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# Emotional Design in Mobile Application

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## Abstract

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This thesis explored the topic of emotional design in mobile applications. The purpose of this study was to investigate and analyse the impact of emotional design elements on user experiences within mobile applications, and find out how important certain design elements are in affecting the user engagement and satisfaction.

The study was carried out by a mixed-method approach, combining the theoretical knowledge gathered by the literature explored, and the data collected through a survey implementation. The literature review covered a brief understanding of emotional design and its impact on user experience. Four key elements in mobile application design were then extracted for discussion and a survey to gather insights from daily mobile application users.

The findings suggested that emotional design plays an important role in shaping user experience within mobile applications. Through designing elements across three levels of emotional design, both user satisfaction and user engagement can be enhanced. The data gathered through the survey also provided some minor insights about user opinions and preferences on various mobile application design elements, allowing designers and developers to take them as a reference.

The outcome of this study should contribute to the field of mobile application development. Providing insights that help designers to create more engaging mobile applications, and assist them to differentiate their products in the crowded market through applying emotional design in mobile applications.

Keywords: Emotional Design, Mobile Application

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# Contents

## List of Abbreviations

1	Introduction	1
2	Research Question and Methodology	3
2.1	Research Questions	4
2.2	Research Methodology	4
2.2.1	Survey Design	4
2.2.2	Participants	5
2.2.3	Data Collection	5
2.2.4	Data Analysis	5
3	Literature Review	6
3.1	Understanding of Emotional Design	6
3.2	Understanding of UI/UX Design	8
3.2.1	User Interface	8
3.2.2	User Experience	9
3.3	Principles and Elements of Emotional Design	10
3.3.1	Visceral Design	10
3.3.2	Behaviourial Design	10
3.3.3	Reflective Design	11
3.3.4	Gestalt Theory	11
3.3.5	Colour	11
3.3.6	Typography	11
3.3.7	Form and Shape	12
3.3.8	Sound	12
3.3.9	Narrative	12
3.4	Emotional Design in Mobile Application	13
3.5	Impact of Emotional Design on User Experience	15
3.5.1	Enhanced User Engagement	15
3.5.2	Increased User Satisfaction	16
3.5.3	Improved User Loyalty	16
3.5.4	Facilitates Emotional Connections	16
3.5.5	Promote Usability	17

4	Designing for Emotion in Mobile Applications	18
4.1	Color Psychology in Mobile Design	19
4.2	Typography and Emotional Impact	21
4.3	Imagery and Visual Elements	23
4.4	Animation and Interaction Design	24
4.5	Layout and Gestalt Principles	26
5	Research Design	27
5.1	Survey Implementation	27
5.2	Data Handling and Analysis	28
5.3	Restrictions and Limitations	28
6	Survey Result	29
6.1	Demographic Data	29
6.2	Results of Likert Scake Responses	30
6.3	Results of Open-ended Responses	34
7	Discussion	41
7.1	Creating Emotional Engagement in Mobile UI/UX	42
7.2	Validity and Reliability	45
7.3	Future Work	45
8	Conclusion	46
	References	48
	Appendices	
	Appendix 1: Survey Questions of Emotional Design in Mobile Application	

## List of Abbreviations

- UI: User interface. Visual interactive elements of digital systems designed for interactions between humans and machines to occur.
- UX: User experience. User's perceptions of practical and emotional aspects including usability, accessibility, efficiency, and satisfaction on a service or product.
- UCD: User-centered design. A design process focuses on end-users and their preferences at every stage of the development. Involves in studying user behaviors to conclude design decisions.

## 1 Introduction

In the modern digital world, the mobile industry has undergone tremendous growth because of technological advancements. These mobile applications have become increasingly indispensable in our daily lives, providing various purposes including self-learning, entertainment, and communication between people [1]. As there are millions of applications developed on various platforms, developers experience intense competition to capture users' attention and engagement while developing their products. As a result, the design of mobile applications plays an important role in shaping the overall user experiences and perceptions [2].

Emotional design is not a newly introduced concept. It was introduced by a famous psychologist Donald Norman back in 2004, and he classified the design theory into three levels: Visceral, Behavioural and Reflective in his book [3]. Emotional design has become more and more popular among designers in recent years since designers are increasingly recognizing the importance between a good product and a good customer experience [4]. Emotional design is not only about the basic functionality and aesthetics of a product, but it aims to raise specific emotional responses that enhance user satisfaction and user engagement. Emotional design could be important in differentiating applications in a competitive market, where creating a resonant user experience can significantly impact how successful the application could be.

The primary goal of this thesis is to explore the importance of emotional design in mobile applications and its influence on user experience. Understanding how users emotionally interact with mobile applications is vital for both developers and designer. This research aims to investigate how various design elements, such as colour schemes [5], typography [6], imagery, and animations [7], can provoke different emotional responses [8]. The findings of this study are intended to provide valuable insights for stakeholders in the mobile application industry, helping them to craft more engaging and user-centred digital products.

Furthermore, this thesis will explore the integration of emotional design in mobile application development through investigating the effects of the design elements mentioned above across three levels of emotional design. As digital applications become more extensive in our lives [1], the ability to integrate emotional intelligence into application design will become increasingly important. This research will not only benefit the mobile application industry but also offer insights that could be applied to other digital interfaces, enhancing our interaction with technology on an emotional level.

## **2 Research Question and Methodology**

Mobile application development is a complex process [9]. To create a successful application, it does not only require a cohesive development team comprising developers and designers, but also an alignment of the application's user experience with the expectation of its targeted users [10]. Especially in today's highly competitive environment, promoting user engagement is a key to distinguish the application from its competitors, and it can be achieved by integrating emotional design into the product [11].

This section will discuss the core research questions, serving as a foundation of the exploration on the thesis topic. The main objective of this thesis is to explore and analyse the impact of emotional design elements on user experience and user satisfaction within mobile applications. Aiming to explore the strategies of enhancing user engagement and connectivity in mobile apps through emotional design theory.

In order to address the questions, this section will also outline the methodology designed to gather relevant data and analyse insights. This methodology is the blueprint of how the research is conducted and ensures the reliability of the findings.

By defining the research questions and the methodology clearly, this section establishes a solid path to explore the identifications of important elements which contribute to emotional design in mobile applications.



## 2.1 Research Question

The research and analysis in this thesis are linked to the emotional design principles, user experience (UX), and user-centred design (UCD) within the context of mobile applications. To study the complexity of emotional design and its impact on mobile application development, the objective of the thesis can be achieved by answer the following research questions:

1. How can emotional design principles be integrated into the process of mobile application development?
2. What is the impact of emotional design on user satisfaction in mobile applications?
3. How important are various design elements in influencing user satisfaction during their mobile experiences?

By answering these research questions, this thesis can offer a comprehensive understanding of the role of emotional design in mobile applications.

## 2.2 Research Methodology

In this thesis study, a quantitative research approach will be used to investigate the impact of emotional design on user experiences with mobile applications. The primary tool for data collection will be a structured survey aimed to gather insights from the general population, focusing on daily mobile applications users. Together with the literature review, this approach can facilitate a broad understanding of user perceptions and experiences on the thesis topic.

### 2.2.1 Survey Design

To answer the proposed research questions, a survey will be conducted to further investigate users' perception of various design elements in mobile applications. The survey will be designed to complement research conducted in Section 4, enriching the findings of this thesis by integrating insights from both theoretical exploration and empirical data from the survey. Most of the survey questions will

utilise a Likert-scale format, allowing participants to express their degree of agreement with statements related to emotional design in mobile applications. To gain deeper insights, the survey will also include a few open-ended questions, encouraging the participants to provide more detailed responses and personal perspectives.

### 2.2.2 Participants

The participants will be recruited on a voluntary basis, starting with the author's network who are daily mobile applications users, including classmates, friends, and relatives, who will then be encouraged to share the survey within their networks. This approach helps to ensure a diverse range of respondents while at the same time maintaining a degree of control over the participant pool, avoiding data contamination from random respondents.

### 2.2.3 Data Collection

The survey will be distributed online through email and direct messaging, utilising the network expansion mentioned above. The data-collecting approach aims to gather a broad but controlled sample of daily mobile app users, and ensure the data's relevance to the thesis objectives. The collected data from this survey will be anonymized, ensuring participants' confidentiality.

### 2.2.4 Data Analysis

For responses collected by Likert-scale questions, a descriptive statistical method will be used to analyse the data, including calculating the means and medians to provide an overview of the participant's opinions. As for data collected from open-ended questions, a qualitative analysis approach will be applied to extract key information from the participant's answers, allowing us to gather a comprehensive understanding of the participant's personal experiences and perceptions to emotional design in mobile applications.

### 3 Literature Review

This section explores the existing knowledge base of emotional design and its relationship with UI/UX design in the field of mobile applications, by examining various foundational theories and principles, through related books, journals, and conferences. This section aims to establish a comprehensive understanding of how emotional design is implemented in the industry and its significant impact on user experience. The exploration serves as the foundation for further investigation into how emotional design influences user interaction and satisfaction in mobile apps. The insights gathered here will provide a theoretical framework for analysing the survey studies and data in subsequent sections of this thesis.

#### 3.1 Understanding of Emotion Design

Emotional design is a design concept that focuses on creating products that create specific emotional responses from the users. It is based on the understanding that emotions play a vital role in human decision-making and perception [12], significantly influencing user engagement and satisfaction. Donald Norman's framework of emotional design, which categorises product interactions into three levels, visceral, behavioural, and reflective, is foundational in this area [3].

Starting by the first level, visceral relates to the initial impact of design on users, influenced by aesthetics and first impressions. At this stage, users create immediate emotional responses to the design, which can significantly influence their subsequent interactions and perceptions [3]. In the next level, behavioural design focuses on the usability and functionality of a product, where the user's emotional response is associated with the ease and efficacy of use of the product [3]. In the last level, which is reflective level, it refers to deeper cognitive engagement, where users reflect on their overall experience, often influencing long-term attitudes towards a product and decisions on future use [3].

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 often involves understanding the target audience's emotional triggers and designing interactions that can positively influence their feelings and behaviours. For instance, positive emotions such as satisfaction and happiness can enhance user engagement and loyalty, while negative emotions such as dissatisfaction and frustration might lead to disappointment and abandonment. [13].

Emotional design is occasionally related to psychological and neuroscientific research as well, providing insights into how different design elements can trigger specific emotional responses from users. This multidisciplinary approach may help designers to understand which aspects of a design can generate joy, trust, or even frustration, and how these emotions can influence our mental processes like memory, decision-making, and problem-solving. Understanding these psychological mechanisms is beneficial for designers to create more effective and emotionally engaging interfaces. [14].

For instance, the theory of embodied cognition implies that our cognitive processes are strongly related to human interactions, including those guided by technology. This theory implies that the physical aspects of different designs, such as shape, texture, or movement, can all influence users' emotional and cognitive experiences [15]. Although mobile applications may not be a physical design containing different aspects, by investigating unique aspects which mobile applications contain, designers can create mobile applications that not only appeal to users visually but also resonate with them on a more profound emotional level, leading to more meaningful and lasting user engagement.

## 3.2 Understanding of UI/UX Design

In modern mobile application development, the role of User Interface (UI) and User Experience (UX) design cannot be underestimated. This is not just about attracting users with visual appeal interfaces designs, but also providing them an intuitive digital experience. Proficient UI/UX design is crucial for creating engaging and user-friendly mobile applications.

### 3.2.1 User Interface

User interface is where the interaction between humans and digital devices unfolds. In mobile applications' perspective, it usually refers to the appearance being shown on the display. Therefore, user interface design mainly focuses on the visual and interactive elements of a mobile application.

A well-designed UI communicates to the users in a professional way, making the application friendly, easy to understand, and efficient. Compared to visual and graphic designs, UI design is more like a communication concept, handling the conversation between the users and the product to perform tasks and achieve users' goals [16]. When applied to a mobile user interface environment, a well-designed UI ensures the functionality, usability, performance, and supportability of the mobile application [17].

As mentioned above, UI designs refer to the appearance of the application being shown on the display, which makes UI designers responsible for the design of all the interfaces that the application includes, including the overall layouts, colours, typographies, and even the components and icons [18]. A good UI combines carefully selected colour palettes and typography to establish a visual identity that aligns with the application's brand and purpose, and it should also be aware of the interfaces' responsiveness when displaying on different devices.

### 3.2.2 User Experience

User experience covers more than the moment-to-moment interactions between the user and the product. As users may discover more about the product when they continue using it, what they experience will affect the likelihood of having recurring interactions. So UX also includes the reflection after the usage, and anticipation before the next use of the product [19]. User experience is often related to user behaviours such as the users' expectations, emotions, and thoughts while they are interacting with the application. Therefore, user experience is very important to how well the users engage with the application.

One of the largest parts in UX design is to collect user requirements through user research [20]. This is not limited only to mobile applications development, but also in many of the other products in the modern world. User research is essential for making a product successful because it ensures that the product meets the user's specific needs. For this reason, UX design requires the designer to emphasis on user's thinking. UX designers usually understand how the users think by conducting surveys, interviews, creating user personas, and usability tests to gain insights of user preferences and their pain points [21].

Accessibility is another imperative aspect in UX design. While UI designer focuses more on the visual appearance of the interfaces, it is important that UX designer ensure that the application is usable by most individuals or the main targeted customers. UX designers carefully examine factors such as screen reader compatibility, colour contrast, and keyboard navigation to create the best user experience possible.

Wireframing and prototyping are two important UX design processes. These processes provide a blueprint for the user journey of the application by using low-fidelity visual representation and can be done by pen sketching or using technical tools. High-fidelity wireframing can also be used to bring extra features into the prototype, showing some key interactions and features of the application [22].

### 3.3 Principles and Elements of Emotional Design

Building on our understanding of emotional design as a method to engage users at a deeper emotional level, this section will further discuss specific principles and elements that serve as a basis for emotional design. Emotional design is not just about evoking responses from the users as discussed before, it is about creating emotions that deepen the user's connection to the product. We'll explore these guiding principles, initially defined by Donald Norman [3], and the key elements that designers can manipulate to craft emotionally resonant experiences.

#### 3.3.1 Visceral Design

The visceral level is the first level of emotional design in Norman's theory. It targets the user's immediate reaction when approaching a product, which in fact is largely influenced by its visual appeal. This initial impression is crucial, as it sets the feeling for the user's subsequent interaction with the product. In product designs, the colour, the shape, and the texture, are all examples of some of the key elements on this level. Norman's work emphasises that this level of design is about invoking an instinctual response that can be both positive and negative based on the visual element presented. [3].

#### 3.3.2 Behavioural Design

The behavioural design is the second level in Norman's theory as mentioned. This level went slightly deeper to address how users interact with the product and how their emotions arise while the product is being used. It's where functionality and usability step to the fore. A product that is intuitive and efficient promotes a sense of satisfaction and confidence to the users, which is essential for encouraging ongoing engagements. Norman highlights that this level is about the pleasure and effectiveness based upon the use of the product. [3].

### 3.3.3 Reflective Design

Being the top degree in emotional design, reflective design encompasses the user's conscious reflection on their experience with the product. It includes the combination of personal experiences, memories, and even the ability to project the product's impact on one's life. This level is influential in forming long-term emotional bonds and attitudes towards the product. Norman believes that reflective design can influence how users perceive the product's role in their lives, impacting their loyalty and advocacy. [3].

Having explored the principles of emotional design that introduced by Donald Norman [3], it is essential to understand how these principles are presented through various design elements. Each element contributes uniquely across these levels, shaping the user's emotional experience.

### 3.3.4 Gestalt Theory

Gestalt Laws of Perception was introduced by Wertheimer in the last century [23]. This theory focuses on how humans perceive visual elements, suggesting that the human brain has a natural process to find order in disorder, helping us to better understand complex contexts by patterns, groupings, and organisations [23]. Designers have begun incorporating some Gestalt principles in their work since the 1920s. By embracing the Gestalt concepts, Gestalt psychology has influenced other design concepts such as Figure-ground relationships, Visual hierarchy, and Associativity [24].

### 3.3.5 Colour

On the visceral level, colours are immediate and powerful. As a fundamental element of all visuals, it plays a major role in inducing direct emotional responses [25]. At the behavioural level, colours can be used to guide the user when interacting with the product [26], affecting usability and readability, it may also influence user actions and decision-making. As in the reflective level, colours



could contribute to brand identity and user perception over time, affecting how users might remember and think about the product in the future [27].

### 3.3.6 Typography

Typography design is the process of arranging the typefaces to stylize the appearance [28]. As a key role in visual communication, typography is important in delivering contents to targeted audiences [6], while also shaping the mood and personality, aligning with the reflective design principles [29]. At the visceral level, the typography style can cause immediate emotional reaction just like colours. It can be used to draw attention or simply leave a first impression on the user's mind [30]. Behaviourally, it influences the readability and legibility of the design, affecting the user experience and usability of the product directly. On the reflective level, it can be used to play a major role in conveying the brand's message over time.

### 3.3.7 Form and Shape

The form and shape of a design or product can create visceral reactions on users based on the design's aesthetic appeal or symbolism. While behaviourally, the form and shape of a product have great influences on how the product is used and experienced. Reflectively, forms and shapes contribute to the narrative and identity of the design, resulting in a long-term perception and attachment. [3].

### 3.3.8 Sound

While not all design and product may include sound element, sound element serves similar functionalities as the other elements. Research showed that by combination of interesting sound effects and attention-grabbing colours, positive emotions in multimedia can be produced more effectively [31]. Besides triggering immediate emotional responses at the visceral level, sounds can be used as a guide for user interactions. In the reflective level, sound contributes to reinforcing brand identity and user memory in an effective way.

### 3.3.9 Narrative

Storytelling within a design or product can create a visceral connection through engaging content, influence behaviour by guiding the user through a designed journey and build a reflective attachment by embedding the experience within a meaningful context. A study shows that narrative could be effective in evoking different emotions, which is favourable to information processing and problem solving [32].

By examining the above elements through the lens of Donald Norman's emotional design levels [3], we gain a comprehensive understanding of how they are used to shape the user's emotional experience. This foundation is essential for later discussions on the topic of these elements in mobile application design.

## 3.4 Emotional Design in Mobile Application

Expanding on the foundational understanding of emotional design elements from the previous section, elements focusing on the unique landscape of mobile applications can now be discussed. The design of mobile applications presents different challenges and opportunities compared to product or other designs, especially in terms of interaction design [33]. Not all general design elements can be translated directly to mobile application design; for instance, the physical form and shape, which are crucial in product design, are less applicable in the virtual space of mobile applications. Here, discussion on how emotional design principles can be effectively applied to the mobile application experience will be made, emphasizing the elements that are particularly impactful in this field.

Beginning with the colour element, a study by Naz Kaya on the psychology of colour once demonstrates how different colours can affect human mood and behaviour [34]. By integrating colour psychology into interaction design, colours can be used to encode information, direct the user's attention, and even affect psychological changes [5]. For example, specific colours can enhance user engagement and facilitate navigation within the app. An analysis with an Italian

medical linkage system has tested the UX and interaction logic guided by colour psychology [5]. Showed that the colours on mobile applications do not only influence the feelings of the users towards the product, but also a great tool to guide users throughout the application flow, resulting in a simplified operational logic for users [5]. In the reflective level of emotional design, colours of the application can transmit the brand information in an effective way, users can also remember the function of each module by different colours more easily [26].

Typography in mobile applications not only needs to ensure readability but also deliver the right emotional tone. The choice of font, size, and spacing can affect user perception and emotions entirely due to the limited display area on mobile devices. A study illustrates that typography can impact user comprehension and retention, affecting the overall readability of the product, underlining the importance of type choices in mobile interfaces [35]. A clear, legible font is important to reduce user frustration, while a unique typeface can contribute to the app's personality and user connection.

As mobile applications are virtual, imagery and visual elements are noteworthy in such shapeless products. Icons, illustrations, and photographs are all important factors in enhancing user experience [8]. Moreover, colour of the images should be in cooperation to the overall application content, ensuring the consistency in the UX point of view [36]. Due to the smaller screen size, each image must be chosen with care to ensure it communicates effectively and promotes the intended emotional response.

While not applicable in every application, sound is another element that can play a key role in mobile application emotional design when used appropriately. Notification sounds, feedback chirps, and even ambient sound and background music can enhance the emotional ambiance of the app experience. For instance, a fitness app might use upbeat music to motivate users, while a meditation app might employ soothing nature sounds to promote relaxation. The proper usage of sound elements is effective in contributing to the overall user experience and engagement.

Interactive element is something unique to digital products. Interactive design elements like animations, transitions and touch feedback can significantly enhance the user experience on digital products [37]. Gestures like tapping, swiping, and pinching on mobile applications can enhance the emotional experience by providing a sense of personal manipulation and engagement with the app. Well-designed interactions can raise feelings of delight and make the user feel understood, enhancing user satisfaction and emotional bond with the application.

This section covered how the principles of emotional design can be adapted and applied to mobile applications through different elements applicable on mobile, emphasizing the importance of each design element in creating an effective user experience on mobile devices.

### 3.5 Impact of Emotional Design on User Experience

As mentioned, when adapting emotional design in mobile application development, it is not just about creating visually appealing interfaces, but to form a deeper connection between the user and the product. By integrating emotional design principles, the overall user experiences of the mobile application can be enhanced. This section will explore the impact of emotional design on UX in a few aspects, including user engagement, user satisfaction, and user loyalty.

#### 3.5.1 Enhanced User Engagement

Emotional design can enhance user engagement significantly. Two Japanese researchers once performed research with two functional identical ATMs, while one of them has more attractive interfaces. The research found that visually pleasing interfaces have direct impact on user engagement levels, as aesthetically attractive interfaces were perceived to be easier to use [38]. By promoting positive emotions, products can result in a higher user satisfaction, making users more likely to explore additional features themselves and recommend the product to others, enhancing the overall user engagement [39].

### 3.5.2 Increased User Satisfaction

Since user satisfaction is closely tied to how users feel when they interact with the application, emotional design can elevate user satisfaction by creative positive emotions and reduce possible frustrations. Products that were designed with emotional considerations can enhance user satisfaction by supporting users' psychological needs in addition to their functional requirements [40]. As indicated that elements such as colours and interactions can be used as a great tool to guide users within the mobile application flow, user satisfaction can then be lifted by maintaining a user-friendly and easy-to-use approach. User satisfaction is a keystone of the overall user experience since it influences how users perceive the app. A high user satisfaction usually proves the success of a mobile application, as it not only attracts new users but also retains the existing ones.

### 3.5.3 Improved User Loyalty

User loyalty can also be improved by using an emotional design approach when developing mobile applications, and user loyalty has even a greater impact on retaining existing users when compared to user satisfaction. When the user forms an emotional bond with a product, they are more likely to keep using it and less likely to look for a substitute [3]. Elements such as typography and imagery have significant benefits on stronger brand connections in users' memory as discussed [39]. Developing a mobile application with these elements in emotional design aspects can create a sense of attachment between the user and the application, leading to increased user loyalty in UX.

### 3.5.4 Facilitates Emotional Connections

Sometimes, emotional design can facilitate personal connection between the user and the application. In product design's point of view, when the product is well-developed with emotional design, positive emotional connection can transform ordinary interaction into meaningful user experience, making users more likely to interact with the product [4], and the same can be applied to mobile

applications. Applications that can raise emotions tend to be more memorable to users and increase the likelihood of continuous usage [38].

### 3.5.5 Promote Usability

Applying emotional design on mobile applications also promotes usability by making interfaces more intuitive and easier to navigate. In Norman's theory of emotional design, positive emotions may enhance one's cognitive abilities, making it easier for users to find solutions to problems by themselves [3]. As a result, when a user feels positive about the application because of the well-structured emotional designs, the user may overlook some minor usability issues. Unlike poorly structured design leading to negative emotion, which may only result in amplifying the problems. Therefore, since emotional design determines the usability of the applications, it has a significant impact on user experiences.

## 4 Designing for Emotion in Mobile Applications

As mentioned in the previous sections, designing for emotion is not just an accessory to mobile applications, emotional design can be a decisive factor in differentiating the products in a crowded market [39]. This section targets to discover how various design elements can be integrated into mobile applications to promote different emotional responses from the users, enhancing the overall user experiences and engagement.

On the introductory level, emotional design can refer to evoking various emotions by the practice of creating user experiences [40], so the ability to understand user emotions when working with emotional design is fundamental. However, emotional design goes beyond that to the three levels that were defined by Norman [3], impacting all five aspects in UX design as mentioned in the previous section.

By comprehensively empathizing and analysing the targeted audience's emotional responses, designers and developers can adjust the user experiences to align with the user's expectations and needs [41]. The empathetic approach in emotional design ensures that every aspect of the user interfaces is contributing to a cohesive and emotionally engaging user journey.

The strategy for designing a mobile application can be divided into 6 necessary elements, including colour, font, icons, illustrations, brand design and navigation [42]. In the following subsections, 6 design elements above will be classified as colour psychology, typography, imagery and visual elements, and animation and interactive designs. These components are the backbones of shaping user experience [8] in mobile applications across all three levels of emotional design. Details of each of these elements will be discussed below and explore how they can be modified to developed mobile applications with emotional design.

## 4.1 Colour Psychology in Mobile Design

Colour is a powerful design tool that can be used to signal action and influence user's emotion in the field of mobile applications design. Therefore, colour psychology becomes more important since it can be used to influence multiple aspects, such as enhancing user engagement, promoting brand identity [43], and affecting the overall usability of the mobile application [44].

In design's perspective, colour choices are more than just for aesthetic purposes. Over the years, designers have defined intrinsic meanings for different colours which each of the colours can provoke different kinds of emotions, and there is more than just one definition for each colour depending on which aspect you are looking into [45].

Choosing an appropriate colour scheme while designing a mobile application is a complex process since a design of an application is a mixture of colours. Designers should always consider different aspects such as the application's purpose and the targeted users of the mobile app [46], while the colours of some components are not necessarily had to be the same as the main theme [26], [47]. For example, while blue is a valid option for confirmation buttons because of its representation of trust and calmness, and red could be used for alerts since it is often associated with danger in our daily lives, these two colours can both appear in an education app whose main colour is probably green.

Choosing the right colours that work well with each other and forming a colour palette for a mobile application is never an easy job [45], especially when colours of an application might be closely connected with its logo design and brand personality [48]. To achieve this, it is advisable that designers acknowledge what impressions do different colours cause influences on users' emotions before they start testing different combinations of colours. Table 1 below shows a summary of different expressions that the common colours may provide towards the users, mobile application designers can use it as a reference to choose the colours strategically that best align with the app's purpose and its targeted users.



Table 1. Summary of common colours and their expressions. [49]

<b>Colour</b>	<b>Expressions</b>
Red	<ul style="list-style-type: none"> <li>• Energy, Strength, Power</li> <li>• Danger, Urgency</li> <li>• Desire, Love</li> </ul>
Green	<ul style="list-style-type: none"> <li>• Nature, Freshness</li> <li>• Calm</li> <li>• Piety, Sincerity</li> </ul>
Blue	<ul style="list-style-type: none"> <li>• Authentic</li> <li>• Warm, Peaceful, Compassionate</li> <li>• Flexible, Imaginative</li> </ul>
Brown	<ul style="list-style-type: none"> <li>• Dependability, Reliability, Honesty, Stability, Mature</li> </ul>
Orange	<ul style="list-style-type: none"> <li>• Energetic, Enthusiasm, Fascination</li> <li>• Joy, Happiness, Encouragement</li> </ul>
Yellow	<ul style="list-style-type: none"> <li>• Joy, Happiness, Cheerfulness</li> <li>• Honorary, Loyalty</li> </ul>
Pink	<ul style="list-style-type: none"> <li>• Love, Youth</li> <li>• Tenderness, Hope, Kindness</li> <li>• Innocence, Naïve, Vulnerability</li> </ul>
Purple	<ul style="list-style-type: none"> <li>• Royalty, Nobility, Dignity</li> <li>• Luxury, Ambition</li> <li>• Mystery, Magic, Creativity</li> </ul>
White	<ul style="list-style-type: none"> <li>• Clean, Purity, Virginity</li> <li>• Goodness, Safety, Faith, Positivity</li> </ul>
Black	<ul style="list-style-type: none"> <li>• Elegance, Formality</li> <li>• Fear, Mystery</li> <li>• Evil, Negativity</li> </ul>

The table above shows some of the common colours that we can encounter in our daily lives and their symbolic meanings. The usage of colours on mobile applications has significant impacts on user's moods, perceptions, and even their decision-making processes. These features are all essential to the user engagement and usability of the mobile application. When working with colours during mobile application design, it is recommended to understand the audience well in order to apply the colour psychology above, while at the same time designers should always consider the contrast between different colours to improve readability and accessibility. Always carry out user tests to gather feedback until finding out the best colour schemes to resonate with the users.

#### 4.2 Typography and Emotional Impact.

Typography is another impactful feature on mobile application design, not only because it is the main method to deliver information to users on mobile apps, but it is also affecting user's emotion directly at first glance. With over half a million fonts available across the internet, it is worth for designers putting some effort into exploring the psychology of typography, for the purpose of finding the best suitable font to promote the user experience. In this section, symbolic impact of various font families on users' emotion will be discussed, providing understanding on how typography is related to emotional impacts on mobile application's perspective.

Fonts are visual elements that are used to display information or deliver messages to users on mobile applications, but it is more than just a text displaying tool [28]. By integrating typography psychology, fonts can also be used to deliver emotional expression to the users [50]. For instance, with the traditional and formal appearance of Serif fonts, they are often being used to promote a sense of reliability and respectability within mobile applications [49]. Since there are too many existing fonts, designers tend to categorize them into six different style groups, table 2 below shows a summary of the font styles as well as their psychological associations.

Table 2. Summary of font styles and their expressions. [51]

Font Style	Category	Expressions
Serifs	Trustworthy Fonts	Stability, Tradition, Intellect, Formality
Slab Serifs	Powerful Fonts	Enduring, Strong, Masculine, Tough
Sans Serifs	Friendly Fonts	Progressive, Sensible, Friendly, Simple
Modern Sans Serifs	Chic Fonts	Exquisite, Futuristic, Elegant, Clean
Script	Fun Fonts	Creative, Amusing, Romantic, Playful
Display	Decorative Fonts	Unique, Adaptable, Original, Casual

The table above showed some different expressions given by different styles of fonts, while fonts can also evoke a variety of emotions depending on their design characteristics, here are some examples: [52].

- Fonts with thin strokes are elegant and sophisticated, they often deliver a sense of luxury and are commonly found in high-end branding.
- Fonts in the decorative category give out a playful and unique tone, these fonts are commonly used in children's products as well as artistic products.
- Fonts that are bold and heavy usually convey a sense of strength and power, they often appear in headings and logos to grab users' attention.
- Fonts that are rounded and soft evoke a sense of warmth and friendliness, these fonts are suitable for brands that want to establish personal connection with their users.

Apart from the general perceptions about font styles mentioned above, there are other factors driving the font psychology as well, such as font colour, font size, and spacing of the fonts, each having influences towards the overall mood and user experience of the application. For instance, fonts that are large and bold tend to grab more attention and represent importance or urgency, while light and smaller text appear to be more subordinate.

### 4.3 Imagery and Visual Elements

Imagery and visual elements are powerful tools to decorate mobile applications nowadays, not only because they can strongly influence users' emotion, but more often because imagery and visual elements are processed more readily by the brain than words [53]. If used properly, images and visual elements together can deliver messages more efficiently than text and enhance the user experience of the mobile application significantly. This section will first discuss some psychological impact behind the imagery and visual elements, then explore some guidelines on how they can be used strategically in mobile applications to influence user emotions and behaviours.

Images on mobile applications can be used to deliver complex ideas quickly [54], sometimes it can even be used to avoid language barriers [55], assisting users to understand complicated concepts more effectively. Other than that, imagery and visual elements have the ability to evoke a wide range of emotional response, a research study once found out that images can cause several physiological reactions, such as increasing heart rate and blood pressure, sweating, and even upset stomach [56]. The right choices of images and visuals can determine the tone of the mobile application, affecting users' mood and even influence their decision-making and behaviour [57]. For example, vibrant and dynamic images energize users, so they are suitable for appearing in sport applications [56], while interpretive and descriptive visuals in serene themes can benefit E-learning apps [59].

Human eye is constantly taking in new information every second. Research has conducted an experiment that has found that humans can even identify images in just 13 to 80 milliseconds [60]. Mobile designers and developers should take this into account since modern people hate reading a whole page of text. Imagery and visual elements become more essential and powerful as we can find them not only on digital products but also on newspapers and other physical products. From an emotional design perspective, images and visuals are much more memorable than display text since they can evoke stronger affective and

engagement responses. Depending on the purpose of different mobile applications, this boost in remembering benefits the application in multiple aspects, not only making the application more memorable because of the enhanced user experience, but also useful in increasing users' trust [61].

Unlike colours and typography that we have mentioned above, it is difficult to classify imagery and visual elements into different categories and discuss their corresponding expressions. In order to select the best appropriate visuals, it is always recommended to perform extensive user research while designing the mobile application. The user research should be focusing on the targeted users' preferences and cultural backgrounds [62], and never forget the original purpose of the mobile application [10].

It is also advisable for designers and developers to maintain the consistency, accessibility, and inclusiveness when working with imagery on mobile application design. Ensuring that the emotional tone given by the visuals aligns with the theme of the application that shares the same emotion brought by the colour and typography psychology. In addition, high quality images that are optimized for different devices should always be used as a means to preserve the overall user experiences.

#### 4.4 Animation and Interaction Design

Same as the other components mentioned above, animations and interactions design are also essential features that make the application trendier and build customer loyalty [63]. Applying animations and interactions design into a mobile application can not only enhance the decorative appeal but also significantly affect the user experience and emotional engagement [64]. This section will explore how integrating animation and interaction into mobile application design can improve the usability of the app in emotional design perspective.

Animation and interaction design is closely related to the user experience of the mobile application and there are many ways to present them in a mobile application. A well-crafted mobile application with animations can contribute to creating more engaging and user-centred digital products in various ways, including guiding user flows, and promoting brand identity [65]. For instance, for applications that promote joy and surprises are suited to implement more playful animations within the UI such as adding bouncing elements. In fact, there are unlimited approaches to design animations and interactions within a mobile application, so it is hard to establish a solid guideline for how to implement animations and interactions correctly. If the animations are not overused such that the application becomes disorganized and confusing to the users, implementing animations and interactions have positive influences on emotional design within mobile apps [66].

Table 3 below shows a few types of beneficial animations that can be commonly found in different mobile applications nowadays, along with their corresponding purposes to enhance the user experiences.

Table 3. Types of essential mobile app animations [64], and [67].

<b>Animations</b>	<b>Purposes</b>
Loading and Progress	<ul style="list-style-type: none"> <li>• To inform the user that the contents are being loaded.</li> <li>• Showing that the app is not failed to respond.</li> <li>• Provide dynamic elements to reduce the negative experience of waiting.</li> </ul>
Transition	<ul style="list-style-type: none"> <li>• Help users to understand the app's navigation structure.</li> <li>• Enhance the classification between different flows within the same application.</li> </ul>
Scroll	<ul style="list-style-type: none"> <li>• Adding dynamic elements to make the app less boring.</li> </ul>
Visual Feedback	<ul style="list-style-type: none"> <li>• To inform users about whether certain actions were done or failed.</li> </ul>

	<ul style="list-style-type: none"> <li>• Assuring users that their actions are recognized.</li> </ul>
Notification	<ul style="list-style-type: none"> <li>• Make notification more noticeable and prevent users from missing important information.</li> </ul>
Logo	<ul style="list-style-type: none"> <li>• Integrate branding into UI design, further increasing brand awareness.</li> </ul>

Through the implementation of the above animations, emotional design can be achieved by making the user interface more intuitive and engaging. Although the mobile application would still function without these micro-interactions, incorporating them can be crucial in making the app more competitive through ensuring a better user journey while interacting with the application [65]. As indicated the second level of emotional design is behavioural design, and animations and interactions are particularly effective in this field. If properly designed, they can assure that users can easily understand how to interact with the app, it is significantly important in guiding users through the application [67].

#### 4.5 Layout and Gestalt principles

Emotional design on mobile application can also be achieved by applying the Gestalt principles [68]. According to the gestalt psychologists, humans tend to group things together for better understanding, and 7 principles were then defined and used while designing [69] based on this human behaviour. These principles include Proximity, Similarity, Common-Region, Focal Point, Continuity, Closure, and Figure-Ground, and they are useful in creating visually structured UI layouts. For example, the law of proximity can be used to arrange images that are more related together, while the law of common region can be used to divide the taskbar and the contents [70].

By applying gestalt principles to mobile interface components designs, the application's usability can be increased in the efficiency, memorability, and utility aspects [71]. This is beneficial to emotional design in all three levels, ensuring

the application is not only visually appealing, but also notable in its accessibility and user engagement encourages prolonged app usage.

## **5 Research Design**

The research questions that were introduced in Section 2 assist us to investigate the thesis topic, providing better understanding of the how applying emotional design impacts on user experience and user satisfaction in mobile applications. To answer the research questions presented in Section 2, this thesis has been divided into two complementary parts. The above sections have provided foundational knowledge that establishes a solid theoretical framework about emotional design in mobile application. The investigation continues by conducting survey research. This survey aims to gather deeper insights directly from general mobile application users, making the thesis not only support the theoretical points discussed but also the overall comprehension of emotional design's influences on user experience, resulting in an extensive exploration of the topic by connecting theoretical perspectives and the data collected.

### **5.1 Survey Implementation**

The questions of the survey are formulated by the four major design elements that were discussed in Section 4 and developed to gather user perceptions on such emotional design elements in mobile applications, primarily targeted to daily mobile application users. This survey will be deployed using the Google Forms platform, consisting of both Likert scale questions and open-ended questions. The Likert scale questions will be mandatory, ensuring the consistent set of quantitative data collected from all participants. In contrast, the open-ended questions will be optional, since not all the respondents are inclined to provide detailed feedback.

As mentioned in Section 2, the participants will be recruited on a voluntary basis by receiving the link to complete the survey, the participants will then be encouraged to share the survey within their networks. This approach leverages



personal and professional networks to reach a diverse participant base, ensure wide reach of respondents while maintaining a degree of control over the participant pool, avoiding data contamination from random respondents.

## 5.2 Data Handling and Analysis

After the end of the data collection period, all the data collected from the participants will be automatically organized by the available tools provided by the platform Google Forms, creating preliminary visualizations to assist the process of research analysis.

To analysis the responses gathered by the survey, a quantitative approach will be used since most of the questions are in Likert scale. The descriptive statistics obtained by this approach can be utilized to summarize the data. By calculating the mean, and median values, the general standpoints of the participants can be identified.

For the responses of open-ended questions, the data will be analysed to learn more about participants' perceptions towards different emotional design elements on mobile applications. The method of coding will be used to identify user satisfaction impacts influenced by emotional design, categorizing the collected data for summarizing.

## 5.3 Restrictions and Limitations

This survey approach poses certain limitations when interpreting the findings. Firstly, the optional open-ended questions may lead to a lower response rate for those items [72], potentially skewing the qualitative data towards respondents who feel more strongly about the subject [73]. Secondly, the recruitment strategy may not capture a fully representative sample of the general mobile user population, affecting the generalisability of the results. Lastly, there is also a concern about self-reported data, which relies on the accuracy and the honesty of the participants' responses, involving the risks that the participants may provide

socially desirable answers or may not be able to fully recall their experiences accurately.

## 6 Survey Results

This section presents the results from the survey conducted to explore the impact of emotional design elements on user experience in mobile applications, and the insights will be further discussed in the next section. This survey was conducted through the Google Forms platform and has received 86 responses by the end of the survey period. The survey questions are attached in the appendix (appendix 1). By combination of Likert scale and open-ended questions, this survey aimed to gather insights from daily mobile application users on how emotional design elements influence their perceptions and overall satisfaction with the apps.

### 6.1 Demographic Data

This subsection provides an overview of the demographic data of the survey participants. Figure 1 below shows the participants' age distribution and Figure 2 below shows the daily usage of mobile applications of the participants.

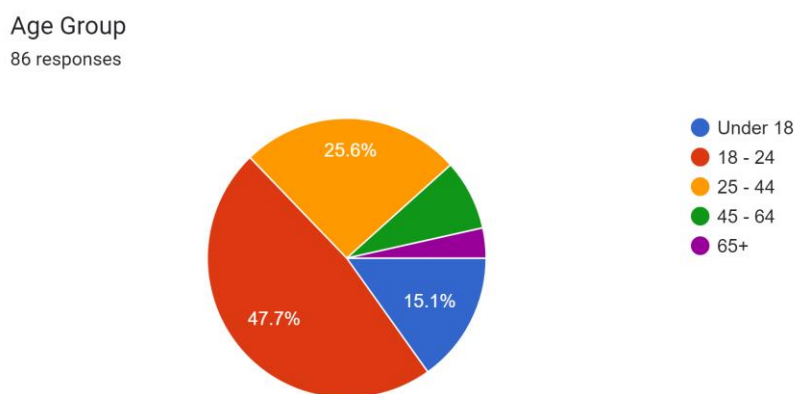


Figure 1. Distribution of participant's age group.

As shown in Figure 1, nearly half of the participants who completed the survey are from the age group of 18 - 24 years old. And the second largest come from the age group of 25 – 44 years old. This indicates that the insights and

perceptions that were collected through this survey mainly came from adults and young people, which is great because they are usually the largest group of users of modern mobile applications.

Daily Time Spent on Mobile Applications  
86 responses

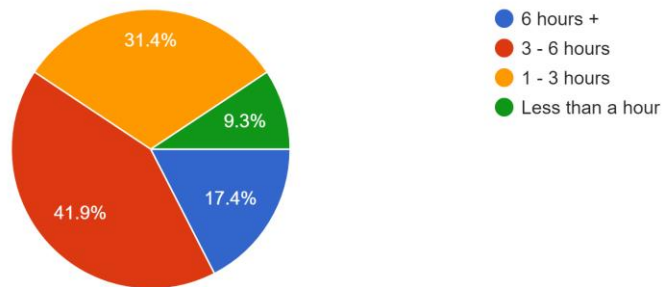


Figure 2. Daily usage of mobile applications of the participants.

Figure 2 shows the daily time spent on mobile applications of the survey participants. The popularity of mobile applications can be seen as a majority of people use mobile applications for more than an hour daily nowadays, this shows how impactful and beneficial it is to understand the impacts to the users of implementing emotional design on mobile application.

## 6.2 Results of Likert Scale Responses

This subsection presents the results from the Likert scale questions in the survey. Visualising these responses helps quantifying participants' preferences and perceptions, offering a statistical foundation for understanding the emotional design's influence on user experiences.

When using mobile application, how important is the color scheme to your overall experience?

86 responses

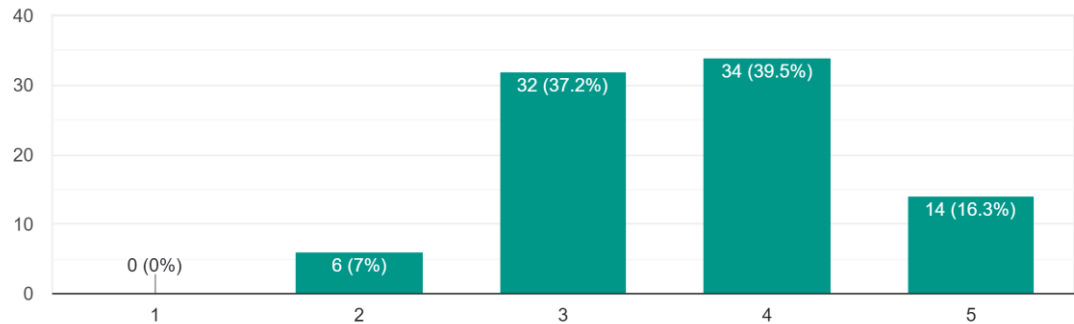


Figure 3. Responses of how important colour scheme to overall experience is.

According to the statistic shown on Figure 3, most of the participants have given the importance of colour scheme a 4 score. Meanwhile, the mean and median of this question are 3.65 and 4 respectively. This indicates that participants somewhat agree that the colour scheme of the app is impactful to the overall experience of using the app as the average score is above 3 and no one has chosen the lowest score.

Will different font styles of text appearing in mobile applications affect your perception to the app's reliability and professionalism?

86 responses

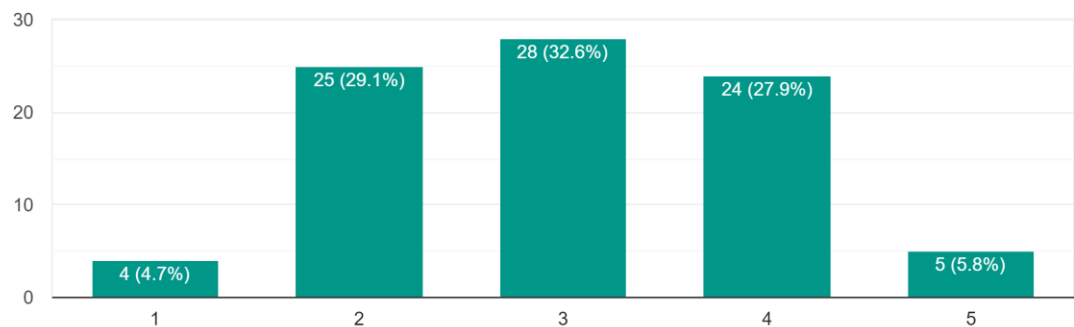


Figure 4. Responses of different font styles affect the app's reliability and professionalism.

As stated by the statistic shown on Figure 4, score 3 has the most responses in this question. Meanwhile, the mean and median of this question are 3.01 and 3 respectively. This indicates that when comparing typography to the colour scheme of the mobile app, the affection of typography is less impactful. Moreover, judging by the distribution of the responses, the participants have different standards towards the expectation of typography appearing in the apps. While typography might be less important, it is advisable that designers and developers should still spend effort into picking the best font that align with the product's message, ensuring the application delivers the desired impression to the app users.

How important do imagery and visual elements contribute to your emotional connection with a mobile application?

86 responses

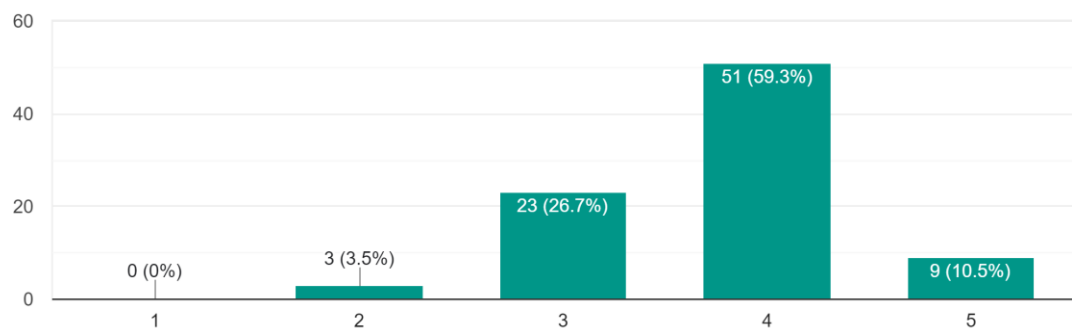


Figure 5. Responses of how important imagery and visual elements to emotional mobile application design are.

According to the statistic shown on Figure 5, almost 60% of the participants have picked score 4 for this question. Meanwhile the mean and median of this question are 3.77 and 4 respectively. This has indicated that imagery and visual elements are a major aspect in shaping emotional connection between the users and the mobile applications.

Do animations and interactive elements in mobile apps affect your level of engagement with the app?

86 responses

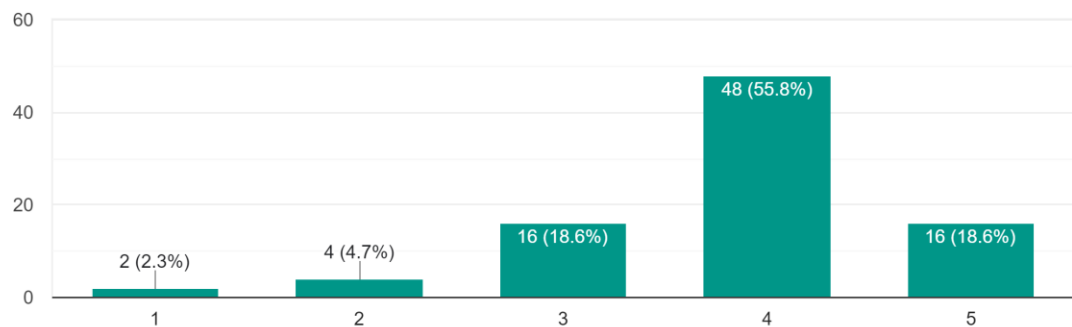


Figure 6. Responses of how interactive elements affect the level of users' engagement.

Based on the statistic shown on Figure 6, nearly 55% of the participants assigned a score of 4 to this question, which is slightly lower than the response distribution of the previous question. However, the mean and median scores of this question are 3.84 and 4 respectively. When comparing the result of this question to the previous one, it is notable that while animations and interactive elements have a higher mean score, indicating a favourable perception, this does not necessarily translate directly to being more important. This is because the distribution of the scores for this question is more spread out, as indicated by a higher number of responses in both scores of 1 and 5.

Overall, how important do you think the emotional design elements (Color, Typography, Imagery, Animations) in influencing your satisfaction with mobile apps?

86 responses

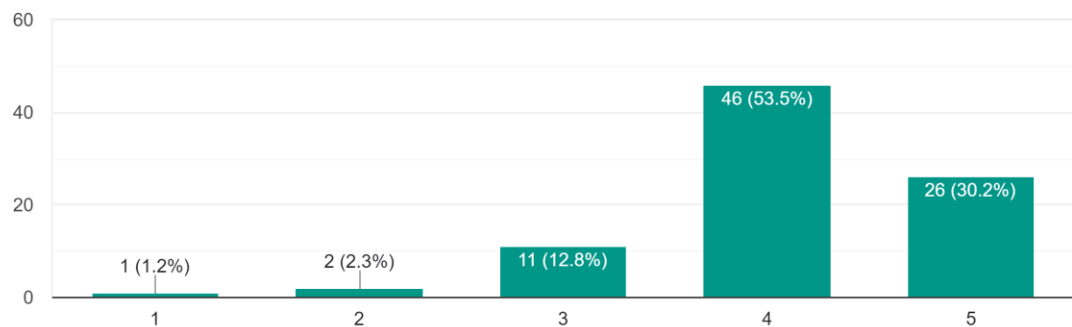


Figure 7. Responses of how important emotional design elements in influencing user satisfaction are.

According to the data shown on Figure 7, over 80% of the respondents have chosen scores 4 and 5, while the highest pick rate is score 4, having over 50%. The mean and median of this question is 4.09 and 4 respectively. This data shows that the majority of daily mobile application users believes that emotional elements are important in influencing users' satisfaction, reaffirming the needs of implementing emotional design into mobile applications by applying design elements according to the emotional design principles.

Which of the emotional design element has the most significant impact on user experiences in your opinion?

86 responses

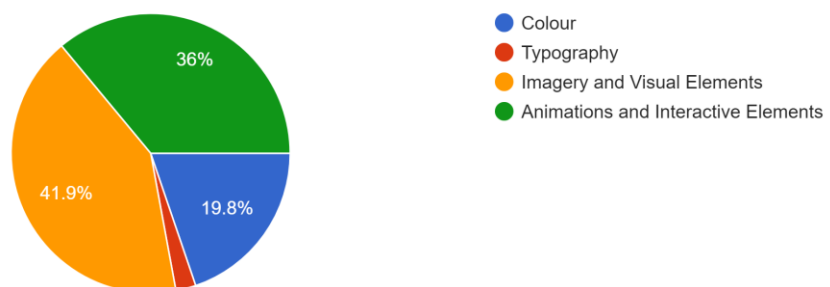


Figure 8. Responses of the most impactful emotional design element.

Figure 8 provides a visual representation of the respondents' opinions in which design element has the most significant impact on user experiences within mobile applications. And according to the data gathered, approximately 42% of the daily mobile application users think that imagery and visual elements is the most influential factor in shaping user experiences on mobile applications, showing that visual contents play a crucial role in capturing user attentions and engaging users within mobile applications. Following is the animation and interactive elements ranked in the second by 36%, highlighting the importance of creating dynamic and engaging user interfaces to enhance user interactions with the app. Colour scheme is the third most influential design element in emotional design according to the respondents' opinions while the typography has the least impact.

### 6.3 Results of Open-ended Responses

The following subsection presents the summary of the data gathered from the open-ended questions in the survey. The answers to these open-ended questions are not required in the survey, but the responses offer in-depth insights into participants' personal experiences, feelings, and their own opinions regarding the survey questions. Since the respondents are anonymous and no gender information was collected, the responses presented below will be presented with the demographic data that was obtained.

Question: "Do certain colour schemes in mobile applications evoke special emotions for you? If yes, please provide an example."

According to the gathered responses, while colour schemes can influence users' emotions and the ambiance of the app, users also focus on the overall readability and user experience rather than the emotional impacts brought by the colours. Several extra findings can be summarized as follows:

1. **Minimal Concern for Colour Schemes:** The result of the survey indicates that some users do not place a high priority on the colour schemes of the applications. Users may see colour choices as a background feature to support the brand's identity rather than a feature that significantly impacts



their user experience. The sample of the related comments that lead to this conclusion are as follows:

“not really, I guess it's related to its brand color anyways”

[Respondent 14, Aged 25 - 44, 3 – 6 hours daily mobile usage]

“Not a lot”

[Respondent 66, Aged 18 - 24, over 6 hours daily mobile usage]

“Colors indicate the theme of the mobile application”

[Respondent 86, Aged 18 - 24, 3 – 6 hours daily mobile usage]

2. Preference for Simplicity and Cleanliness: Some respondents expressed that they prefer applications to maintain a clean and uncluttered interface with limited colour variation. Showing that users also value designs that promote readability. The samples of the related comments that lead to this conclusion are as follows:

“I don't really mind the colors if it's clean and clear”

[Respondent 5, Aged 25 - 44, 1 - 3 hours daily mobile usage]

“I don't like apps that are are having too many colors in their color scheme”

[Respondent 71, Aged 18 - 24, 1 - 3 hours daily mobile usage]

3. Preference for Dark Mode: According to the responses, there are some preferences among mobile users for dark theme applications. Apart from the emotional preferences that a dark colour scheme might bring to users, some responses indicated that dark mode is preferable to reduce their eye strain at night. The samples of the related comments that lead to this conclusion are as follows:

“Apps with color black have a sense of formality in my pov”

[Respondent 70, Aged 18 - 24, 1 – 3 hours daily mobile usage]

“dark theme so i don't blind myself at night”

[Respondent 65, Aged 18 - 24, 3 – 6 hours daily mobile usage]

Question: “Can you recall an example of a mobile application, where the imagery or visual elements have made a strong positive or negative impact on your feelings toward the app? Please describe.”

Based on the gathered responses, imagery and visual elements can impact the users' feelings toward the app on multiple aspects. Some participants have indicated that they prefer a well-balanced integration between the texts and visuals on mobile applications. Some participants have also expressed concerns regarding icons and images within mobile apps, the two following are some extra findings from the responses:

1. **Icon Usability and Design:** Users think that app icons are particularly helpful in guiding navigation within the app, making it easier to access various features efficiently. Apps with unique icon designs can also leave a positive impression to the users. However, icons that are too stylized or abstract may confuse users, leading to frustration and dissatisfaction.

“Apple Health app. Intuitive icons, simplified graph illustrations provide clear data presentation, preventing users from being overwhelmed by massive text”

[Respondent 12, Aged 18 - 24, 3 – 6 hours daily mobile usage]

“Sometimes the apps having unusual icons make me very struggled in finding what I want”

[Respondent 20, Aged 18 - 24, 1 – 3 hours daily mobile usage]

2. **Quality of Images in Applications:** Users' responses suggested that images may be crucial in influencing their purchasing decisions within applications. Users often rely on images to gain a clear and better understanding of the products, making visual representation a critical element in digital shopping experience. Conversely, low-quality images

can pose a detrimental impact, potentially driving users away from the application product.

“The images online give me a better idea of what's the product looks like, enhancing my memory”

[Respondent 8, Aged 18 - 24, 3 – 6 hours daily mobile usage]

“The images that showcasing the products help me understand the details of the products”

[Respondent 64, Aged 18 - 24, over 6 hours daily mobile usage]

Question: “Can you recall an example of a mobile application, where the animations and interactive elements have improved or worsened your experience? Please describe.”

“I don't think interactions will affect the usability of the app”

[Respondent 5, Aged 25 - 44, 1 – 3 hours daily mobile usage]

“I have experienced using an app without loading animations, I always thought the app wasn't responding and that's dissatisfying”

[Respondent 13, Aged 25 - 44, 3 – 6 hours daily mobile usage]

According to the participants' responses, not having animations and interactive elements do not necessarily affect the usability of the mobile application, but badly implemented animations do. These features are often viewed as an ability to enhance the professionalism and engagement of an app. The key finding from the responses of this question is that designers and developers should find the right balance when implementing animations and interactive elements into their mobile applications.

Some respondents claimed that effective animations, such as smooth transitions between app screens and visible feedback following user actions, can significantly improve their user experience by making the app more professional. And there were a number of responses expressing their dissatisfaction with badly

implemented animations within a mobile application. An excessive number of animations can be distracting and cause a long loading time if they are not well-optimized [63], result in a slow or unresponsive interface. The user experience of the mobile application can be seriously degraded because of these performance setbacks.

## 7 Discussion

This study explores the impact of emotional design elements on user experience in mobile applications. The findings above provide insights into what users expect and how users are influenced by the major design elements, understanding these factors can be crucial in enhancing user experiences in mobile application by emotional design principles, affecting the overall engagement level and satisfaction of the mobile application. By summarizing the survey results from above, we can discuss the topic by the aspects of different design elements that were mentioned.

Beginning with the colour aspect, according to the result from the survey, a proportion of users find that colour schemes in mobile applications do not evoke strong emotional reactions to the users. Users have voted colour to be the second least impactful element in shaping their user experiences in the survey. It can be discovered from the open-ended responses that users value the overall readability more than the emotional reactions that colour schemes might bring. To effectively integrate emotional design in mobile applications through colour, it is best to utilize colour primarily to reinforce brand identity rather than evoke emotional responses directly from the users. Survey data indicates a trend towards minimalism in app aesthetics, which promotes simplicity and cleanliness design in mobile applications. Additionally, there is also a noticeable increase in the demand for dark mode features, which highlights users' desire for flexibility and personalization in app usage in the future.

Proceeding to the typography aspect, unlike previous studies which suggest typography as an important component of user trust and professionalism. The survey findings suggest that typography, while important, ranks the lowest in the overall impact on user experience while compared to other design elements. To utilize typography in emotional design of mobile applications, it is suggested that designers and developers should prioritize readability as primary concern, alongside the potential emotional impact of typography. As a major tool in delivering app contents, the clarity of the typefaces cannot be underestimated.

The guidelines regarding the emotional expressions of different fonts which are discussed in Section 4, can serve as a reference in enhancing the app's theme and align the typography with the brand's identity.

In the imagery and visual elements aspect, participants responded positively and ranked this the most impactful feature in shaping the user experience of a mobile app. From the responses gathered, it is noticeable that images serve as a second major tool for content delivery within apps besides of text. Users prefer to browse through images to understand the context more effectively than decoding extensive text, supporting the findings that visuals are more powerful in capturing user attention. The ability of imagery and visual elements to create long lasting impressions in users' memory and accelerate their understanding of the context highlight their significance in emotional design, especially in the behavioural and reflective design levels. Additionally, few survey responses claimed that unique icon designs can leave a favourable impression on users, considering that the icons are not too abstract which may result in confusing the users.

Lastly, animations and interactive elements are the second most impactful features in shaping the user experience according to the collected data. A major factor is that nearly all modern mobile applications are equipped with such features. These elements are particularly important in emotional design, especially at its behavioural level. Thoughtful interactions such as visual feedback can considerably differentiate an application from others, allowing it to stand out in the highly competitive mobile application market.

## 7.1 Creating Emotional Engagement in Mobile UI/UX

Creating emotional engagement in mobile UI/UX is more than just an implementation of an individual design element. In fact, it requires the integration of all the components that we mentioned in the previous sections, including but not limited to colour, typography, imagery, and animations [7]. This subsection summarizes the elements that we have discussed in section 3 & 4, then examines how to align these factors in mobile application development.

Beginning with the three levels of emotional design that were introduced by Norman [2]. These levels have built the foundation of emotional design, making emotional design something much more than just about evoking users' emotions.

- **Visceral Design:**  
The first level of emotional design that focuses on the initial impact of the design on users, usually caused by the app's interfaces and first impressions.
- **Behavioural Design:**  
The second level of emotional design, which focuses on the usability and functionality of the application. Closely related to the user journey which is influenced by user behaviour and satisfaction.
- **Reflective Design:**  
The top level of emotional design, it covers the overall meaning and value of the application, affecting the long-term attachment and loyalty of the users.

With the basic understanding of the three levels of emotional design. Investigation on how various mobile design elements influence the emotional design of mobile applications can be concluded. Table 4 below shows some examples of how various mobile design elements can influence the mobile application in different levels of emotional design aspects by summarizing the details discussed in Section 4.

Accordingly, achieving emotional engagement in mobile cannot be done by a single element. It is recommended that to create a truly emotionally engaging mobile user experience, designers and developers should integrate different factors that were discussed, including the Gestalt principle . Emotional design can influence several key aspects of user experiences directly. As discussed in section 3.5, these key aspects include user engagement, user satisfaction, user loyalty, user emotional connections and usability. These user experiences benefits are the potential outcomes brought by achieving all three levels of emotional design.

Table 4. Influences of mobile design elements in three emotional design levels.

<b>Emotional Design Level</b>	<b>Mobile Design Element</b>	<b>Example of influences</b>
Visceral Design	Colours	Combination of design elements that makes the application looks appealing. A favourable UI that attracts users.
	Typography	
	Visuals	
	Animations	
Behavioural Design	Colours	Colours that indicate the clickables can effectively guides users throughout the application.
	Typography	Sizes on different texts that can promote readability and hierarchy of the application, dividing different sections clearly.
	Animations	Different interactive elements that enhance the overall usability as discussed in 4.4, for example aiding in the navigation of the app.
Reflective Design	Colours	Colours that align with the brand to promote brand identity.
	Typography	Fonts that align with the app's theme can resonate with the emotions of the users, emotionally connecting the app with users and encourage the frequency of usage.
	Visuals	Graphical components' aesthetic appeal is effective in evoking emotional responses and making the application more memorable.



Incorporating the mobile design elements with emotional design will ensure the mobile application not only looks appealing but also intuitive and engaging to users. Through three levels of emotional design, designers and developers can elevate the user experiences to next the level, turning ordinary app interactions into memorable and emotionally engaging journeys for the users.

## 7.2 Validity and Reliability

The insights gathered in this thesis have certain validity issues, due to the anonymization of the data collected and no gender information was collected. This absence prevents direct linkage between the responses and respondents, and poses a potential reliability threat. Furthermore, given the fact that not all the respondents are guaranteed to understand the meaning of emotional design, the results collected might be inaccurate to provide deeper insights. In addition, besides the limitations that were discussed in Section 5, the sample size in this survey research is relatively small, which may not fully represent the global mobile user base.

## 7.3 Future Work

Future research can be continued with controlled experiments to measure user behaviour in response to specific design changes, providing more accurate and objective data to investigate the impact of emotional design. Overall, the survey results provided a level of insights from the daily mobile application users, more engaging and satisfying mobile applications can be developed by integrating user preferences with emotional principles into the design elements discussed above.

## 8 Conclusion

The main objective of this thesis is to investigate the importance of emotional design in mobile applications and its influence on user experience. Three research questions have been established in the beginning of the thesis to guide the investigative process. Through a combination of literature review and a survey, this study explored how various design elements may influence user engagement, and satisfaction across three levels of emotional design.

The theoretical part of the thesis has provided a foundational review and analysis on the existing knowledge of emotional design. By initially introducing the three levels of emotional design: visceral, behavioural, and reflective. And then examined four key design elements that can be implemented in mobile application design: colour, typography, imagery, and animations. These four elements not only formed the basis for the survey conducted later, but also facilitated the actionable guidelines for implementation by integrating insights from various studies and theories. These insights emphasize the importance of balancing creative user interfaces with functional usability to meet both the emotional and practical needs of users.

A research survey was then conducted to support the insights introduced in the theoretical section. The survey inquired about users' opinion on how important various mobile design elements are. By combining the responses from both Likert scale and open-ended questions, the result revealed user preferences and perceptions regarding the design elements that were discussed earlier, and highlighted that while users admire visually attractive UI designs, functionality and ease of use are also equally paramount.

In conclusion, this thesis explored the topic by investigating both theoretical emotional design principles and practical user feedback on design elements within mobile applications. The insights discussed validates that successful mobile application design must not only be visually attractive but also intuitively

usable, aligning with both the emotional and practical expectations of the users, while reinforcing the product's identity in users' perception.

Given that the theoretical guidelines are broad, and the survey participants do not represent the global mobile user base, it is recommended that designers and developers undertake extensive user research before developing a mobile app. The data and insights from this thesis should be used as references but not definitive solutions. This procedure can ensure the design choices are built upon the preferences of targeted users, enhancing the likelihood of the application's success in the competitive market.

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## Appendix 1: Survey questions of Emotional Design in Mobile Application.

Survey Link: <https://forms.gle/Dxjje1XVuSDNojLPA>

1. Age Group:  Under 18  18 - 24  25 - 44  45 - 64  65+

2. Daily Time Spend on Mobile Applications:

Less than an hour  1 – 3 hours  3 – 6 hours  6 hours +

Likert-Scale questions are selected between 1 (Not at all) – 5 (Significantly)

3. When using mobile application, how important is the colour scheme to your overall experience? [Likert Scale]
4. Do certain colour schemes in mobile applications evoke special emotions for you? If yes, please provide an example. [Open-ended]
5. Will different font styles of text appearing in mobile applications affect your perception to the app's reliability and professionalism? [Likert Scale]
6. How important do imagery and visual elements contribute to your emotional connection with a mobile application? [Likert Scale]
7. Can you recall an example of mobile application, where the imagery or visual elements have made a strong positive or negative impact on your feelings toward the app? Please describe. [Open-ended]
8. Do animations and interactive elements in mobile apps affect your level of engagement with the app? [Likert Scale]
9. Can you recall an example of a mobile application, where the animations and interactive elements have improved or worsened your experience? Please describe. [Open-ended]
10. Overall, how important do you think the emotional design elements (Colour, Typography, Imagery, Animations) in influencing your satisfaction with mobile apps? [Likert Scale]
11. Which of the emotional design element has the most significant impact on user experiences in your opinion?  
 Colour  Typography  Imagery and Visual Elements  
 Animations and Interactive Elements

