally interpret and interact with a product, fostering a deeper and more memorable connection. Some of the imagery visuals are shown in Fig. 3.3.

3.5 Micro-interactions

Micro-interactions are small, often subtle animations or responses that occur during an action, such as a "like" button pulsing when clicked. These tiny moments help bring personality to the app and create a sense of interaction with the product. For example, Instagram's "heart" animation when liking a photo is a small but rewarding and enjoyable moment. In the way other design elements are, animations



(a) Music App. (b) Social App.

Figure 3.3: Visual example apps.

and micro-interactions are critical for making the app more appealing to customers and increasing customer loyalty, and keeping it fashionable and engaging (Sinha, 2016). The inclusion of animations and interactions in the mobile design enhances not only the look of the app, but significantly enhances the user's experience and emotional attachment (Yalanska, 2021). In this part, we'll speak about how the use of animations and interactions makes the app emotionally accessible.

User experience is closely related to animations and interaction design, where there are many chances to implement this concept into mobile applications. One way of making one's product nicer and user-centric is through intentionally designing mobile app animations. For instance, the application of animations can lead users' through the processes with a reinforcement of the brand's identity (Vadhadia, 2023). For apps that aim to evoke joy and surprise, playful animations like bouncing elements work well to create a fun and engaging atmosphere. There are virtually endless ways to incorporate animations and interactions into mobile apps, so it can be difficult to create one-size-fits-all guidelines for implementing them correctly. However, if animations are not overused and clutter the interface, they

can positively influence emotional design and enhance the app experience. When used thoughtfully, animations and interactions help create a more engaging, visually appealing, and emotionally rewarding user experience

Microinteractions are brief interactions with a device that typically take less than four seconds to initiate and complete. These interactions are designed to minimize disruption, allowing users to quickly engage with the device and then return to their primary task. No UX design can thrive without effective micro-interactions. When incorporating micro-interactions into mobile app or web design, it's essential to ensure they align with the target audience and the overall theme of the product or app. Keep search-related microinteractions simple and intuitive, and use subtle animations to enhance the content without overwhelming the user. Thoughtfully designed microinteractions create a more engaging and user-friendly experience, making interactions feel smooth and rewarding. As noted, the second level of emotional design is behavioral design, where animations and interactions are particularly impactful. When designed effectively, they ensure users easily understand how to interact with the app, which is crucial for guiding them through the app's features (Kachan, 2019).

Anatomy of a Micro-interaction

According to Dan Saffer, "Micro-interaction is an interactive detail, which can make a product more fun, attractive, and establish a deeper, smarter bond with the user. Although micro-interactions are small, and sometimes invisible, they play a very important role" (Herna, 2020). In today's highly competitive market, micro-interactions are crucial. When users quickly adapt to a product due to a seamless experience, brand loyalty is often established. Many of these positive experiences are driven by micro-interactions within the product. To design an engaging app, it's essential to understand the anatomy of micro-interactions. Every micro-interaction

in mobile UI design has four key parts, which, when carefully executed, can significantly enhance the user experience.

1. **Trigger** initiates a micro-interaction, it announces the action to occur. It spurs the action and it should be simple and user-friendly. Regardless as to whether you have a tap, click, swipe, or hover interaction, the trigger should be straightforward and easy to use. Usability improves with a recognizable trigger, while a smoother and more effective interaction is achieved.

2. **Rules** After users kick off the trigger, the reactions displayed are determined by the rules. The rules must match users' intended actions and mental models, and this is vitally necessary. These rules describe what visual or functional reaction occurs as a result of the user's input. As an instance, the act of tap a button could be an example; the rule might describe the button to change colors, move, or perform another task. These rules define the going forward of the micro-interaction in aligning with users' expectations as they go through the interaction.

3. **Feedback** is the output that the app will generate immediately after the user interacts with the app. It informs the users that their activities have been recognized and the application is handling requests. Feedback can be visual, auditory, or tactile, depending on the context of the interaction. For example, a vibration when a button is pressed, a color change when a user clicks, or a sound that plays when a task is completed. Feedback reassures users that the action was successful and keeps them engaged.

4. **Loops and modes** refer to the meta-rules that guide the micro-interaction's behavior. Some micro-interactions may involve looping actions, like a continuous animation that runs until a task is complete. Others may involve different modes, such as a toggle switch with an "on" and "off" state. These elements

help guide users through the app and provide clear instructions about the current status of an action.

It is shown in Fig. 3.4

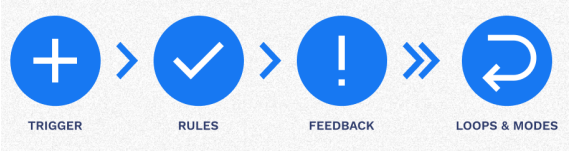


Figure 3.4: Four parts of microinteractions

Examples of Microinteractions

First a heart icon changing color and animating when a user likes a post on social media. Secondly, a progress bar showing the status of an ongoing download or upload. Thirdly, a button that enlarges slightly when a user hovers over it with the cursor. The fourth one is the confirmation message appearing after successfully submitting a form. Lastly, a pull-to-refresh animation that updates content in a news app. This makes users perceive the app as more human, and intuitive, and more fulfilling in a greatly positive emotional way which binds users to the product.

3.6 Impact of emotional design principles on UI Design elements for Mobile Applications

Buttons: They are the mechanic elements of mobile apps or web pages that trigger a specific function upon being pressed - most commonly entering information or ending a page. They usually have a rectangular shape with rounded edges. The label can be either text or an image, but it should be clear and easy to read. To catch attention, buttons often use bright colors like red or yellow. This is because buttons are essential elements, and they need to stand out to guide users through

the interface. To make buttons more engaging, we can add effects, like changing colors when a user taps them. This is a good practice for creating a responsive experience UX that helps users feel in control. The button's style will depend on the app's purpose, the platform, and design guidelines. Buttons can also change based on user interactions. There are different states of buttons. Enabled is the state of button which is active and can be clicked. Hovered is the state appears when a user hovers their mouse over the button (not applicable on mobile devices). Pressed state appears when the button is clicked or tapped. Disabled is the state in which button usually appears gray or semi-transparent, showing it cannot be clicked. Material Design 2 defines these states as ways to visually communicate the status of a component, ensuring that users can easily notice and understand when a button is in a different state. This prevents confusion and enhances the user experience. Mobile interfaces typically don't use hover effects because mobile devices don't support hover interactions . Buttons states are shown in Fig. 3.5

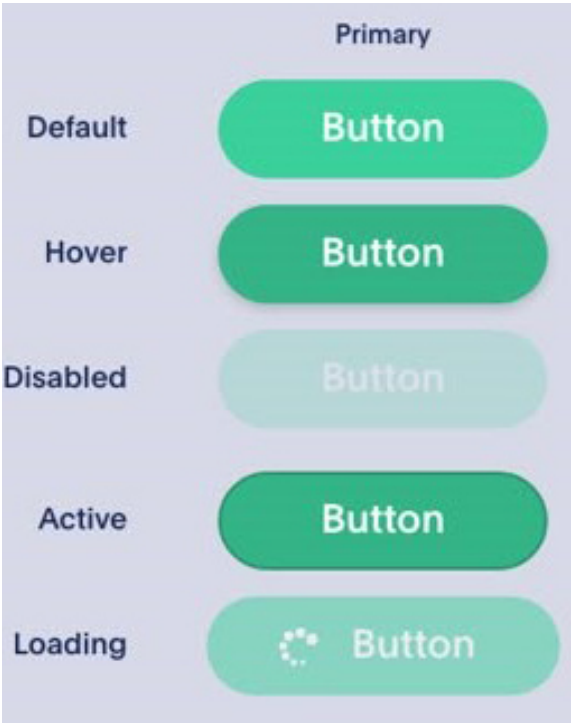


Figure 3.5: Button states

On mobile UIs, buttons play an essential role in emotional design. They link the user's intentions to actions, providing immediate feedback and giving users a sense of control. How buttons look and behave can significantly affect how users feel when interacting with an app. To start with, buttons, which are given rounded borderlines and warm tones, may be able to facilitate all-around friendly and hospitable user experience. The use of sub par animations or shadows give a sense of interaction, making the app more interactive thus rewarding to the user. Readable labels and change color is when button will be pressed further influences users that intended effect has occurred. Buttons have a higher role than just things that execute commands as they lead emotional users, build their confidence, and make for a nice flow of enjoying the application. Buttons in mobile app are shown in Fig. 3.4

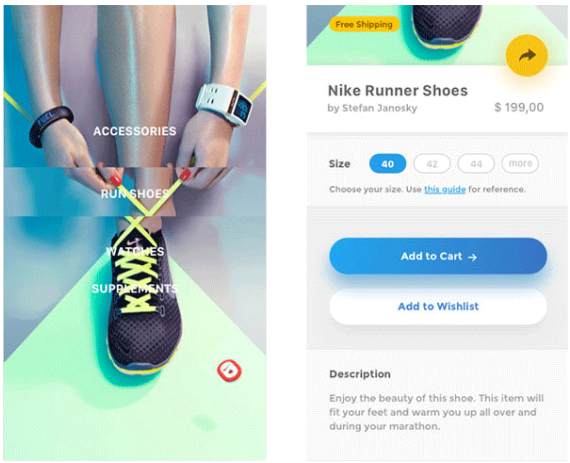


Figure 3.6: Buttons layout

Toggle Button: They are a switch buttons that lets users choose between two states, like turning something on or off. It's a great tool whenever you need users to activate or deactivate a feature in your app, that is why toggles are commonly found in the app's settings screen. With toggles, it's important to clearly distinguish the "on" state from the "off" state, so users can quickly tell which one is active. A common way to do this is by using gray to represent the inactive state. Toggle buttons are typically used for on/off switches that allow users to change settings.

They are also known as switch buttons or toggle switch buttons in various design systems. Toggle switches are often used when a decision with two clear options needs to be made, such as turning a feature on or off or switching between two states. Common examples include turning Wi-Fi on or off on a mobile device or toggling between light and dark modes in an app.In mobile UIs, toggle buttons play a key role in emotional design by providing the straightforward, switch-like action gives users a strong sense of control, allowing them to make quick decisions with little effort. The smooth sliding motion, animated transitions, and color changes that happen when toggling create a responsive and enjoyable experience, making users feel like the app is actively responding to their input. This helps users feel empowered and connected to the app, enhancing the emotional aspect of their interaction. The dynamic and simple interaction of toggling not only improves usability but also adds to the emotional flow of the user experience. Toggle Button in mobile app are shown in Fig. 3.7

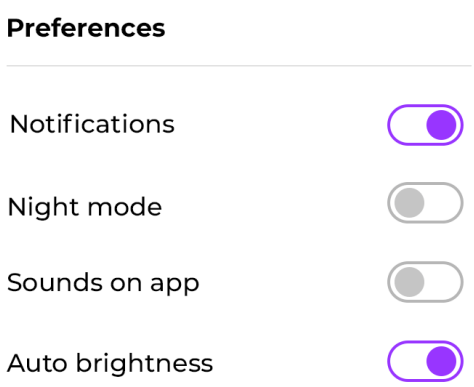


Figure 3.7: Toggle Buttons State

Icons: Icons give plain but visual means of conveying things, actions, and concepts to users. These are small graphic markers that represent unique meanings that cannot be confused and users can easily understand and remember these entities. Icons are largely applied on mobile interfaces, which perform such tasks as recog-

nising a brand, focusing on some actions or attracting the user's visual attention (Zhang et al., 2017). Essentially an icon serves as the graphic representation of a particular object, action, conception, or idea. Still, vague icons may quickly annoy the user if they do not discern what the icon is for at first sight. If users struggle to understand what an icon represents, it can prevent them from completing tasks effectively, causing a negative user experience. The use of icons in mobile interfaces offers several benefits. They save valuable screen space, allowing for a cleaner and more organized design. Icons are also quick to identify at a glance, which speeds up user interactions. Since they are graphic-based, icons don't require translation, making them universally accessible across different languages. Additionally, they contribute to the overall aesthetic appeal of an app, making it visually pleasing (Wang & Li, 2017). Some of icons are shown in Fig. 3.8

Figure 3.8: Icons

Icon design refers to the creation of graphic symbols that effectively convey specific meanings. A detailed set of guidelines for icon design is essential, especially when considering the style aspects of each icon. Icons need to be carefully and simply created, to retain the clarity and the recognizability of them. Once too intricate or not easily comprehended, users might become confused and unsure. An

icon design success is enhanced with the collaboration between design principles and analysis of user behavior. The strategy largely assists designers as well as researchers optimize the usability and functionality of icons as stated by. Even though businesses see icons as beautiful, there is little scholarship about how to develop icons that attract and captivate users. The certain features of visual design of mobile app icons have not been well studied. Nonetheless, there is an underdeveloped research on how icons are received and applied by diverse user groups . In view of this, research on icon design should highlight that the icons serve to transfer the proper information to the user. The general scope of this investigation is to determine the fundamental design elements that are important to the effective use of icons in mobile applications(Kamarulzaman et al., 2020). Icons in mobile layout are shown in Fig. 3.9

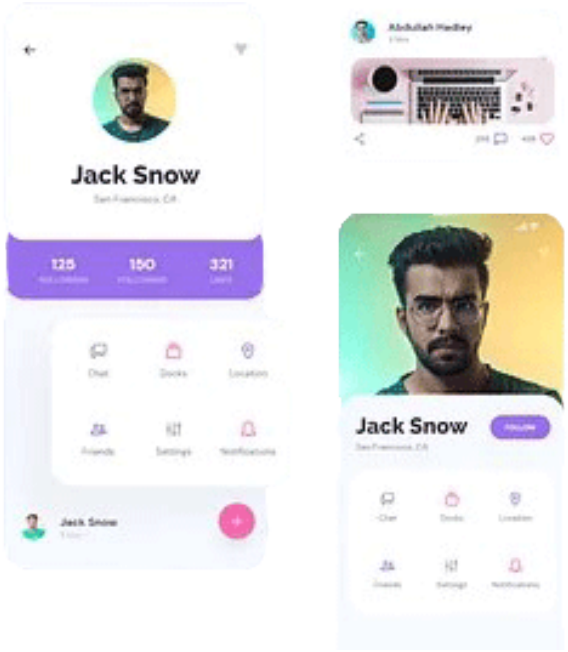


Figure 3.9: Icons in app layout

Icons contribute to an emotional bond between the users and the mobile applications. Creative use of icons' shapes, colors and styles in design may affect the person's feelings: familiarity, playfulness, seriousness or trust. Icons carefully de-

signed help users to easily navigate through interfaces by using meaningful pictures instead of text and thus have a smoother, more approachable user interface. Take for instance the heart icon which could make users feel warm or cared for, and the gear icon which broadcasts customization as well control – each icon pushes users as it ought to, to better impact on their experience. If icons are designed cohesively, well done, and carefully animated, they will guide clearly with their individuality and tone wove into the user experience. Via this way, icons become more than an action symbol and they have a role in creating emotions to users and giving them a better experience as they use the app.

Drop-down list: Dropdown list contains four basic elements: a box for containing, a downward facing button arrow, a list of options to select, a label for explanation. The available options are revealed by the users by clicking the arrow and then choosing one item from the list. Form designers often use dropdown lists to present long or frequently updated lists of items on limited displays effectively. For example, if you need users to choose from a list of employees, a dropdown list is ideal because the list can change over time. Similar to text fields and buttons, dropdown lists can be interactive. For instance, they may change border colors when tapped, providing a responsive touch. If there are many options, the dropdown may become scrollable when expanded. When users select an option or click outside the dropdown, it automatically closes, showing the chosen value in the container box. In addition to standard dropdown lists, there are dropdown menu buttons, which are groups of buttons that open a temporary menu with multiple options for users. A selected item can represent the chosen value, like in forms or filtered content. A different type of button is the **split button**, often seen in menu bars. A split button has two parts: the main button (label) and a small arrow icon to open a dropdown. The left side often holds the default action, while the right side, with the arrow icon, opens the dropdown to change that action. Unlike dropdown menu buttons,

split buttons usually contain commands that can be grouped together (Laubheimer 2019). They present choices in a compact, organized way, making users feel more in control and less overwhelmed, especially when make an interaction with complex or varied options. By hiding multiple selections under a single tap, dropdowns reduce visual clutter and help maintain a clean, focused interface, which fosters feelings of calm and clarity. When designed with smooth animations, clear labels, and responsive touch feedback, dropdowns create an easy and satisfying interaction experience. Dropdownlists is shown in Fig. 3.10

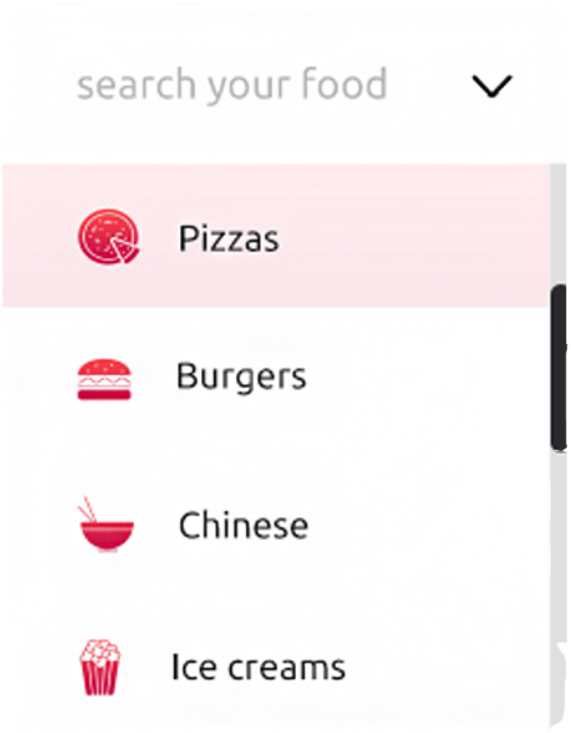


Figure 3.10: DropdownList

Checkboxes: They provide a list of fixed options for the user to choose from. Checkboxes allow users to select more than one option at a time. They are ideal for questions that require multiple responses. For example, in a health app, users may be asked to check off all symptoms that apply to them. Checkboxes are often arranged vertically, but they can also be displayed in multiple columns, which is particularly useful when comparing different lists. In mobile UIs, checkboxes are

key elements in emotional design, providing users with a clear, tactile way to make choices, feel in control, and experience accomplishment. The simple design either checked or unchecked makes the decision-making process feel straightforward and easy to manage, which can help reduce mental effort and anxiety. Rounded corners or soft checkboxses can evoke a sense of satisfaction and confidence with each selection. Additionally, checkboxes foster a sense of autonomy by allowing users to customize settings, preferences, or actions at their own pace. Especially in forms, lists, or preference menus, well-designed checkboxes contribute to an emotionally positive experience. Checkboxses are shown in Fig. 3.11

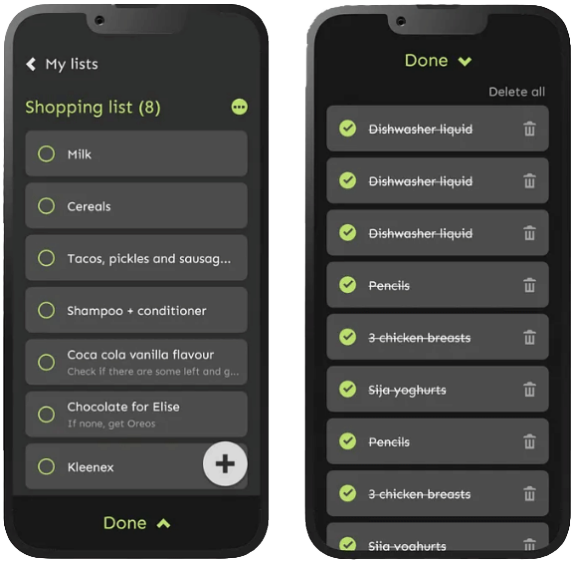
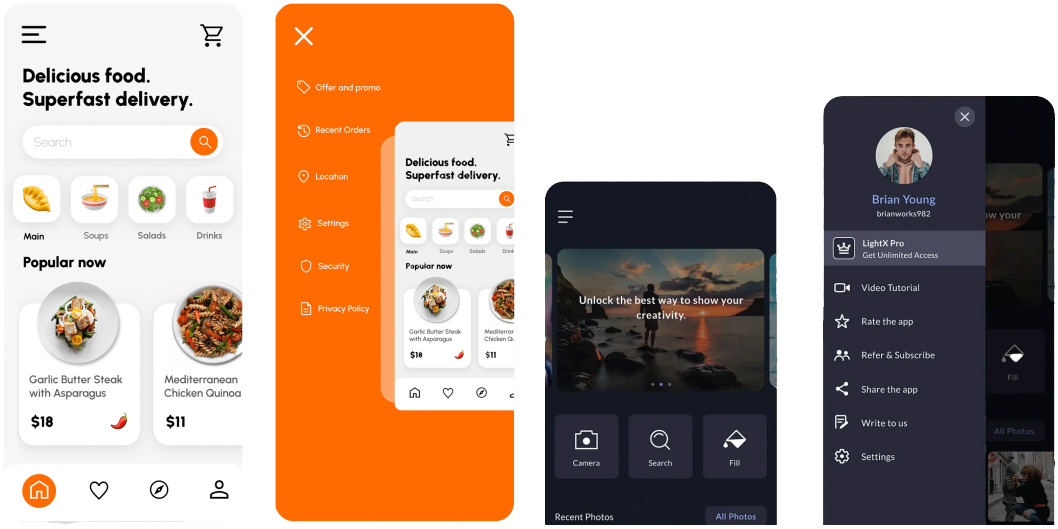


Figure 3.11: Checkboxses in app layout

Hamburger menu: The icon was first created by Norm Cox in 1981 as a way to represent a container for contextual menu options. Originally, it didn't have a name; it was simply a menu icon, with three lines representing the items inside the menu that would appear when clicked. The icon became known as the "hamburger menu" when it gained popularity in mobile apps around 2009, as the three lines looked like an abstract representation of a hamburger. When clicked, it reveals a hidden menu. The hamburger menu has become a widely recognized navigation tool in apps. People instinctively understand what it does when tapped. It's especially

useful because it allows for a compact menu that doesn't take up screen space, making the interface less cluttered. This design decision enables more screen space and retains a purely visually minimal yet pleasant layout. This method adds to a better user experience as it allows users to toggle the side menu whenever necessary; there is no mess, which is what happens when too many menu items are available. Hamburgermenus are shown in Fig. 3.12.



(a) Hamburger menu. (b) Hamburger menu.

Figure 3.12: Two different hamburger menus.

When the interface is not filled with too much navigational clutter there is a better opportunity for users to interact with the content. The "burger" approach is especially effective when it comes to reducing design because the navigation is kept hidden. Hamburger menus in mobile UIs support emotional design as they allow for the preservation of cleanliness and simplicity in retaining clear control by users in complex content worlds. A cleansed layout holds an illusion of sophistication and of simplicity, enhanced by flowing animations and uncomplicated feedback. In cases when the hamburger menu is packed with too many choices or its labels are ambiguous, it may cause user problems and indignation. A good hamburger menu pays off by blending functionality with emotional efficiency, creating a feeling of confidence and control for users exploring a smooth, pleasing interface.

Tab bars: They consists of a row of icons that runs at the bottom of the screen, with each icon linked to the main section of the app that constitutes it. This application will allow a user to quickly shift between app sections in much the same way as switching tabs in the browser can be used as means of navigating between Part of the reason for their wide scale use is because they appear at the bottom of the screen. Such a layout is easy to navigate, because the user can get to the tab icons with the thumb and easily tap the buttons when holding the device on one hand. Their position at the bottom guarantees that the most essential app functionalities become accessible with ease, effortlessly minimizing efforts to touch switch between tasks. Tab bars are more interesting and interactive if easy to understand icons, soft color changes, or smooth visual effects are used, which is an enhancement of the user's emotional appeal around the interface. By streamlining navigation within an app using tab bars, not only is usability improved but a healthier emotional tie to the application will be promoted. Tabbar is shown in Fig. 3.13

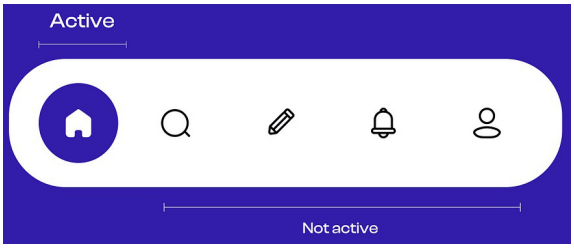


Figure 3.13: Tabbar

Tooltips: They represent light notifications that contain informative descriptions of app elements. Tooltips are mostly there to instruct users on certain UI elements tools as they use the app, with tooltips sometimes being revealed by the user action (like an icon tap such as a question mark) or at screen introduction. Tooltips are a key concept in the progressive onboarding as well as products walkthroughs by helping guide users one step at a time through the app's functionalities. Like in other mobile apps, tooltips are short messages, localized, and displayed near or around the corresponding UI elements. Tooltips are shown in Fig. 3.14 .

(a) General tooltip example 1. (b) Tooltips in Food app layout.

Figure 3.14: Examples of tooltips.

Most common of all, tooltips contain textual instructions to provide specific, useful information that can help guide users, point out features, or advise on changes and updates experienced during one's session. Tooltips reduce user confusion as it becomes easier to understand and use confusing or complicated features. By providing transparent information as to actions or icons, they keep interface clean and make users feel more confident. By using this mechanism trust is established and it builds a more meaningful emotional link between the user and the application. Ultimately to improve usability, tooltips contribute to a serene, supportive, and emotionally sensitive user environment.

Loaders: These elements in applications inform users that the system is undertaking some background work. They subtly inform users that they need to wait, preventing the feeling that the app has frozen. The most common loader is the spinner, which starts as a gray circle and slowly gains color as the task progresses. The spinner is beneficial because it doesn't take up much space. Loaders are important for user experience (UX) because they reassure users that the app is still functioning, instead of leaving them wondering if it's stuck. They can also help mask latency or speed issues, particularly if the app displays an engaging loading screen. Some of the variations of loaders are given below:

- Spinner: A simple animated icon that continuously spins to show that the app is processing or loading content. It's a widely recognized loading indicator.

- Skeleton Loader or Stencil: Skeleton screens show placeholder structures that resemble the layout of the content being loaded. They give users a rough visual idea of what the page or interface will look like while the actual content loads.

- Progress Bar: This type of loader visually shows how much of a task is completed by gradually filling a horizontal bar. Users can often see a percentage of completion or an estimated time remaining.

- Progress Circle: Following the example of the progress bar, which indicates how some task is progressing at a given point in time, a progress circle represents the achievement of some task using a filling motion in a circle.

- Animated Icons or Illustrations: The playful animations or icons arrest the attention of the users turning the loading experience into something more fun.

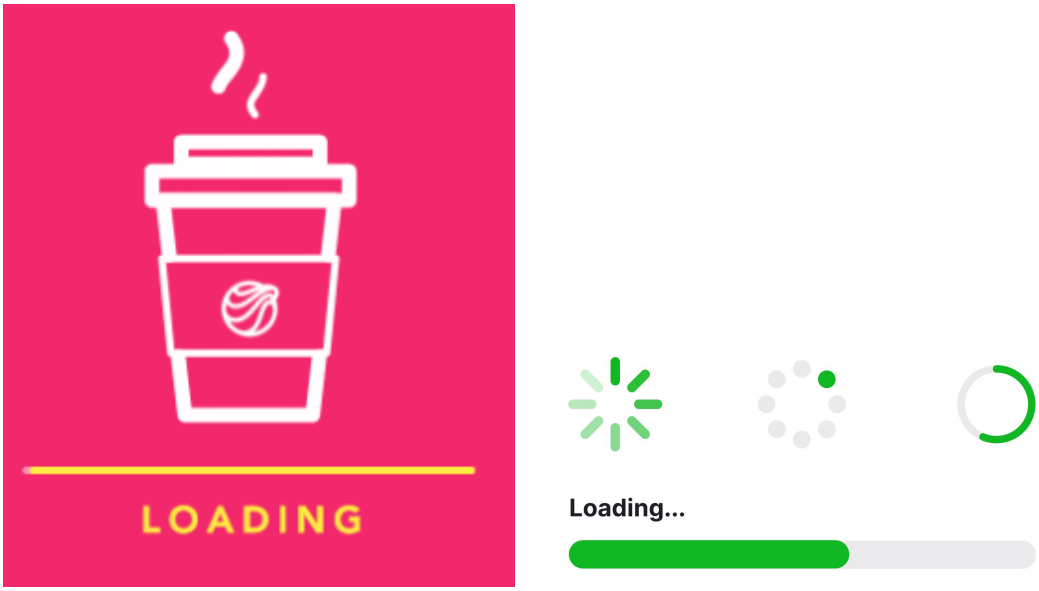
- Loading Text or Message: A short "Loading..." or "Please wait" notification means that the app is doing its job processing the request.

- Percentage IndicatorProviding the time as the percentage, the user may see how much from the task is left for completion and how many timepoints are still there.

- Hybrid Indicators: They create a new and engaging wait experience by combining such features as spinners amidst progress bars or inserting animations into progress circles.

Some of the loader variations are shown in Fig. 3.15

Loaders of mobile designs act as helpful emotional devices, guiding anticipation and affect during times of loading. Although even small wait times may make one



(a) Progress bar loader. (b) Different types of loaders.

Figure 3.15: Example loader bars.

impatient, though, good loading messages go some way to removing this through informing the users that the system is indeed working. The use of soft transitions, inviting visuals, and such comforting transitions as "Just a moment" or original advice can bring some personality to the waiting intervals, and make them less annoying, but more interesting. Loaders do not just update the users on status but they provide support both emotionally ensuring that users have an edge to relate positively to the app.

Accordions: They are very easy to expand and minimize certain parts of information, all a user needs to do is to tap the interface element that does it. Their purpose is mostly characterized by compartmentalizing large volumes of content so that users may navigate through content easily and quickly locate what they find interesting. They help display more information without overwhelming the user. For example, in an e-commerce app with a large number of products, you can use an accordion for each product category. This way, users can tap on the categories they're interested in, and everything else will remain hidden, reducing visual clutter. There are various states of accordions. Collapsed When an accordion section is closed, its

content is hidden. A visual cue, like a chevron or plus icon, usually shows that the section can be expanded. Expanded is used when a section is opened, its content is revealed. The visual indicator typically changes, such as rotating the chevron or turning the plus icon into a minus. When a user hovers over an accordion header, it may change its appearance in a visual sense, with such effects as color shift or a soft drop shadow so the user knows it's interactive. For accessibility reasons, when the accordion header gets the focus; it should standout visually, e.g. by showing border or change in background. A disabled accordion section looks passive with dimmed/ muted color often, to indicate it is not active.The trust and frustration-free experience is created through accordions, designed with the transparent, uniform labeling and usable interaction, which promotes positive, intuitive user experience. Changing a cluttered screen of information into an interactive and controlled structure, accordions make users feel calm, clear, and capable. Since they integrate usability and discovery, accordions allow the users to feel recognized and treated when they use the app.

Cards: They are Space-efficient items, which are interactive, are called cards. and are meant to gather and make a summary of related information on your app's screen. Cards are used to display critical information and offer a button or link so that users can further explore more information when they wish. There are many apps, such as Headspace, which are adopting cards in order to successfully navigate across time. Cards are a trustable choice if you want to organize information in a visual form. Product cards tend to change their appearance depending on what users are engaging with or some situational requirements. And all these states give user feedback which makes the process more dynamic and engaging. Hover State is triggered whenever user hovers their mouse cursor on the card. When the user activates the card by clicking or tapping on it the active state is shown. In disabled form, the card is insensitive, appears faded indicating it is inaccessible. A focused

state gives a card prominence when it attains focus, which ensures that it can be used by all users. Cards in app layout is shown in Fig. 3.16

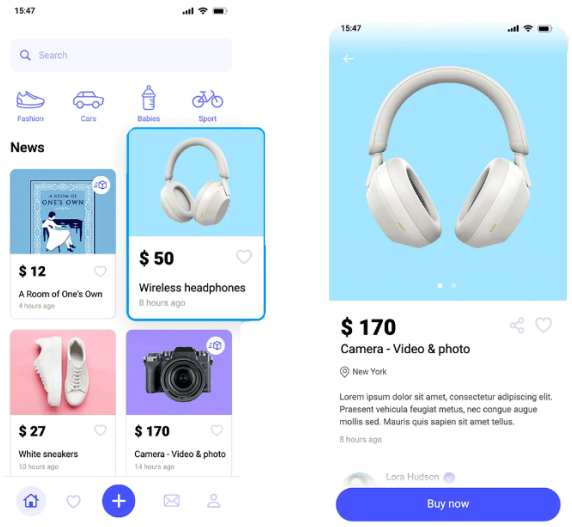


Figure 3.16: Cards in E-commerce app

Although selected state resembles active state, sometimes (when users are done interacting with the card) it may remain highlighted. When the card is collecting or processing data the loading state seems to suggest such process. These states become a more dynamic and informative environment that guarantees users receive immediate situational response and guidance, while interacting with the product cards, across various platforms. Cards render information easier to deal with by breaking it into small pieces making it interactive and making it seem recognizable and easy to manage. The design of cards strives to reduce information accessibility and processing complexity, which leads to greater transparency and the lesser cognitive requirement. The flexible design of cards, use shadows, its rounded edges, and dynamic animations, can give the sense of warmth, trust, and pleasure. When cards display personalized information, such as information specific to each user, they may build greater recognition and belonging to the app. If constructed correctly, cards can make boring information representation a satisfactionful and emotional experience for users.

Forms: They are part of app and developed to collect and manipulate data, for instance, contact information and details of an order. They work almost like paper-based forms, such as those required to open a bank, or to provide tax documentation. Forms are shown in Fig. 3.17

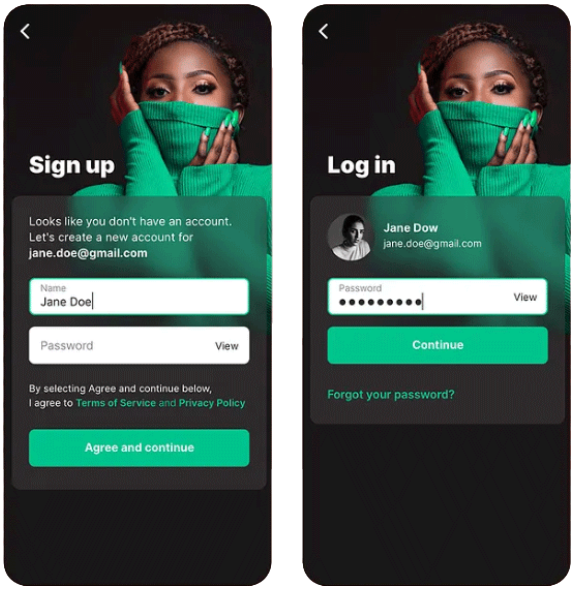


Figure 3.17: SignUp and Login Form

At the bottom of a form, you will see a lot of input areas and a submit button. The press of button submit initiates the actions of the form and sends or processes the entered information to the server. This division of the form leaves users less overwhelmed visually and more user-friendly. Properly constructed forms are of paramount importance to relate the desires of the user with the goals of a business. Carefully designed forms make the process easier to follow leading to increased completion by users. Simple form layouts facilitate the input of correct information and, corresponding, reduce the possibility of input errors. The secure and well organized forms can indicate reliability, respect user privacy and they go along with building trust among users. Poor form designs can even drive away users. The well-designed forms build trust, feel useful to use, and are satisfying especially if they look clean, are clear to navigate, and are quick to adapt. Application of

design elements like approachable language, easy navigation between the steps, live responses, and comfort features such as progress bars limit the stress of users and enhances their confidence. Color, shape, and typography are also factors on the design side that affect user's feelings while interacting with forms. Most often soft colors and round corners make the atmosphere warmer and less frightening. Where the process is comfortable and the users perceive their needs are being heard, the experience better ingrains the user in addition to being more emotionally satiating.

4 Research Design

The research design is created to examine the impact of emotional design levels on design elements and user interfaces in mobile applications. This examination is done by the findings of survey methods, data collection and analyzing various case studies of mobile applications. All the survey questionnarie are given in Appendix A.

4.1 Design Surveys

In a design survey, researchers systematically get information from a group of participants to understand more about a specific field. Unlike asking questions casually, a design survey is carefully made and is based on ideas and concepts that suit the research purpose. Usually, quantitative data is collected using closed-ended forms of questions (for example Likert scales or multiple-choice), and open-ended questions are used for deeper qualitative responses. When planning a survey one should set a clear research question, identify the target group, choose the type of sample, compose questions that are neutral and easily understood, and decide on how to distribute the survey (via emails, during interviews, or on questionnaires). The main purpose is to ensure that all information is accurate, steady, and clear enough to detect trends, habits, opinions, and user needs. Surveys design is particularly helpful in user-centered design because we must know what users expect, need, and struggle with. The survey is typically piloted (or tested) before its final use, all ethical standards such as the need for informed consent and privacy are followed

and a plan for data analysis is made. Basically, a design survey helps move from theoretical research goals to what actual users think, thus guiding design steps using real data.

The design survey is created to analyze the research question given in section 1. The design survey contains a set of questions based on the emotions of the users with the design elements which are explained in detail in section 3. The surveys would be based on mobile applications to target users' positive emotional engagement with the user interfaces of mobile apps. The four design surveys will be created, one will be a general design survey and three surveys will based on some specific mobile applications such as Instagram, Duolingo, and MyFitnessPal. The case studies of specific mobile applications from different industries such as Instagram(social industry), Duolingo (educational industry), and MyFitnessPal(Health industry) will be analyzed in section 4.3. Google Forms will be used to collect data from the survey which features both multiple-choice and open-ended questions. The quantitative method Likert scale questions have to be supplied for all participants so that the data collected from them is the same. This contrasts with the qualitative method of open-ended questions which the respondents are required to answer the questions. According to Section 1, participants would be friends and volunteers, the link will be sent to these participants, and asked to forward the survey to their contacts. By using personal networks, this approach invites more participants, spreads the survey to many people, and helps control the quality of the data by avoiding responses from random users.

Four surveys would be conducted: a general survey, an Instagram survey, a Duolingo survey, and a MyFitnessPal survey, based on the three-level principles of emotional design. All the surveys include questions about the overall color scheme, visual images, animations and transitions, navigation, scrolling, typography, grid layouts, sound interactions, icons, checkmarks, progress bar, micro-interactions, user

logging, and visuals (graphs and charts). The results after evaluation will be shown in section 5.

4.2 Data Handling and Analysis

Once the data collection is done, all the responses are automatically put together by Google Forms, giving access to some charts and graphs to use in the analysis.Once the data collection is done, all the responses are automatically put together by Google Forms, giving access to some charts and graphs to use in the analysis. As the main questions of the survey are in Likert scale and can be counted, a quantitative approach will be used for analysis. The descriptive results from this approach is to summarize the data.To find out what the participants generally think, determine the mean and median of their responses. To learn about participants' views on the emotional design elements of mobile apps, the data from open-ended questions are analyzed.

4.3 A/B Testing

Duolingo "A/B":

1. Streak Counter and Daily Goal Tracker: In Version A of Duolingo app, the real design, shows how a good behavioral design makes use of visuals and emotional moods to make users use the app regularly.The flame icon is the central feature and beside it stands a bold number representing the current user streak. The fact that the icon is not only a symbol it creates visceral connection by helping users emotionally understand that their progress streak is alive and should be kept running. The illustration created a sense of urgency and made users feel responsible by highlighting their fear of losing streaks and making them consistent in learning. Besides the flame, the ring around the goal dynamically fills as people make progress

and reward their habits. Such quick visual confirmations support a repeated cycle of benefits, as every accomplish task encourages users to continue with the habit loop such as cue, action, reward.

Alternatively, Version B which was tested side by side with the original, solved the problem by changing the flame icon to a calendar icon. Days the user has completed are marked with golden stamps and your active streak moves to a separate menu. Even though this method captures how students are improving, it is somewhat less emotional and concrete. The alert from a calendar is not as sudden and attention-grabbing as that of a burning flame icon which often brings fear of losing streaks.As a consequence, people did not feel pushed to use the app every day. Since there are no clear visual cues or satisfaction right away, the behavior becomes less habitual and not as interesting to the player.Even though the gold stamps are visually pleasing, the stamps do not bring the same emotional feelings of timeless growth.

2. Duo the Owl Notifications: Duolingo clearly demonstrates how reflective design guidelines can be used which are explained by Don Norman. Duo the green owl becomes the main character, connecting with users via push notifications that show a unique and emotional personality. The messages are frequently playful or embarrassing, like saying "I'm watching" and they also come with emojis and small heart animations. It doesn't only focus on the gameplay; it also lets players relate to the character emotionally and creates a bond with them. These notifications make the user to remember and bring on emotions like amusement, guilt or affection, they add to users' overall reflection by prompting them to review their learning habits and feelings rather than only focusing on functionality. Emotional and character-driven designs influence users to form an identity-related bond with the design interface.Duo changes from a reminder app to be a fun, determined companion on the language

journey. Emotional branding boosts user involvement as it makes people feel engaged and interested enough to share on social media.

But in Version B, most of this personality-related interaction was eliminated.The messages to users were made more professional and factual and without Duo image smooth animations such as “It’s time to practice your language with Duo,”.Despite working on an experiential level, this version not having the warm and playful tone of Version A. As a result, users described the messages as unappealing,unmemorable and easily ignored. Because the reminders lacked humor and animated mascot, they could not create a strong emotional reaction, help users relate or make learning a language feel fun. The fact that there was no personality in the design meant there wasn’t a lasting emotional connection formed between the user and the app and the user feel bored to learn or continue with the app further.

3. Gamified XP Progress Bar and League Competition: Version A of Duolingo uses both visceral and behavioral design enhancing user motivation and engagement. The user interface makes use of eye-catching colors, micro-interactions and real-time features to involve and interest players with emotions.While users go through lessons, the XP bar fills up on screen, rewarding their achievements and helping keep their momentum. Celebrations such as confetti and visual warning notifications about rank changes in leagues help produce excitement and a desire to improve. The immediate positive sensations helps strengthen a sense of effort and satisfaction. Through this dynamic feedback, users get a strong feeling of joy which makes them believe their efforts are worthwhile and their growth is real. This shows the main idea of visceral design: targeting the senses and making the interface both pleasant and engaging for users.

According to behavioral design, An animated progress bar gives instant updates and provides users with a sense of continuing accomplishment as they work. Each league clearly marks an improvement from Bronze to Diamond, competing play-

ers are motivated by status, achievement, and a desire to win. Live updates on the leaderboard make players want to act immediately to protect or increase their standing by using motivators such as the sense of urgency, the desire for rewards and the fear of losing their place. Gamification of progress pushes users to return to games often and sustained engagement, since they want to stay at the top or get higher rank. Instead of Version A, Version B kept the basic XP system and leagues but took away the thrilling and engaging elements. The XP bar is static, most animations were removed and users got league updates only at the end of the week. Although everything here was implemented, users did not get emotional engagement encouraging signs they had from Version A.

4. Use of Animated Characters (Duo and Friends): Duolingo tested to see how interacting with animated characters affected users' engagement, emotional connection and consistent to their lessons. Users in Group A saw the standard interface, where Duo is onscreen only occasionally and shows few animation or changes in expressions. The Duo shows minimal presence and the reactions to users' actions are not very distinctive. Even though the character is still recognizable, not being able to interact much gives the experience a more practical use and less emotion or excitement. This interface depends more on the functional learning, with less emotional support.

Alternatively, Group B was given an interface with many emotions and interactions between the learner, Duo and other Duo companion characters helping the user to complete their learning language goals. These characters moved energetically, showed expressive face animations and offered feedback depending on how the user performed. After completing a lesson, Duo could show fireworks or a friendly thumbs-up animation to cheer for the user. He might portray disappointment or pretend to be upset if the user didn't succeed or if something broke their streak. The presence of companion characters like Lily or Zari brought more variety with

their kind encouragements or joyful comments which made the interface feel like a friendly social setting, instead of a simple learning tool. These companion character animations make the user more emotionally engaged, and feelings of companionship make the user more encouraged and motivated to come back on the app and be consistent.

4.4 Case studies

4.4.1 Instagram

Instagram is a social network people mostly use to post and share photos and videos. Mike Krieger and Kevin Systrom built the app in 2010 and users were drawn to it because it featured a simple design and powerful editing tools. It lets individuals place their photos on the app, add filters if desired and distribute their images with others. Among its interactive features, the platform offers Stories that vanish in 24 hours, Reels, a place for lengthy videos called IGTV and a feature for talking privately with friends.

According to visceral design, When user open the Instagram from the first moment the user experience is visually appealing and emotionally engaging. Instagram have a minimalistic user interface with aesthetic appeal due to simple white background, a clear base and unclutterd element design. This approach in design focuses on clearing all distracting elements so that nothing other than the content is seen by the user. The minimal style, helps the most important products on the app the photos and videos which stand out at once and it makes the design much simpler so that nothing distracts attention viewer's. It also helps the users to navigate easily through features without being over stressed. A clean minimalistic UI achieved by easy-to-understand images and reducing the clutter is appealing and at the same time makes users feel calm and emotionally connected to the Instagram. Another im-

portant core component of Instagram's is the high-quality visual and imagery. Users can easily modify their images and short videos through various filters and editing tools on the platform provided by the instagram app.These amazing features, helps users to transform basic normal photos into attractive, professional images. Making changes to brightness, contrast, saturation and sharpness helps users produce images that are likely to visually stand out and encourage visitors to stay engaged. Because of its visual consistency, an Instagram feed looks visually attractive and supports visual satisfaction which enhances the browsing experience for everyone. Moreover, Instagram delivers eye-attracting gradient borders around Stories, serving not only as a design feature but also as a way to enhance user interaction.If a user has active stories to watch, these colorful rings appear around their photo on the profile page, rotating among vibrant hues such as pink, orange and purple colors. These gradients are visually appealing, attractive and also giving signal to the user for new or unseen content. By targeting emotional designs these colors gives a feel of joyness, natural curiosity and urgency to users, which makes the user to tap and explore what's the new content being shared. These gradient borders giving asthetic appeal,encourging interaction and maintainig the consistency of user engagement. In addition to, the emotional connection between the user and the app is made deeper by using microinteractions. For example, If someone likes a post by either tapping the heart icon or quickly tapping the image twice, the heart appears and pop up briefly animates smoothly.This small yet forceful moment gives instant visual feedback and gratification, reinforcing a positive interaction with content. Not only does the animation provide proof that the like was recorded, it also creates a sense of joy and emotive engagement with each interaction. Combined, they deliver a visual-first impression that not only is aesthetically pleasing, but also emotionally welcoming. Instagram's visceral design makes users comfortable, happy, and instinctively connected to the app, leading to more extensive and more frequent use.

In Behavioral Design (Functionality and Usability), Instagram is thoughtfully designed for usability and smooth interaction to provide a streamlined and compelling user experience to induce continued and repetitive use. One of the most notable design aspects contributing to this stance is the endless scrolling feed, allowing users to scroll through feed after feed without ever having to click or press a "refresh" button. When users scroll through their feed, new posts load instantly without users having to press a button or issue a command, providing a never-ending flow of feed to browse through with a sense of effortlessness. This piece of design makes users want to keep browsing because there's always something new visible right below the previous post. This never-ending flow of photographs and clips induces a state of "flow," in which users get highly engrossed and tend to lose track of time while scrolling. This state is extremely engaging and enjoyable, enabling users to use the app for long periods without even realizing it. Without pauses in the content, endless scrolling encourages users to keep scrolling and therefore visit the app again and again by turning casual browsing into a habitual activity and long-term user engagement. Furthermore, The basic and effective touch gestures make the app easier to use. The double-tap to like option means users can like a post with a simple, effortless action. The intuitive gesture enables users to like a post by tapping twice quickly on the image or video, without having to search for and press the like button. The speed and fluidity of this action makes it close to instinctual, reducing interaction barriers and motivating users to respond more often to content. Since this gesture feels so fluid and gratifying—particularly in conjunction with the minimalistic heart animation—it leaves a sense of instantaneous response and affective reward. This smooth interaction not only affirms user behavior but also enhances a more dynamic and active browsing experience. Through time, the double-tap feels second nature, transforming passive viewing into active engagement and solidifying the user's bond by making the action to like posts almost automatic

with both the platform itself and the contents they read. Another Instagram's swipe gestures to navigate improve the app's usability by providing a quick and natural means to switch between major features like Stories, Reels, and direct messaging. Rather than having to use buttons or a menu, users can swipe right, left, or up to access major portions of the app. This kind of fluid navigation people require very little conscious thought and make fewer steps, so it is much less tiring for the brain meanwhile reducing the cognitive load. Therefore, people can focus mainly on viewing information and communicating instead of thinking that how to navigate between different sections. Since the gestures are easy to use, the touch response or user experience is smooth and the interface is comfortable and joyable. Through streamlining navigation, users can discover various types of content and communication tools, which highlights the user engagement by spend more time on the platform. Moreover, when users are posting content and receiving a quick response from other viewers such as a growing number of likes, encouraging comments, or their posts being shared they experience joy, happiness, satisfaction and verification which enhances user behavior socially and maintains user engagement through feedback loops. This feedback triggering the release of dopamine, which is a neurotransmitter that refers to pleasure and motivation. In consequences, users repeat the behavior of posting more content and interacting with others. These feedback loops enhancing long-term engagement and social interactions by emotionally satisfying the user experiences, and making the app more habit-forming.

In reflective emotional design, Instagram engage users through psychological level by making their identity, memory, and social lifes as meaningful. Profile curation makes users to represent their profiles as digitally and show themseleves idealized. Users carefully select and maintain their posts by creating a grid which is astheticaly reflects their personality, values, or lifestyle. These curated profiles can be used as personal branding, influencers, for professionalism, portfolio and for public persona.

They can choose color schemes, photo grids, captions, and filters for their profiles as unique. While using these applications, users manage an online presence that expresses their character or goals to their audience. That way, people can express themselves more, feel in control of their identity online and feel proud of it which makes the platform meaningful, emotionally engaged and exciting for them. Additionaly, Instagram have another amazing feature such as Archiving stories and Highlights and preserving as memorable. These enable users to store and revisit significant moments, making ephemeral moments into enduring memory. These would expire after 24 hours. The Archive stores Stories automatically in a private space, allowing users to reflect upon their lives at any moment even if they are not publicly visible. In contrast, Highlights enable users to curate and showcase a subset of Stories permanently on their profile, grouped by category such as vacations, milestones, or favorite moments. This makes the ephemeral nature of Stories into enduring digital mementos, serving like a personal scrapbook. These not only enable users to hold onto memories, but they also enable them to share one's life story with others in a more intentional and structured manner. Enabling users to reflect on important times and memories, Instagram becomes an important place for people to consider their pasts and who they are by reflecting nostalgia and building identity. Moreover Instagram shows a digital status by follower counts, likes, and visible indicators as verified badges which creates the user social identity popular while making the users to feel self-worth. The blue verified badge shows the high follower count signaling the social worth and admiration or popularity such as celebrities, public figures, and best brands. In the consequence, users are strongly motivated to become more engaged with the platform because everyone like their validated , trustworthy and entertaining content, which attracts the audience more towards their profiles again and again. Furthermore, Instagram is also promoting community through hashtags, direct messages (DMs), and group features and enabling users to connect around

shared values, interests, and experiences which makes the higher user interaction with the app. By using these features, users can meet others with similar interests, values or experiences, helping to create important and focused communities. Hashtags show users content about chosen subject areas and also allow them to join in on these topics. Hashtags allow people with common interests to meet and create virtual groups around any topic, whether well established or not. Instagram also enables functionalities like group chats, shared content, and shared posts, which enable collective interaction and engagement.

4.4.2 Duolingo

Duolingo is a leading language learning platform that marries education with gamification to provide learning in a fun, accessible format. Duolingo, founded by Luis von Ahn and Severin Hacker in 2011, currently offers courses in more than 40 languages. Duolingo encourages users to progress while monitoring how far they have got. Duolingo breaks down language learning into bite-sized learning sessions in a format easy to start, complete, and understand.

In Visceral Design, Duolingo's user interface easily stands out by virtue of its bright, lively color scheme, which serves a key function in defining the app's emotional tone. Predominantly green, yellow, and blue hues define the color scheme, not only aesthetically pleasing but also psychologically effective. The color of mascot and interface elements are green which corelates with growing, learning , and peacefulness for an educational environment. Yellow shows the cheering and warmth feel, while blue color refers to the trust and make the user reliable by using the app. Highlighted by these colors, interactive button elements, progressing bars, icons and background sections work well together to make the app look attractive and consistent. This bright palette make learners feel positive, energetic and encouraged which sparks their interest and motivates them to explore the lessons. Duolingo learning

environment feels like a more freindly feel like a game and less like a boring formal classroom. Furthermore Duolingo mascot, Duo the Owl is a central and emotionally meaningful part of what makes the Duolingo app unique. The green owl is not just a logo however it is a lively animated character who is freindly companion-like and encourages the users learning journey to establish an emotional connection. When the user completes the lesson sucessfully and acheive the milestone the Duo mascot give appreciation by cheering with excitement and bursting celebration animation. Explosion of confetti and bright vibrant colors come across the whole interface, with enjoyable music effects, the Owl, starts cheering, and dancing in a wave acknowledging the sucess of user. This visceral response, provides the joy, delightfulness and emotional satisfaction that leads to positive behavior. The user becomes satisfy, by winning a game, getting an emotional reward and receiving applauses. This will start the feedback loops ,encourage, develop loyalty, attachment and motivate the user to learn more lessons with continued engagement and getting the rewards. Mascot also shows sad emotions when users skip or fail their regular goals. It also delivers guilty emotion while sending reminders when the user is missing the daily streaks which indicates the danger. Dulingo become successful in creating a user experience that feels personal, engaging, and emotionally rewarding. Moreover, Typography is also an design element which shows the asthetic appeal of the Dulingo. The fonts used is the formal serif styles which are rounded without sharp edges. This typography design style shows a casual look that completes the app's goal which is the learning language acessible and free of stress. This simple and elegant typography style makes sure that learning would not be rigid and boring and emotionally it can be smooth. Another feature is Duolingo's sound effects are important aspects of its emotional design delivireng an instant sensory satisfaction to users, increasing their involvement and improving skills, and helping them remember what they are taught. Every interaction in the app is indicated by various auditory cues such as the right

answers cause the app to play happy chimes or dings, whereas mistakes are followed by sound effects that are gentle and designed to make sure the learner does not feel frustrated. These sound effects are selected carefully by the designers providing positive emotions when accomplish even a small success. Moreover, Duolingo also gives spoken feedback of pleasant voices that are pronounced properly like a natural language. This spoken element enhances the user experience by interacting in a real learning environment. All of these audio components are coordinated with the pictures on the screen to give the viewer rich information and a rewarding emotional experience.

In behavioural design, Duolingo use gamification element such as XP points and leaderboards which motivates the user through competition and achievement. User earns a number of XP (experience points) whenever a user finishes a complete lesson,session, and challeng. These points make the user's position within Duolingo's weekly leagues with other competitors. When the collect XP, they move up through various leagues such as Bronze, Silver, Gold, and Diamond. The leaderboard is a benchmark through which users can see how they compare to others and get motivated to work on themselves day after day to improve their rank. This turns language learning into a challenge that feels both social, encouraging and rewarding. Crucially, the competition does not feel stressful or serious which helps preserve the friendly atmosphere of the app. Furthermore, In Dulingo daily streak is a feature to set a habit for the user to learn daily lessons without breaking the streak which gives positive and emotional cues to encourage consistent use. If the user completes the lesson every day, the user streak count increases, by an icon lightening up with the orange-yellow flame which enhances the user's continued engagement. Users receives daily Duolingo regular notifications to remind the user to practice the lesson, by using mascot as emotional language, such as "I feel sad you did not practice today" . These emotional reminders are designed to trigger a feeling of guilt and making a

friendly companion sad, which supports the users to come back to the app. Users become more motivated to maintain the personal comittments to accomplish the goal and extend the streaks. Through internal satisfaction and emotional stabiliy user learn the consistency and a loop of habitual behavior. Moreover, Duolingo uses the Hearts System to make the lessons more engaging and fun without ever making users feel like giving up. At the start of the sessions, users have a five limited number of hearts representing the chances available for mistakes. Every wrong answer results in losing one heart, which encourages users to focus more carefully on every question. It also offers many ways to recover lost hearts, by finishing revision exercises or the hearts can be regenerated over time. This keeps the user experience more engaged and makes learners motivated without fearing of failure. Additionally, small microinteractions provides a quick responses and a continous feedback to the user. Whenever the learner make a correct answers of the questions, a green highlights feedback with sound effects and encouraging messages like “Great job!” or “Excellent!” a tooltip would appear on the screen. If the learner gives a wrong answer, a supportive red highlight would appear like “Almost!” or “Try again!” on the screen. These immidiate colored feedbacks are the indicators to give guidance to the user’s for making their understanding and concentration on learning. These feedback loops are positive emotions and which helps the user to know their mistakes without discouraging them. This will make user feel that errors are not the signs of but its a part of their learning journey. These small microinteractions transform every lesson into user interactive experience which give the emotional feelings of responsiveness and satisfaction and helping the user to cognitively engaged with the app.

According to Reflective design, Duolingo Stories are important because they help explain language points ,vocabulary and grammar by combining them with interesting instances that relate to the user’s life.These interactive narratives often use

humor, characters that are easy to understand and stories about ordering food, seeing a doctor or talking normally, things learners come across in daily situations.Using this strategy helps students enjoy learning and see how they can use language in real life. Learners cognitive process and emootional engagement are encouraged through these storytelling, and this make the learners to get motivation through learning entertaining content. Additionally Badges are another element that provides an identity information of sucess. Learners earned the Badges by completing milestones like completing challenges, streaks and XP goals showing the dedication and sucessfulness. Emotionally users are encouraged and motivated by these digital rewards. The app allows to share the acheivements publicaly on their profiles or in leaderboards so users can show their learning status within the Duolingo community. This emotional connection will strengthening their user-engagement and long-term consistency to the app. Moreover, The Achievement Trees on Duolingo allow users to track their progress and split their language learning steps into easily handled parts. All the skills in the tree are linked and designed to support things like vocabulary, grammar and phrases. As soon as users finish lessons and pick up new skills, the relevant nodes on the tree are highlighted or change color to let them know what they have accomplished.Since learners can observe where they are and where they need to go ahead, the process is both orderly and aims to achieve certain goals. When students see their progress, they are more inspired and find it easier to remain motivated toward the following aim. Furthermore, The milestone messages like "You've Learned 1,200 Words!," in Dulingo app emphasizing users' prolonged achievements.These notifications givings indication to the user achievements by measuring progress in numbers, real and abstract words. When user see their progress like 1,200 words learned will make users more focused on learning and sucess. So they will feel motivated and encouraged that their learning has turned into something meaningful since they began. This reflective moment will strengthen

an emotional bond between the user and the learning educational process. Lastly, The Duolingo brand stands out because its messages are both playful and persistent, playing a big role in keeping people engaged with the app. Mascot in the app, the green owl, sends comical and playful cheeky reminders or notifications such as "Duo will find you." The Whimsical notifications or reminders are entertaining and become so popular that they have inspired a meme culture and made Duolingo recognizable to many people in their daily lives. Instead of making users feel irritated by reminders, this approach turns them into funny, but helpful alerts, resulting in more people staying with the app.Moreover, Duolingo regularly reminds users of a larger purpose: making education accessible, enjoyable, and universally accessible. By means of its inclusive language and costless model, the app not only presents itself as a utility, but as a movement. This positioning gives users a sense of mission, leading them to view themselves as participants in a global effort to democratize language education. The feeling of shared values and a shared purpose makes people more emotionally connected, leading users to feel they are part of something.

4.4.3 MyFitnessPal

MyFitnessPal is a health and fitness app designed to help users track their diet, exercise, and overall wellness goals. Launched in 2005, it has become one of the most widely used platforms for calorie counting and personal health management. With an extensive food database, barcode scanning, and integration with fitness devices, MyFitnessPal offers a streamlined way to monitor nutrition and physical activity.The app empowers users to take control of their health by setting personalized goals whether it's weight loss, muscle gain, or maintenance.

In visceral design, MyFitnessPal app has a smooth, clean, and minimalistic user interface with a white background and soft blue color palettes. This blue color palette is significant to evoke positive emotional feelings of calmness, trust and pu-

rity when they open the app first. The app's soothing colors create a comforting and peaceful supportive environment for the users who may feel difficulty and anxiety about tracking their weight, healthy diet, calories and other health measurements. This minimal and simple interface of the app increases the usability by making the distraction minimal, which makes the users to focus on tracking their calorie counting, weight loss, and strengthening muscle goals . Furthermore, The simple app feature icons let the user quickly navigate, understand , interact without being overwhelmed such as navigation,food entry and exercise icons because they are familiar with these icons in their daily lifes. For the begginers, these icons make the user experience as visually guided and reduce the cognitive load. Additionaly, To indicate completed tasks and accomplishments the app provides some visual elements such as progress bars and checkmarks . As green color is used to indicate the neutral or normal measures, so myfitnesspal app shows the green color coded text of the calorie feedback which supports the user as a emotionaly that they are in their normal calorie range which are not more or less calories however if the calorie text is in red color then it indicates that they are eating more calories the their daily intake goal. This feedback makes them keeping on a track with a healthy behavior through positive visual confirmation and the app also alert users in a gentel way to make improvements to keep on track. Simply, MyFitnessPal's iconography and overall visual appearance support a user's emotional needs and motivate them stay on track with their fitness goals. Moreover, To make the user's experience better, MyFitnessPal uses simple but meaningful micro-interactions and animations that happen during interaction to enhance user engagement and experience. When someone records a meal, a checkmark will often appear and if they finish a workout, a progress bar will usually start to fill up smooth animation. Such simple micro-interactions give right away a feeling of satisfaction and accomplishment by showing that the user has done something worthwhile.The process of switching between screens and noti-

fications has been designed to be smooth and comfortable to avoid any jarring or distraction to the user concentration.When animations are carefully designed, they give people a visual guide so navigating through apps is easy and without any effort.In addition, small vibrations added by light haptics confirm user actions, making the actions more real for them. All of these little sensory improvements enhances users satisfaction and responsiveness. Each time users see their success, these small interactions motivate them to keep returning to the walking log and meeting their fitness goals. As a result, MyFitnessPal encourages its users with emotional messages and motivational reminders every day ehich makes the users to return back on the app for long-term usage.

Accordin to behavioural design, The logging system in MyFitnessPal is set up to be as simple and quick as possible so the user can track food , water and exercise with ease. It only takes a couple of taps for users to record meal calories according to what they consume in a day which makes the user to remain consistent. The barcode scanner helps users by allowing them to scan packaged foods and see the nutritional details appear instantly which enhances the efficiency. Users can also save their regular meals and liked favourite recipes, allowing them to start logging them on the spot in the future. Instead of logging daily users can reuse their saved entries more effortlessly than starting every time from scratch and reducing repetitive work. This logging method will keeps the user motivated and supportive of their continuous health goals without putting any effort. MyFitnessPal offers powerful progress visualization tools that provide users with clear, instant feedback on their health journey. By using simple graphs and charts, users can see changes in their weight, notice patterns in how many calories they eat every day and see how much protein, fat and carbs they eat. Using graphics, users learn how the routines they keep each day affect what they want to achieve over time.The app helps by making advancements progressive and so simple to read which encourages motivation

and rewards good habits. It helps users stay informed ,encouraged and boosts their confidence. Additionally, Streak tracking is another helpful feature, marking and congratulating those who keep up the good habit of logging for seven days straight by showing the message: "Congratulations, you've logged every day for 7 days!". Users are encouraged to stick with the app by the reward of not breaking any current streaks. Apart from streaks, the app sends reminders and notifications at the right times, encouraging users to log their meals, water intake or exercises in a relaxing way.The app offers encouraging nudges all the time, for example, reminding you to keep moving forward with messages such as "You're almost there, keep pushing!" All of these features combine to make tracking enjoyable so that users continue improving their lives for a longer time. Moreover, It makes MyFitnessPal more useful and easier to use by connecting seamlessly with top health and fitness apps such as Fitbit, Apple Health and Garmin. The data is synchronized to users multiple devices through this connectivity so users can easily view all of their health and wellness information together across different devices and apps. MyFitnessPal works hand in hand with other elements of a health ecosystem to gather information about exercise, nutrition, sleep and other important statistics.The integration means users save time and their progress is tracked more reliably by automatically importing activity data with accuracy and without any errors, so the need for manual input has decreased. By including popular platforms, MyFitnessPal helps people manage their health better and make decisions with a full view of their habits.

In Reflective, Users of MyFitnessPal can view data related to their health journey from the past days, weeks, months or years whenever they want. As a result, users can view how they have improved from the past until the present through a clear story and numbers.Going over previous achievements, hard times and highlights helps users realize what their habits are and how continuous work shows real progress. This will motivate users to continue a healthy lifestyle by accomplishing

their goals. Having the power to view one's journey develop, however, not only deepens engagement but also solidifies the story of transformation, turning this app from a tracking app into a partner in one's continued journey toward health and well-being. Moreover, MyFitnessPal also includes social sharing capabilities through which users can share their progress with friends, family, or a general social network either within the app itself or through mainstream social networking sites. Such a function assists users in reinforcing a "healthy person" identity by visibly recognizing one's progress and commitment to health. Sharing weight loss milestones, streaks, or completion of workouts not only gives users a sense of external approval and motivation but also creates a sense of accountability and social support. Belonging to a group where health milestones are known and admired by others encourages users to remain consistent and active in maintaining a healthy path. Putting progress or achievements online using badges helps people feel valued which can encourage them to keep putting in extra effort toward their goals.Talking about achievements or badges online helps people feel more committed and healthy which can raise their self-esteem and continue to motivate them. Lastly, Using the Premium version, members can easily personalize the app according to what they want to achieve for their fitness goals. They pick calorie goals and set limits for protein, fat, carbs, and other nutrients, giving close control of each food log. Premium members also unlock rich charts and reports that dive into habits and progress. Besides customizing your goals, Premium allows you to see advanced data showing your deeper insights such as habits, food selection, progress, nutrients and calorie intake and any changes that occur over a period. As a result, users can make better choices for their health since the app now offers the right tools for decision-making and modifications. By blending deep choice with honest data, MyFitnessPal Premium offers a more personal, interesting, and steady way to guide long-term wellness for lasting health success.

5 Survey Results

Survey questions are presented in Appendix A. General surveys, case studies and A/B testing results are explained in follwoing sections 5.1, 5.2 and 5.3.

5.1 General Survey Results

According to the general survey, 25 responses are received from the participants which shows that group age (18–25) and (26–35) teenagers and adults use 96% of social media apps like youtube, whatsapp, facebook, instagram etc on the daily basis as shwn in demographics. After selecting the apps of their own choice they describe their emotional feelings with the user interfaces of mobile apps by answering the likert-scale questions as agree,disagree, important, unimportant, likely, unlikely, satisfied and not satisfied. The table 5.1 below shows the evaluation on the basis of Likert-scale.

The overall results from the survey are 77.3% optimistic and proven positive results. The highest result from the above table is 88% for navigation through menu bars tabs and icons. Users are very satisfied with the navigation throughout the app. Navigation is the most important fact that designers should look into while designing the app. Navigation reflects the behaviroul level of emotional design, If navigation is not smooth then users get frustrated to the app and they will never come back on the app. Moreover 84% ofusers also agree with the joyful animations and smooth typography for the user interface. In the survey, These results prove the

Table 5.1: Survey results

Elements or features	**Positive Results**	**Overall %**	**Emotional Design**
Color scheme	Neutral, Agree	80%	Visceral Design (emotionally connected, calm, joyful, inviting)
Visual images	Neutral, Agree	76%	Visceral Design (affect mood positively)
Animations and transitions	Neutral, Agree	84%	Visceral Design and Behavioral Design (lively and enjoyable)
Typography	Neutral, Agree	84%	Visceral Design (smooth, pleasant)
Navigation through menu bars, tabs, or icons	Satisfied, very satisfied	88%	Behavioral Design (smooth and satisfied)
Sounds of interactions (tapping, clicks, beeps, bells, vibrations, and transitional sounds)	Neutral, important	56%	Visceral and Behavioral Design(significant)
Overall Design Layout	Important, veryimportant	72%	Visceral, Behavioral, and Reflective Design

Dorn Normans Three level Emotional Designs as visceral, behavioral, and Reflective. After the evaluation, we got most of the positive and satisfied results which shows that emotional designs play an important role in enhancing user engagement with the user interface design layout of the mobile app.

5.2 Case studies surveys results

5.2.1 Instagram Results:

According to the general survey, 23 responses are received from the participants which shows that 91.3% of teenagers and adults group age (18–25) and (26–35) use Instagram mobile app on a daily basis as shown in demographics. They express their emotional feelings about the user interfaces of Instagram by answering the Likert-scale questions as agree, disagree, important, unimportant, likely, unlikely, satisfied and not satisfied. The table 5.2 below shows the evaluation on the basis of Likert-scale.

The overall results from the survey are 77% proven positive results. 87% of users are satisfied with the appealing color scheme, effortless infinite scrolling, visuals and image filters as the highest result from the above table. It proves the visceral

Table 5.2: Instagram survey results

Elements or features	**Positive Results**	**Overall %**	**Emotional Design**
Overall color scheme	Likely,very likely	87%	Visceral Design (appealing)
Visuals and image filters	Neutral, satisfied	87%	Visceral Design (satisfaction)
Stories gradient ring (pink, purple,orange)	Agree, strongly agree	65.2%	Visceral Design (curiousty)
Heart animation (liking post)	Agree, strongly agree	73.9%	Visceral and BehavioralDesign (enjoyable,fun)
Infinite scrolling	Agree, strongly agree	87%	Behavioral Design (effortless)
Navigation around the whole app	satisfied, very satisfied	82.6%	Behavioral Design (smooth and satisfied)
Own profile photo grid layouts and captions	Neutral, satisfied	73.9%	Behavioral and reflective Design(satisfied, joy)
Past archive stories	Neutral, agree	65.2%	Reflective Design (nostalgic)
Verified blue badge	Neutral, agree	69.5%	Reflective Design (worthy, valuable)
Hashtags	Neutral, important	69.6%	Behavioral and Reflective Design (feel valued, important)

and behavioral design of the emotional design levels which means that pleasant layout, visuals and effortless features are important for users to feel calm and reduce the cognitive load. Moreover, 82.6% of users are very satisfied with the smooth navigation without frustration throughout the mobile app.

It is visible from the case study that Instagram uses all three types of emotional design principles to create an engaging, attractive, and emotional setting for its users.The moment you open Instagram, its simple minimalist layout, white background, and millions of pictures and videos attract users to find themselves in a calm, focused, and aesthetically pleasing experience. Gradient rings and pretty heart animations during small actions help improve the app's appearance and make users feel more interested and satisfied. Being user-friendly is a big part of Instagram's design, so scrolling endlessly, tapping twice to like, and moving through Stories, Reels, or messages with smooth swiping is possible. The way these elements are designed takes stress off users and makes it pleasurable to explore, reducing cognitive load and helping users focus better and spend more time in the app. The app keeps users hooked by rewarding them with likes, shares, and comments, which raises levels of dopamine in the brain and prompts them to revisit the app. Lastly,

Instagram allows users to show their identity and recall memories by editing their profile, creating Highlights, and keeping their Stories on the platform. They allow people to develop their own unique personal branding which makes users proud of what they show on social media. Besides, aspects like following counts and verified badges make users feel worthy in the eyes of others, while specific community features such as hashtags, group chats, and shared content tie people collectively by common interests. As a consequence,users' emotional satisfaction and daily engagement make a deep connection between users and the platform through these Instagram features. Successfully the design strategy of Instagram supports both user needs and long-term platform loyalty.

5.2.2 Duolingo Results

According to the general survey, 18 responses are received from the participants which shows that 91.3% of teenagers and adults group age (18-25) and (26-35) use Duolingo mobile app on rare basis as shown in demographics. Normally, individuals use educational apps for some specific area of learning according to their goals so they use educational apps rarely not for their whole life. Users show their emotional feelings interacting with the Duolingo app by answering the Likert-scale questions as agree, disagree, important, unimportant, likely, unlikely, satisfied and not satisfied. The table 5.3 below shows the evaluation on the basis of Likert-scale.

The overall results from the survey are 75% proven positive results. 83.3% of users like to receive playful notifications and reminders as the highest result from the above table. It proves the behavioral and Reflective design of the emotional design levels which means that users are more encouraged by receiving these notifications to come back daily on the app to learn the language and more motivated to acheive their learning goals.

Using different types of design, Duolingo makes learning a language emotion-

Table 5.3: Duolingo survey results

Elements or features	**Positive Results**	**Overall %**	**Emotional Design**
Color scheme (green, yellow, and blue)	Agree, Strongly Agree	77.8%	Visceral Design (joyful, inviting)
Mascot (Duo the Owl)	Neutral, Agree	72.2%	Visceral, Reflective Design (satisfied learning)
Typography (rounded, soft fonts)	Satisfied, neutral	77.8%	Visceral Design (stress-free)
Sounds(chimes or dings)	Likely, Very likely	77.8%	Visceral Design (joy, motivation)
Audio feedback	Important, Very important	77.7%	Behavioral Design (significant)
Earning XP, Leaderboards	Agree, Strongly agree	77.7%	Behavioral and Reflective Design (high motivation)
Sad Reminders	Neutral, agree	66.7%	Visceral, Reflective (motivation to learn daily)
Instant feedback (green or red highlights)	Neutral, very concerned	72.2%	Behavioral design (concentration)
Supportive messages (“Great job!”)	Agree, Strongly Agree	77.8%	Visceral, Behavioral design (motivated, encouragement)
Notifications	Likely, very likely	83.3%	Behavioral, Reflective design (encouragement)
Visual Achievement Tree	Neutral, Strongly Agree	72.2%	Reflective, Behavioral design (feel understandable)
Funny or playful reminders	Agree, neutral	66.7%	Visceral, Reflective design (motivated and encouraged to complete learning goals)

ally attractive and consistent for everyone. Because of its vivid colors, animated fun, funny owl, rounded lettering, and cheerful music, the site helps users connect with the subject through interactive, enjoyable, and game-like moods rather than requiring academic discipline. Applying gamification, Duolingo uses aspects such as XP, leaderboards, daily streaks, hearts, and fast interactions to ensure learners keep practicing and to improve and motivate learning habits with continuous feedback, encouragement, and challenges. As a result, users consistently feel good about their progress and do not give up when they experience losses. Duo’s emotional replies boosts the friendly atmosphere and feelings of companionship and responsibility in users, so users tend to be more involved. Lastly, thoughtfully designed items such as Duolingo Stories, achievement badges, tree-like progress charts, and entertaining texts show users how they are doing in learning a language. As a result of these components, users begin to reflect on themselves, encouraged, feel proud, recognize their identity, purpose, and connection with the overall learning community. Be-

cause of these strategies, users feel more connected to the app creating long-term engagement, which boosts their user satisfaction, leads them to use it frequently, helps them develop new habits, and gives them extra motivation to language learning journey.

5.2.3 MyFitnessPal Results:

According to the general survey, 16 responses are received from the participants which shows that 87.6% of teenagers and adults group age (18-25) and (26-35) use MyFitnessPal mobile app on a rare basis as shown in demographics. Usually, every person has their own fitness goals some people love to be in shape and great in health but some people do not have an interest in fitness so if they use the fitness app on a rare basis that is their choice. They express their emotional feelings while interacting with the MyFitnessPal user interface of the mobile app by answering the Likert-scale questions as agree, disagree, important, unimportant, likely, unlikely, satisfied and not satisfied. The table 5.4 below show the evaluation on the basis of Likert-scale.

Table 5.4: MyFitnessPal survey results

Elements or features	**Positive Results**	**Overall %**	**Emotional Design**
Color Scheme (white and blue)	Agree, Strongly Agree	62.5%	Visceral Design (Calmness, welcoming)
Minimalist Layout	Satisfied, Neutral	87.5%	Visceral Design (satisfaction)
Navigation through icons	Agree, neutral	81.3%	Visceral Design (Stress-free)
Micorinteractions (check-marks and progress bars)	Satisfied, very satisfied	75.1%	Visceral Design (Smooth, satisfaction)
User logging	Agree, strongly agree	75.1%	Behavioral Design (effortlessly)
Weight Visuals (charts and graphs)	Important, Very important	81.3%	Visceral and Reflective Design (Significance, motivation)
Sharing achievements	Neutral, Agree	68.8%	Reflective (motivation)

The overall results from the survey are 76% proven positive results. 87.5% of users are satisfied with the minimalist layout, as the highest result from the above table. It proves the visceral design of the emotional design levels which means that

individuals like calm and pleasant layouts, especially in health apps to feel relaxed when using apps. Moreover, 75.1% of users are very satisfied with the smooth micro-interactions and effortless user logging which reduce the cognitive load in terms of visceral and behavioral design.

The findings of the case study prove that MyFitnessPal applies various emotional design factors to ensure users are engaged for a long time, form healthy behaviors, and develop loyalty to the app. Emotionally and visually, the software offers clear minimalist design and soothing support by having a white background and soft blue elements. Playing with different kinds of symbols, adding simple color-coded calorie feedback, and using checkmarks and animations gives the user instant satisfaction and helps them stick to the app over time. Being practical, the app has a simple user-freindly way for users to log their intake, such as scanning barcodes, saving meals, and joining with other health apps, all to support tracking regularly without effort. Viewing progress, getting encouragements, and tracking streaks help users enjoy following their health goals in their day-to-day lives. By providing historical charts and data, MyFitnessPal allows users to watch their long-term progress as time goes by and feel their personal growth. Accepting badges for social sharing makes people feel good about themselves and they get community backing at the same time. Having customizable goals and advanced analytics helps Premium users watch their habits, supporting them to choose better for their health. As a consequences, MyFitnessPal is a user-friendly health-tracking app that adds emotional meaning, motivates users, and helps them achieve lasting health results according to visceral, behavioral, and reflective design principles of emotional designs.

5.3 Open-ended Survey Results:

5.3.1 General Survey

In this survey, Highest number of adults and youngsters frequently use multiple mobile apps in their daily life. High number of individuals are from 18-25, 26-35 age group who choose social apps Instagram, WhatsApp, tiktok, Facebook, Snapchat and YouTube. Instagram, Facebook , Snapchat and WhatsApp helps people to stay connected with friends through photos and stories, follow favourite pages, messaging and calls. Adults and youngsters favourite apps are TikTok and YouTube for entertainment and short videos. Some users highlight about appealing and pleasent color scheme in the below comments.

"I choose green color. It is very natural and bright"/"The color scheme is green and quiet satisfying"/"The YouTube app's dark mode looks nice, feels comfortable on the eyes, and allows for more frequent use."/"Red and White colour scheme and nowadays black and white color combinations are really attractive."

From the above consequences, users feel appealing and emotionally engaging with the color schemes of their selected apps. Most of the users chose the green and white color scheme from WhatsApp, they said that the green color looks natural and bright giving a feel of freshness and positivity. Some other users choose YouTube's dark mode, saying that they feel at ease and relaxed in using dark mode because it's comfortable for their eyes and suitable for long hours of usage. Additionally, Some users chose YouTube for its red-and-white color scheme saying it looks appealing to them. All these color schemes of the mentioned apps by users are aesthetically pleasing and emotionally comforting which enhances the user experience. This reflects the visceral level of emotional design, where users are immediately emotionally engaged with visual aesthetic layouts or color schemes of the interface.

Some users talked about the joyful animations in the comments below

"When i upload any status"/"Swiping to see the stories"/"Funny gifs and emojis in WhatsApp" /"Swipe down animation of a video into pop-up mode."/"Instagram's way of wishing special occasions"/"A gentle, floating leaf icon that drifts across the screen, symbolizing growth and serenity. A pulsing circle that expands and contracts, guiding users through breathing exercises."

From the above consequences, Users emotionally feel joyful and pleasurable from the animations of the apps they selected.Some users said they feel curious and fun while swiping swipe-down animation that turns a video into a pop-up mode which creates smooth engagement. Some users said that they feel happy and celebrated when Instagram shows special occasion animations that add a festive touch. Additionally, Some individuals talked about floating leaf-like or pulsing circle animations that evoke calmness and peace. Other users also mentioned that they feel humor and emotional expression in conversations while using animated WhatsApp funny GIFs and emojis. Overall, this proves the visceral level of emotional design, these mentioned animations from user-specified selected apps are interactive and engaging and evoke positive emotions like joy, pleasure, and peace.

Some users highlight about the transitional sounds in the comments below:

"Clicking"/"Beeps are good sounds."/"Notification sound gives a satisfying appeal."/"Feel Enjoyed when hear tapping sound".

From the above consequences, Users feel a sense of responsiveness while making smooth interactions with clicking and tapping sounds in popular apps such as WhatsApp, Instagram, and Snapchat which enhances user experience. Some users mentioned beeps and notification sounds alert and remind them to connect immediately with their social apps such as WhatsApp and Facebook. Users also said that they feel accomplished when they hear the sound of a story uploaded. Overall, this proves the visceral level of emotional design, because these interactive sounds make users enjoyable and emotionally satisfying while engaging with the interface.

5.3.2 Instagram

Some users highlight about minimalist layout in the comments below:

"Yes, Looks good"/"The minimalistic design makes the content the main thing about Instagram. The overall color scheme is good enough." / "Yes, anything with a white background feels good." / "Yes, the minimalistic design with a white background feels clean and calming. It draws attention to the content without distraction, making the app feel modern, organized, and easy to navigate right from the start." / "Yes, white color is a light background color that attracts eyes. It's pleasant and satisfactory for use." / "Well its simple and beautiful"

From the above consequences, The minimalistic design layout with a white background color scheme of instagram gives pleasant and satisfying feel to users. Many users said that the white color schem looks clean and simples which makes the content focused and undistracted. It gives calming and organized effect to the user whenever they open the app from the first moment every time. Users also said that the clear clean layout looks soothing to the eyes which enhances their comfort. This experience proves the visceral level of emotional design, where users feels calmness, clarity, and satisfaction through an instant visual aesthetics evoke positive emotions while engaging with the user interfaces.

Some users talked about the instagram tapping animations in the comments below:

"It is easy to use, eliminating the need to find a like button. Double-tapping hearts encourages people to like your post." / "Sounds good, it feels quick and fun gesture." / "Yes because of it's use with one tap." / "The double tap feature makes the job easy since that way I don't need to find and touch the exact area of the love button" / "The double-tap gesture to like a post feels natural and connection with the post." / "It feels kinda unique unlike other social media apps" / "It looks really good red heart when pops up."

From the above consequences, Users feel that the double-tap gesture is easy, quick, and natural that they don't need to find the specific area to like the post or to find the button. Most users said that they feel the playful and satisfying touch red heart popping up button to like the posts which is visually appealing and unique when compared with other social media platforms. Users feel encouraged to interact freely and strengthen their connection with the app through this simple and engaging. This proves the visceral level of emotional design, where visual interaction becomes memorable for the user and they feel positive and satisfied towards posts.

Some individuals talked about the infinifite scrolling in the comments

"The infinite scrolling can be enjoyable." / "Good. It does not make me to refresh feed." / "Feels good to use after a long tiring day. This endless scrolling feels like discovering new surprises each time." / "Feel Entertained by watching Infinite Reels" / "Fun" / "Amusing i must say" / "It is entertaining at times when scrolling, specially seeing funny reels after having a hectic day."

From the above results, Users feel enjoyment and entertainment through infinite scrolling, commenting, and liking posts or reels. Users said that the infinity feed allows them to continuously discover refreshing and fun content after a long hectic or tiring day. Some individuals describe that they feel amusing and entertaining experiences, with funny reels which relieve their stress and give them a sense of enjoyment and relaxation surprises without needing to refresh the feed. This continuous interaction reduces the cognitive load. This experience proves the visceral and behavioral level of emotional design, where users feel sensory pleasure instantly through entertainment by engaging their selves with an effortless infinite scrolling feature.

Some individuals talked about the swiping stories in the comments below:

"No, Smooth no problem at all" / "It's simple and natural" / "It feels very intuitive, swiping left or right to move between stories matches natural thumb gestures,

so I rarely have to think about it." / "No, it does good job" / "No difficulty in this regard" / "Its good feature" / "No i like it" / "I do not really see stories, but I am aware of this swiping thing. It is ok, its nothing difficult in it." / "Not really that is actually very easy and smooth."

From the above results, Users said that this smooth swiping gesture feels natural with thumb movements while swiping stories from left to right and vice-versa. Users also mention that navigating swiping stories is simple and effective and they do not face any difficulty or frustration. The individuals who don't watch many stories still feel that this feature works well without complications. This proves the behavioral level of emotional design, where natural interaction and feasibility makes the user experience satisfied and stress-free.

Some users mentioned about the blue verified badge in the comments below:

"Feels Special" / "Would be proud" / "Happy and proud" / "It would definitely gives a feel a rush of validation and pride, like I've "made it" in that space." / "Blessed" / "Proud" / "It will be taken as an achievement." / "Feels Good" / "I haven't got one but i believe one must feel superior in a way."

From the above consequences, Individuals will feel special, pride, happiness, and a sense of achievement by receiving the blue verified badge which creates a strong satisfied, and validated emotional response. Mostly, users feel more confident and motivated to post more valuable content after having the blue badge. Users feel blessed and recognized which evokes confidence, satisfaction, and credibility. Users also said that not everyone will receive the varified blue badge but it gives a positive sense of status or superiority. This experience proves the reflective level of emotional design because it makes the user feel accomplished, satisfied, and valued within their digital community through self-worth, identity, and social recognition and makes them stand out from the crowd.

Some individuals talked about the receiving of likes on instagram in the comments below:

"Feel good about post is being liked." / "Makes me feel seen and appreciated." / "Feels good when someone acknowledge." / "I feel a genuine boost of happiness and validation when I see likes and comments—kind of like getting little "thank you" notes from my friends." / "It feels very good. Encourage me to upload more content." / "Yes. It gives more motivation." / "Yes it has a positive impact one me." / "I am a private person and i want to be liked only by my close friends and of course when they like and comment i want to post more."

From the above results, Users feel seen, appreciated, and validated by receiving likes and comments from friends or on posts creating a strong emotional impact of satisfaction. Users feel happiness when they receive little "thank you" notes from their loved ones. Users said that receiving likes and comments on their posts makes them feel encouraged and valued to share more content. However, some individuals do not want a wider audience but are happy and satisfied to receive some comments or likes from close friends or relatives. This experience proves the reflective level of emotional design, as it shows the users' social identity and they get attached to other digital interactions or social identies.

5.3.3 Duolingo:

Some users mentioned about the animations of dulingo app in the comments below:

"Makes me feel proud." / "Yes, when I see the confetti and animations, I feel a real joy, pride and accomplishment." / "It looks awesome and really feels good." / "Yes they motivates me." / "Animations are linked with emotions so i feel it has a emotional component." / "Awesome." / "I feel happy."

From the above results, Users feel more appreciation and rewards through animations and confetti effects after completing lessons. Users said that these animated

celebrations make them feel proud, happy, and accomplished. Emotionally users feel joyful and motivated when these small achievements convert into meaningful moments. This proves the visceral level of emotional design, where users get visually satisfied and engaging feedback which encouraged users to emotionally engage with the app.

Some users mentioned about the streaks in the comments below:

"Yes, The daily streak does help in getting into the flow and eventually turn it into a habit." / "I really like the flaming streak icon, it feels like a little badge of honor every time I open the app. Seeing that number climb day after day gives me a genuine sense of progress." / "Yes, the daily streak definitely helps me build a consistent habit. I don't want to break the chain, so even on busy days I'll squeeze in a quick lesson just to keep that flame alive. It turns learning into a fun daily ritual rather than a chore." / "Yes, ot is quite motivating." / "Yes daily streaks are really good for continuous learning." / "Feels Good." / "Yes, i think it pushes you to learn something small daily." / "It keeps you motivated and a reminds you of your daily tasks so one doesn't forget." / "Yes It gives motivation."

From the above consequences, Individuals feel joyful, fun, motivated, and consistent in learning through the daily streak feature which indicates a flaming icon with a growing number on it. It symbolizes steady progress with visual and emotional rewards. This encouraged users to return to the app for learning even on busy days just to keep the streak alive. The fear of breaking the chain becomes a positive pressure that emotionally supports habit formation, staying focused and on track. This experience proves the behavioral level of emotional design, where the daily streak feature functionality gives a positive emotional effect on the daily routine and creates consistent habits of a learning journey through motivational feedback after complete the daily streak.

Some users highlight about the achievements (badges, streaks, XP) boosts in the comments below:

"Results from the survey are given below." / "Yes, Sharing achievements especially with friends on duolingo and nudging them to catch up to my level is a great way to get more people to stay motivated and keep on learning." / "Yes. It is good for my learning." / "Yes keep me focused." / "Yes It gives motivation to learn more."

From the above results, users said that sharing will boost their motivation to remain consistent on their learning goals. When they share their badges, streaks, and XP they emotionally feel the accomplishment and progression in a friendly competitive environment. Nudging friends adds excitement and helps them to be consistent with learning. This experience proves the reflective level of emotional design because it enhances users' emotional engagement with the user interface by sharing their personal achievements with friends, making social interaction, and long-term goal learning process.

Some users highlight about the funny Mascot Duo Owl in the comments below:

"It feels like a friend" / "It's cute, friendly and funny nature makes it a really good companion." / "Yes, i feel like it is worried about me to learn language." / "Yes like a cute friend." / "The Duolingo owl mascot, Duo, feels like a friendly companion, adding a playful and approachable touch to the learning experience." / "Its Cool Friend." / "Yeah like a companion." / "It's fun to watch it."

From the above individual consequences, The individuals perceived the animated Duo Owl mascot from Duolingo as a friendly and enjoyable companion. They mention that it looks visually cute, funny, and supportive friend than a logo. They feel an emotional connection as stress-free, motivated, and encouraged with the Duo Owl Mascot throughout the learning experience. This proves the reflective level of emotional design, where users make a friendly bond with the mascot, which enhances

their long-term user engagement, motivation, and emotional attachment with the user interface.

5.3.4 MyFitnessPal:

Some individuals talked about the color-coded text in the comments below:

"Yes. Seeing my calorie balance highlighted in green gives me a quick, positive "all-clear" signal that I'm on track."/"Seeing green text boosts my motivation and encourages my healthy habits." /"Yes, it's like a green flag motivation, a positive one to keep it up".

From the above individual results, The users feels a strong emotional support when they saw the green color-coded text for calorie feedback. The highlighted green color-coded calorie text assures them that they are on the right track with their fitness and health goals. This green color text gives them motivation, and satisfaction, boosts and encourages confidence to follow a consistently healthy lifestyle. This experience proves the visceral level of emotional design, which makes the user satisfaction and encouragement when receiving visual positive feedback while interacting with the visual interface.

Some users mentioned about the synchronized data across other devices in the comments below:

"It gives a satisfying feel because of its automation as if things needs to be done right from scratch everytime I login it will automatically distract me and gives a boring feeling." /"It reduces the work stress to do all the settings over and over again while log in in to new devices."/"It is a stress free process."/"It records and synchronized with other apps helping me to track my routine goals."/"Feels good"/"Excellent."

From the above individual consequence, The users are highly satisfied and feel a stress-free process of automatic data synchronization across their health devices or apps like Fitbit and Apple Health. Users feel emotionally comfortable by using

this feature because it eliminates the repetition of input data whenever a user wants to login to a new device. This feature reduces the cognitive load and work stress preventing the frustration that arises from manual processes. It helps users to record their progress daily and stay on track with their fitness goals. This proves the reflective level of emotional design, where users get satisfied and motivated deeply by engaging their experience with long-term goals.

Some users highlight about the barcode scanner feature in the comments below:

"Yes, in just few second i get all information i need."/"Yes—it's super convenient."/"Yes easier to track calories"/"Yes I feel good"/"Yes, it keeps you on the diet plan... Simple but effective."

From the above results, we can see how the barcode scanner feature is really helpful in accessing the nutritional facts of food packaged instantly. Users feel super convenient and time-saving that it provides all the necessary information within seconds. This makes the process of tracking calories simple and easy to stay consistent towards their diet plans and goals. The user feels good and satisfaction in controlling healthier choices effortlessly. It proves the behavioral level of emotional design, where usability and functionality is concerned, and makes the user feel satisfaction and positive emotions through smooth user experiences and engagement with user interfaces.

5.4 A/B Testing Results:

5.4.1 Streak Counter and Daily Goal Tracker:

The original style of the Duolingo Version A is more capable of keeping users motivated and helped them to be consistent in learning habits. The flame and animating progress ring made people feel emotionally excited, had to act quickly through visual triggers, and were sure to achieve success instantly.The design really made the users

concerned about fear of losing their progress and continued to feel motivated by action and reward which enhanced the regular user engagement with the Duolingo app. However, in Group B users will check the calendar occasionally but the lack the visibility of the flame icon makes the user less emotional to be consistent on the app for the daily learning goal. Hidden streaks and fewer exciting cues or fast results made people feel less interested and emotionally involved. Consequently, persons in Group B had less daily activity and consistency, but Group A managed to inspire members by giving motivation and commitment with a stronger emotional design.

5.4.2 Duo the Owl Notifications:

Through playful and emotional Duo notifications, Group A gave users a reflective experience that helped them form an strong emotional link with the character. By having these witty and lively messages, Duo managed to help users consider their habits and feel more connected to the application rather than just a reminder. As per Don Norman's guidelines, this kind of design helps users think about their habits and create a connection with the product based on their personal identities. As a Consequences, Duo started acting as a personal companion, so learning a new language became something friends do rather than a boring task. These emotional design features increase user engagement, motivation, consistency, and sharing of their experiences will boost long-term retention. In Group B, the formal and emotionless notifications lack animations, which makes the notifications unappealing, forgettable, and easy to ignore. These emotionless reminders failed to maintain user interest or motivation to engage daily with the app for their learning goals. As a consequences, Group B members gradually became less interested disengage over time, whereas Group A's lively and emotional notifications helped them maintain better relationships, greater engagement, and better consistent learning habits.

5.4.3 Gamified XP Progress Bar and League Competition:

The advanced XP progress bar with lively colors and instant animations with celebrartory effects in Version A made learning emotionally interactive and enjoyable for everyone. Climbing the ranks up from Bronze to Diamond on the app, users enjoyed the feeling of growing, which made them want to try harder for higher performance and use the app repeatedly. The appearance of the design was appealing, motivating players by regularly providing updates and organizing competitions in leagues, all of which made them feel more competitive and proud of their achievements. This made users stick to their plans, improve their skills, and visit the app often. In Group B XP and league systems missed animations, instant updates, and emotion-based feedback reduce the user experience as less engaged and active on a sensory and behavioral level. Because the experience bar is static and notifications of the league appeared only at the end, there is no sense of instant achievement and real progression for users in Group B. If there are no immediate rewards or competition, users feel like less motivated and become weak learning process to complete the tasks. Overall, compared to Group B, Group A's members experienced much more excitement, motivation, and continuous engagement, which proves the value of interactive engagement and emotional design in educational gamification.

5.4.4 Use of Animated Characters (Duo and Friends):

Group A uses the basic interface with minimal character animation and interactive engagement, which provides a functional focused learning experience. Duo did not show up often, showed few expressions with their face, and was not very clear during users' actions.Even though using this app was simple, it did not include emotion or help build a close relationship with its users. Therefore, users belonging to Group A were probably in an environment that was not very engaging, so they might not have felt encouraged or motivated to visit often and keep learning. On the other

hand, Group B used a more animated and emotionally interactive user interface showing Duo and his friends like Lily and Zari.These characters were full of expressions, reacted if the player did well or poorly, and either celebrated with fireworks or appeared disappointed when a user failed or lost a streak. This interaction created a sense of companionship and emotional connection, which made the learning experience friendly. These multiple characters offer fun, joyful, and supportive feedback which keeps the user motivated. Consequently, Group B users are more emotionally engaged and encourage users to keep returning back to the app to continue their lessons.

6 Conclusion

The importance of emotional design in mobile applications and its effect to evoke positive emotions of user interfaces of mobile application apps are analyzed in this thesis. All four research questions are completely investigated through research methodologies explained in Section 1. The user interface design elements are analyzed on the basis of Dorn Norman's Emotional Design levels: Visceral, Behavioral, and Reflective to explore user engagement and user satisfaction with various mobile apps. Section 2 and Section 3 are theoretical parts of the thesis which provide the existing knowledge about UI/UX designing, emotional designs, psychological Theories, and UI Design Elements. Additionally, the design key elements that can be implemented in mobile applications: color, typography, imagery, sounds, animations, icons, buttons, toggle buttons, dropdown lists, hamburger menu, tab bars, progress bars, forms, loaders, tooltips, accordions, cards, checkboxes are discussed in Section 3. Further, These design elements are analyzed in general and case studies surveys (Instagram, Duolingo, and MyFitnessPal) and A/B Testing of Duolingo Mobile Applications on the basis of three emotional design levels, and Psychological theories. These surveys are evaluated by users' opinions on how significant are various mobile design elements for the user interface of mobile apps. The combined results of both quantitative (Likert-scale) and qualitative questions (open-ended) revealed that user preferences and perceptions on the basis of design elements which

were discussed in Sections 3 and 4 are important in designing visually attractive or engaging and functionally satisfied successful mobile apps.

The deep insights sucessfully validate the research questions given in Section 1. The first research question "How do emotional design and psychological theories influence user engagement, perception and satisfaction in user interfaces?" validates the emotional design levels that how users get attached emotionaly to the mobile apllication user interface and keep on returning back to the app. It also proves in some of the apps that emotional designs such as behavioral designs can reduce the cognitive load so users do not get frustrated by using the mobile app. However, in my opinion, In my opinion, UI designers should consider psychological theories when making users interface designs to know that how users engage and feel satisfaction. A good design interface is not just about functionality its also emotions of users. Psychological theories such as cognitive load theory, Gestalt's principle and pattren recognition theories help designers to analyze user behavior. Because emotions comes from the users psychology or behaviour. Combining emotional designs with psyhcological theories leads to greater engagement, more positive perceptions and a higher satisfaction. The second research question "What are the key design elements and feedbacks that evoke positive emotions in user interfaces or UI/UX designs of mobile applications?" validates the key design elements discussed in Section 3 and then they are analyzed through general emotional design surveys. Users share their emotional design element thoughts and feedback when they interact with their favorite ui/ux mobile applications. The results of the second research question are given in Section 5 in general surveys.However , In my opinion Designers should look into the design elements like color, typography, visual images, sounds and microinteractions before delivering any user interface of mobile application. They should be concerned about minimal layout and smooth navigation to reduce the cognitive overload. The layout should be responsive like sound cue, progressbar,

enjoyable animation. In a result it enhances the user emotional engagement in mobile UI/UX with balance functionality and human-centered design that makes user feel confident, connected, and satisfied. The third research question "How can emotional design principles be applied across different industries, such as healthcare, education, and social industry?" This research question is validated by analyzing the emotional design principles: Visceral, Behavioral, and Reflective in user interface case studies of Instagram, Duolingo, and MyFitnessPal by doing surveys both quantitative (Likert-scale) and qualitative questions (open-ended). The results are given in Section 5, which are 80% positive and users are satisfied with the smooth, joyful, and pleasant user interfaces of all mobile applications which enhances user engagement, satisfaction, and motivation. However, In my opinion, Dorn Normans three level of emotional design principles should be applied across various industries like healthcare, education, and the social sector. It enhances user engagement, trust, and satisfaction. Whenever user interact with healthcare app they interact with user interface layout emotionally calm and stress free. Emotional design levels are not just about aesthetics or visual appeals they are also creating meaningful and human-centered experiences. The fourth and last research question "How can UI designers compare, measure, and evaluate emotional responses to various interfaces of mobile applications?" is validated by the UI designers themselves. UI designer analyzes the emotional design elements including features, visual appeal, and functions through A/B testing by creating two versions GroupA and GroupB of one Duolingo mobile app. The analysis and results are given in Sections 4 and 5. Both of groups have their own consequences.However , In my opinion, UI designers should evaluate the, emotional responses by getting feedbacks from users through A/B testing approach. When designers create two versions of the same mobile app such as Group A and Group B versions of mobile application they can evaluate the specific emotional design elements, like visuals, sounds, interactive UI elements, and anima-

tions to see how users respond. Designers should focus on usability, behavioral, and design elements in the user interfaces of mobile applications for the long-term user engagement.

In conclusion, this thesis explored the positive emotions, user engagement and satisfaction withe user interfaces of mobile applications on the basis of emotional designs principles by getting user feedbacks. The therotical data is too much and users did not give a most accurate results because some individuals have lack of knowledge about user interfaces. So It is advisable that designers and developers should do a vast user research before designing and developing a mobile app by considering emotional design principles. If the user interface design is more friendly, satisfactory, visually pleasant, and easy to use in function the more users will use the mobile application and return back to the app daily. After getting all surveys and testing results it is concluded that emotional designs are essential for user interfaces on the preferences of targeted users, which enhances the usability and application growth in the market.

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Appendix A Survey questionnaire

General Survey

Here is the link to the survey https://forms.gle/JaGQbzHXUG5B8E497

1. What is your age range?

   Under 18, 18–24, 25–34, 35–44, 45–54, 55+

2. How often do you use mobile apps?

   Daily, A few times a week, Weekly, Rarely

3. What type of mobile apps do you use most frequently?

   Social Media, Productivity (e.g., to-do lists, calendars) ,Health & Fitness, Entertainment (e.g., streaming, games), Shopping, Finance, Other?

4. Write the specific name of mobile apps you use frequently? (Open ended)

5. The app's appealing color scheme made you feel emotionally connected.

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

6.What is the color scheme of the app you selected? Does it feel appealing and pleasant to you? If yes then explain your emotions about the color scheme.(open ended)

7. The visual images used in the app affect your mood positively.

Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

8. The animations and transitions felt lively and enjoyable.

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

9. Which animation do you feel more joyful and pleasurable from the app you mentioned above? Explain.(open ended)

10. The typography used in the app is smooth and pleasant.

    Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

11. The navigation through menu bars, tabs, or icons throughout the app feels smooth and satisfied for your favorite app?

    Very dissatisfied, dissatisfied, neutral, satisfied, very satisfied.

12. How important for you are the sounds of interactions with the elements of the user interface of the app e-g(tapping, clicks, beeps, bells, vibrations, and transitional sounds)

    Not important, slightly important, Neutral, important, very important.

13. Can you name the sound(e.g.: clicking, tapping, beeps, bells, knocking, vibrations and transitional sounds) used for interactions while using your favorite above-mentioned app and how you feel emotionally about it? (open ended)

Instagram

Here is the link to the survey https://forms.gle/D3hxkJt3K8fUDjh97

1. What is your age range?

   Under 18, 18–24, 25–34, 35–44, 45–54, 55+

2. How often do you use mobile apps?

   Daily, A few times a week, Weekly, Rarely

3. How much do you like the overall color scheme of Instagram when you use the mobile application version??

   Very Unlikely, Unlikely, Neutral, Likely, Very Likely.

4. Does the minimalistic design with white background color scheme look pleasant and satisfy to you whenever you open the Instagram app from the first movement? if yes then explain a bit. (Open ended)

5. Are you satisfied with the quality of visuals and image features like filters of Instagram?.

   Very dissatisfied, dissatisfied, neutral, satisfied, very satisfied.

6.Does the gradient ring with colors pink, purple, and orange around Stories grab your attention or make you curious to explore new content?

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

7. The visual images used in the app affect your mood positively.

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

8. The heart animation when liking a post makes you feel enjoyable and fun?.

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

9. How does the heart animation that appears when you like a post on Instagram affect your overall experience and emotional connection with the app? Does this double-tap gesture to like a post easy and feel natural? Explain your thoughts. (open ended)

10. The infinite scrolling feature makes browsing Instagram effortless and engaging to you?.

    Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

11. How do you feel about the entertainment while doing the infinite scrolling, commenting and liking the posts or reels? (open ended)

12. Do you satisfied with the smooth navigation while browsing around the whole Instagram app?

    Very dissatisfied, dissatisfied, neutral, satisfied, very satisfied.

13. What do you think about the swiping navigation about stories from left to right and vice versa? Do you face any difficulty in navigating through stories? Share your thoughts. (open ended)

14. Do you satisfied with the smooth navigation while browsing around the whole Instagram app?

    Very dissatisfied, dissatisfied, neutral, satisfied, very satisfied.

15. Instagram gives you a nostalgia about your past archive stories?

    Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

16. Instagram gives you a verified blue badge for a high number of followers makes you worthy and stand out from other crowd?

    Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

17. How would you feel emotionally when you get the blue verified badge? explain (open ended)

18. Are the hashtags significant for you to connect to the people or communities who have the same interests? (open ended)

Not important, slightly important, Neutral, important, very important.

19. What do you feel if you receive likes and comments from other people or friends on your posts. Do these features encourage you to post more content and how it effects on your emotions? share your thoughts. (open ended)

Duolingo

Here is the link to the survey https://forms.gle/H2QXKj4Dj9dyHbCw6

1. What is your age range?

   Under 18, 18–24, 25–34, 35–44, 45–54, 55+

2. How often do you use mobile apps?

   Daily, A few times a week, Weekly, Rarely

3. Does the bright and lively color scheme (green, yellow, and blue) affect your mood as joyful or inviting?

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

4. Does Duolingo's mascot (Duo the Owl) add emotional value to the learning experience?

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

5. Animations and confetti effects after completing lessons make you feel rewarded and appreciated. If yes, How do you feel emotionally when appreciated or rewarded?. (open ended)

6.Are you satisfied with the stress-free typography (rounded, soft fonts) of the app in a learning environment? Very dissatisfied, dissatisfied, neutral, satisfied, very satisfied.

7. How much do you feel joy or motivation through sound effects like chimes or dings for correct answers?

   Very Unlikely, Unlikely, Neutral, Likely, Very Likely.

8. How significant is the spoken feedback pleasant audio voices while learning the language?

   Not important, slightly important, Neutral, important, very important.

9. Earning XP daily and climbing up on the leaderboard on weekly leagues to get the bronze , gold or diamond badges make you more motivated to complete the more lessons.

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

10. How do you feel about the daily streak feature with a flaming icon and streak number? Does the daily streak helps you to build a habit of learning consistently? share your thoughts. (open ended)

11. Emotional reminders from Duo (e.g., "I'm sad you didn't practice") influence you to open the app to practice the lesson daily.

    Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

12. How much are you concerned about the Instant feedback (green or red highlights) helping you to correct mistakes and learn better?

    Very unconcerned, Unconcerned, neutral, Concerned, Very concerned.

13. Do supportive messages like “Great job!” or “Try again!” encourage you to continue learning.

    Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

14. How much do you like or feel progression towards encouraged notifications such as “You’ve learned 1,200 words!”

Very Unlikely, Unlikely, Neutral, Likely, Very Likely.

15. The visual Achievement Tree helps me understand and track my learning goals clearly.

    Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

16. Would sharing achievements (badges, streaks, XP) boost your motivation toward your learning goals? If yes then share your experience. (open ended)

17. Duolingo's funny or playful reminders make you daily return to the app to complete your learning goals. Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

18. What do you feel about the funny Mascot Duo Owl animated logo? Does it feel like a friend or a companion? Share your thoughts. (open-ended)

MyFitnessPal

Here is the link to the survey https://forms.gle/L6hTWErVkHuhLoiv7

1. What is your age range?

   Under 18, 18–24, 25–34, 35–44, 45–54, 55+

2. How often do you use mobile apps?

   Daily, A few times a week, Weekly, Rarely

3. The color scheme (white and blue) of MyFitnessPal gives you a calm and welcoming feeling.

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

4. How MyFitnessPal app layout look minimalist to you?

   Very dissatisfied, dissatisfied, neutral, satisfied, very satisfied.

5. The icons of the app make your navigation stress-free throughout the app.

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

6.Does the green color-coded text of the calorie feedback support you emotionally?

   If yes explain. (open ended)

7. Micro-interactions, such as recording a meal, will often display a checkmark, and if someone finishes a workout, a progress bar will usually start to fill up with a smooth animation. Do these micro-interactions give you satisfaction and progression?

   Very dissatisfied, dissatisfied, neutral, satisfied, very satisfied.

8. Instead of logging daily users can reuse their saved entries more effortlessly than starting every time from scratch. This logging method will keep to continuous health goals effortlessly.

   Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

9. How important are high-quality visuals for you like graphs and charts to notice changes in weights and how much protein, fats, and carbs you are getting from food?

   Not important, slightly important, Neutral, important, very important.

10. How do you feel emotionally when your data is automatically synchronized with other top health devices or apps (e.g., Fitbit, Apple Health) and you get the easily access of your data on different devices? Explain your experience a bit. (open ended)

11. Sharing achievements with others motivates you to stay on track.

    Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

12. Does the barcode scanner feature help you to scan and see the nutritional facts of the packaged foods instantly? If yes then how you feel about it. (open ended)