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INVESTIGATING USER PREFERENCES FOR SMARTPHONE ICON DESIGN: A KANO MODEL ANALYSIS

Xia Bingying[1], Mat Redhuan Samsudin[2*]

[1] Faculty of Art and Design,University of Technology MARA, Malaysia
Faculty of Desgin,Anhui University of Arts, China
Email: 2021247266@student.uitm.edu.my
[2] Faculty of Art and Design,University of Technology MARA, Malaysia
Email: redhuansamsudin@uitm.edu.my
[*] Corresponding Author

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Abstract:

In the ever-evolving realm of smartphone interface design, understanding user preferences is paramount. This study endeavors to comprehensively scrutinize such preferences utilizing the Kano model. Engaging 100 participants, the research assessed perceptions regarding 14 design attributes, employing a Likert scale for evaluations. Primary findings elucidated that attributes like recognizability, usability, personalization, and display effect hold paramount importance. However, an intriguing observation was a suggested potential variance across age demographics, which, upon further introspection, remained inconclusive in this research. This denotes an avenue necessitating future exploration. Designers, while conceptualizing smartphone interfaces, are advised to prioritize these identified attributes, possibly complementing age-specific needs, to ensure heightened user satisfaction. Ultimately, this research highlights the Kano model's robustness and its invaluable contribution to the domain of smartphone interface design research.

Keywords:

Smartphone, Interface Design, Kano Model, User Preferences

Introduction

Smartphones have evolved from basic communication tools to multifunctional smart devices that have become an integral part of people's daily lives. According to Irwanto, Saputro, Widiyanti, and Laksana (2023), the number of smartphone users worldwide increased from 4.5 billion subscriptions in 2017 to more than 6.5 billion users in 2022, and is projected to reach

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7.7 billion users in 2027. The significant market demand has led smartphone manufacturers to continuously innovate and launch new products with different features and designs to attract consumers.

Wang et al. (2018) suggest that interface design is an essential aspect of smartphone design, as it directly impacts the usability, functionality, and aesthetics of the smartphone system, and consequently influences user satisfaction and loyalty. Icons, as one of the most common and prominent elements of interface design, are graphical symbols that represent objects, actions, or concepts in a simplified and abstract way (Stotts, 1998). They help users quickly identify and access different functions or applications on the smartphone system.

The style of icons is closely related to the overall visual style of interface design. In recent years, flat design has become a popular trend in interface design, particularly in smartphone systems (Xi & Wu, 2018). Flat design is a minimalist design approach that eliminates realistic details, such as shadows, gradients, textures, and three-dimensional effects, and uses simple shapes, bright colors, and clear typography to create a clean and modern look. The goal of flat design is to reduce visual clutter and cognitive load for users while emphasizing clarity and efficiency in communication.

However, flat design is not without its drawbacks and challenges. Some critics argue that flat design sacrifices usability for aesthetics, as it may reduce the affordance and feedback of the interface elements, making them less intuitive and recognizable for users. For example, some flat icons may be too abstract or ambiguous to convey their meanings clearly(Burmistrov, Zlokazova, Izmalkova, & Leonova, 2015), or some flat buttons may not look clickable or interactive enough to indicate their states or actions. Moreover, flat design may also cause visual monotony and boredom, as it may lack the richness and diversity of realistic details and effects.

In addition to the usability concerns, another challenge of flat design in smartphone icons is the potential lack of visual appeal and diversity. Since flat design relies heavily on simplicity and minimalism, the icons may look too similar and generic, without enough personality or differentiation (Legleiter & Caporusso, 2020). This may lead to visual boredom and user disengagement, especially for users who have high expectations for visual aesthetics and creativity.

To address these challenges, some designers have developed alternative approaches to flat design, such as semi-flat design, which adds subtle shadows or gradients to the flat shapes to enhance the visual hierarchy and depth perception, while still maintaining the simplicity and clarity of the design. Another approach is to use skeuomorphic design, which mimics the realistic textures, materials (Bollini, 2016), and interactions of physical objects, to provide a more immersive and intuitive experience for users. However, these approaches also have their own limitations and trade-offs, such as increased complexity, higher cognitive load, and potential conflicts with the overall visual style of the interface.It is important for designers to strike a balance between the aesthetic and functional aspects of icon design, and to consider the user's needs, preferences, and expectations. User-centered design methods, such as user research, usability testing, and iterative design, can help designers understand the users' mental models, goals, and behaviors, and optimize the design accordingly. Moreover, designers can

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also leverage the power of visual metaphors, symbols, and cultural references, to create meaningful and memorable icons that resonate with the users' emotions and values.

Therefore, it is necessary to conduct a systematic and empirical study on the application of flat design in smartphone icons, to explore its advantages and disadvantages, problems and solutions, as well as its impact on user satisfaction and preference.

Literature Review

The evolution and development of design techniques have remained a consistent focus in the realm of user interface (UI) design and product development. As technologies have progressed, design methodologies have paralleled this advancement, leading to various approaches that serve unique objectives. This review aims to explore three pivotal concepts in the design world: Skeuomorphism, Flat Design, and the Kano Model. By delving into the intricacies, advantages, and potential drawbacks of each concept, a comprehensive understanding will be attained. This understanding will further enable the readers and practitioners to make informed decisions and incorporate appropriate design strategies in their projects.

Skeuomorphism

Skeuomorphism is a design approach that imitates the appearance of physical objects, such as a button that appears raised until pressed or a camera shutter sound when taking a photo (Rogers, Sharp, & Preece, 2012). This technique is used in UI design to create a three-dimensional effect on a flat surface, using metaphors and affordances to help users understand how to interact with applications and UI elements.

Skeuomorphism has a long history in various design fields, including architecture, ceramics, and interior design, and was also used in UI design before the popularity of flat design(Page, 2014). The concept of affordances, which refer to an object's sensory characteristics that imply its functionality and use, has been debated in related literature. While Gibson's ecological approach suggests that an object comes with specific affordances, regardless of prior knowledge or cognitive ability (Gibson, 2014), Norman's perceived affordance theory suggests that affordances can be based on prior knowledge and cognitive ability (Norman, 1999). Zhang, Wang, and Shi (2016) argues that skeuomorphism is not only a visual imitation of an object, but also its functionality.

The introduction of the Macintosh in 1984 and the desktop metaphor introduced by Alan Kay in 1970 marked the beginning of skeuomorphism in UI design (Spiliotopoulos, Rigou, & Sirmakessis, 2018). However, it was the original iPhone launched by Apple in 2007 that revived skeuomorphism in interaction design, particularly to assist users who were unfamiliar with touchscreens (Jun, 2011).

In summary, skeuomorphism is a design technique that mimics physical objects and has a long history in various design fields, including UI design. It employs metaphors and affordances to facilitate users' interaction with applications and UI elements. While the notion of affordances has been defined and approached in various ways in the literature, Gibson's and Norman's theories are the most well-known. The original iPhone's launch in 2007 revived skeuomorphism in interaction design, but the technique was used in UI design even before the popularity of flat design.

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Flat Design

Flat design is a design approach that emphasizes simplicity and minimalism, focusing on the use of two-dimensional elements, such as flat shapes and typography, as opposed to three-dimensional elements, such as gradients and drop shadows. This design style also often uses bright colors, bold typography, and simple iconography.

Proponents of flat design argue that it has several advantages over skeuomorphism. One major advantage is that it can increase the speed and efficiency of a website or application, as flat designs require fewer graphics and therefore load more quickly (Oswald, 2018). Another advantage is that flat designs can be more responsive, as they can scale more easily across different devices and screen sizes (Luo & Zhou, 2015).

However, flat design also has its drawbacks and challenges. Critics argue that flat design may sacrifice usability for aesthetics, as it may reduce the affordance and feedback of interface elements, making them less intuitive and recognizable (Page, 2014). In addition, the simplicity of flat design can sometimes lead to a lack of visual interest or differentiation, making it harder for users to distinguish between different elements on a page (Stickel, Pohl, & Milde, 2014).

One notable example of the use of flat design in user interfaces is Microsoft's Windows 8 operating system, which introduced a flat, tile-based design language known as "Metro" or "Modern". Another popular example is Google's Material Design, which combines flat design principles with a focus on tactile and responsive interactions (Spiliotopoulos et al., 2018).

Research has explored the impact of flat design versus skeuomorphism on various aspects of user experience, such as learnability, image attribution, usability, and intuitiveness. Backhaus, Trapp, and Thüring (2018) found that flat design interfaces were perceived as more modern and aesthetically pleasing, but skeuomorphic interfaces were more recognizable and easier to learn. Burmistrov et al. (2015) found that flat icons scored higher on semantic scales such as "timeliness" and "simplicity," but they fared worse than realistic icons in "identity," "interest," and "familiarity" aspects. Spiliotopoulos et al. (2018) suggested that flat design must address the problem of missing information due to simplification and should put careful focus on the semantics of the used elements.

In conclusion, flat design is a popular design approach that emphasizes simplicity and minimalism, but it also has its drawbacks and challenges, such as potential usability issues. The choice between flat design and skeuomorphism has generated conflicting opinions in the web design and usability field, and both approaches have their respective advantages and disadvantages. Further research is needed to explore the impact of different design styles on various aspects of user experience.

Kano Model

The Kano model is a valuable framework for understanding customer satisfaction and loyalty in terms of the quality attributes of a product or service (see Figure 1). Developed by Professor Noriaki Kano in the 1980s, the model has been widely applied in diverse fields such as marketing, engineering, design, and education. The model categorizes quality attributes into three distinct groups: basic (or must-be), performance (or one-dimensional), and excitement (or attractive)(Kano, Seraku, Takahashi, & Tsuji, 1984). Basic attributes are essential requirements that customers expect to be fulfilled by a product or service, and their absence

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results in dissatisfaction. Performance attributes are the features that customers use to compare different products or services, and their level of fulfillment directly affects customer satisfaction. Excitement attributes are unexpected or innovative features that delight customers and increase their loyalty, and their presence can provide a competitive advantage for a product or service.

By using the Kano model, managers can identify the quality attributes that are most important to customers and allocate resources accordingly (Jeyaraj, Muralidharan, Senthilvelan, & Deshmukh, 2014). The model can also help managers anticipate the changing needs and preferences of customers over time since some excitement attributes may become basic or performance attributes in the future. Moreover, the model can aid managers in creating new value propositions by combining different types of quality attributes in novel ways.

To apply the Kano model, managers must conduct surveys or interviews with customers to elicit their opinions on various quality attributes. One commonly used method is the Kano questionnaire, which asks customers to rate each attribute on two scales: functional (how they feel if the attribute is present) and dysfunctional (how they feel if the attribute is absent). Based on customer responses, each attribute can be classified into one of the three categories or into indifferent (customers do not care about the attribute), reverse (customers prefer the absence of the attribute), or questionable (customers give inconsistent or illogical responses). The results can be plotted on a Kano diagram, which shows the relationship between customer satisfaction and quality fulfillment for each attribute.

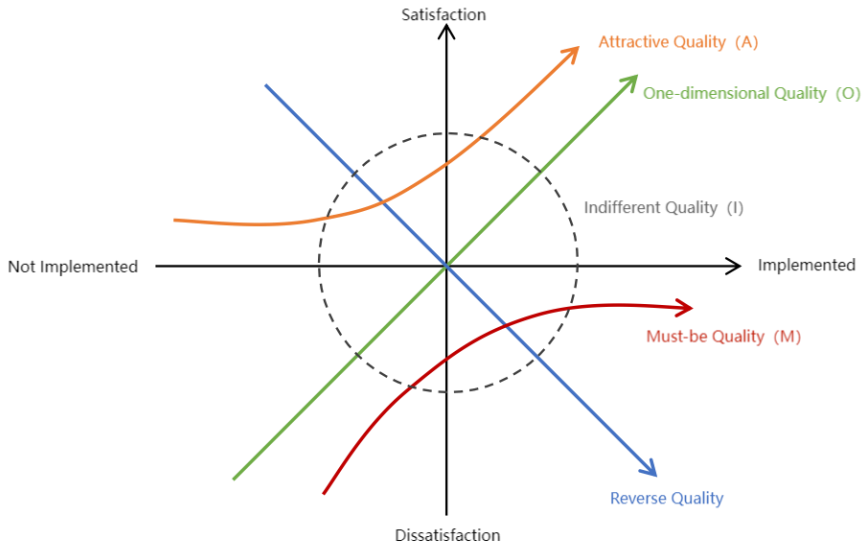

Figure 1: Kano Model

A popular example of the Kano model in practice is the analysis of customer needs for a hotel room, where basic attributes may include cleanliness and safety, performance attributes may include room size and amenities, and excitement attributes may include a beautiful view or unique decor (Park, Lee, & Back, 2020).By understanding which attributes fall into each category, hotel managers can prioritize their investments and marketing efforts to achieve the highest level of customer satisfaction and loyalty.

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According to Lin et al. (2017), the model can help managers to identify the quality attributes that matter most to customers and allocate resources accordingly. The model can also help managers to anticipate the changing needs and preferences of customers over time, as some excitement attributes may become basic or performance attributes in the future. The model can also help managers to create new value propositions by combining different types of quality attributes in novel ways.

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Methodology And Finding

In recent years, the debate on the advantages of flat design versus skeuomorphic design in the context of smartphone icon design has garnered significant attention. To address this issue, this study conducted a qualitative analysis of user preferences for these two design styles using the Kano model, a widely used method for analyzing user needs and satisfaction.

Design Requirements Acquisition

User-centered concept development can be described as an early phase exploratory process in product development that aims to create new product innovations. It involves sampling user research to gain insights into user needs and preferences, which can then inform the design of new products (Mannonen & Nieminen, 2007).Therefore, user needs are important indicators of the target app users' needs and serve as a reference for designing the Kano questionnaire.To ensure a comprehensive understanding of smartphone icon design preferences and to set the groundwork for the Kano model analysis, it was vital to conduct preliminary interviews. These interviews aimed to extract in-depth insights into the nuances of design preferences and to determine the most relevant attributes for subsequent study.

Selection of Key Informants

To identify the key elements for the Kano model analysis, six participants (four males and two females) were recruited from different regions of China. These participants were selected based on their expertise in smartphone icon design and their familiarity with the two design styles of interest (flat and skeuomorphic). Six participants were carefully chosen for these preliminary interviews based on specific criteria:

- Expertise in Smartphone Icon Design: Given the technical nature of the study, it was paramount that participants had a profound knowledge of and experience in smartphone icon design. This ensured that the feedback and insights derived were grounded in practical understanding and expertise.
- Diverse Geographic Representation: Participants were chosen from different regions of China to capture a broad spectrum of cultural and regional design preferences and influences.

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- Gender Balance: To ensure a balanced perspective, both male and female participants were included.
- Familiarity with Design Styles: As the study focused on two primary design styles, flat and skeuomorphic, participants were selected based on their familiarity and experience with both styles. This was vital to ensure well-rounded feedback.

Characteristics of the Key Informants

The six participants consisted of four males and two females. Their ages ranged from 25 to 40, representing mid-career professionals with substantial experience in the field of design,Table 1 below showcases the profiles of these key informants.On average, they had been involved in the design industry for over a decade, holding positions such as Senior UI/UX Designers, Graphic Designers, and Art Directors in prominent tech and design firms. All of them had at least one design attributed to either of the two styles of interest, with most having portfolios covering both flat and skeuomorphic designs.

Table 1: Interviewee Information

Interviewee	Design Background	Area of Expertise
Participant 1	Senior UI/UX Designer with 12 years of experience	Flat & Skeuomorphic icon design
Participant 2	Graphic Designer with 10 years in tech companies	Flat design, App interface
Participant 3	Art Director at a renowned design firm for 14 yrs	Skeuomorphic design, Branding
Participant 4	Mobile UI Specialist, 11 years of experience	App interfaces, Flat iconography
Participant 5	Graphic Designer with 9 years at tech startups	Skeuomorphic design, User experience
Participant 6	UI/UX Consultant with 13 years freelance work	Both Flat & Skeuomorphic design

Interview Process

Key informant interviews were conducted using a semi-structured format, with open-ended questions focusing on users' perceptions of the different design styles and their preferences for specific design attributes. The interviews, lasting between 45 minutes to an hour, were conducted either in person or via video calls, based on the convenience of the participants.The questions were designed to elicit information on the following Kano model elements:

1.Must-have: These are design attributes that users consider essential and would not accept the product without them. Examples of must-have attributes in smartphone icon design include clarity, functionality, and ease of use.

2.Expected: These are attributes that users expect to be present in the product and take for granted. Examples of expected attributes in smartphone icon design include appropriate color schemes, familiar shapes, and standard sizes.

3.Delightful: These are attributes that users may not expect, but when present, can greatly enhance their satisfaction with the product. Examples of delightful attributes in smartphone icon design include animations, personalized settings, and unique designs.

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Identification and Selection of Elements

The interviews were transcribed, and the identified elements were coded and classified into different categories based on their relevance to the research question. After careful analysis and discussion, 14 elements were selected for inclusion in the Kano model analysis (see Table 2): recognizability, usability, display effect, personalization, graphical features, color scheme, icon size, edge shape, icon style, icon color, icon arrangement, icon shape, icon type, and symbolic meaning.

Table 2: Design Requirements of Smartphone Icons

S/N	design requirements	S/N	design requirements	S/N	design requirements
D1	recognizability	D6	Icon arrangement	D11	edge shape
D2	usability	D7	icon size	D12	graphical features
D3	symbolic meaning	D8	icon style	D13	icon shape
D4	display effect	D9	icon type	D14	color scheme
D5	personalization	D10	icon color		

Participant Sampling and Demographics

To ensure that our findings were representative and robust, we adopted a strategic approach to sample our population. Participants were recruited using a purposive sampling method, which is a non-random technique where researchers rely on their own judgment to select participants. Given the nature of our study, our main criteria for selection was based on frequency of smartphone usage, aiming to capture insights from those who regularly interact with smartphone interfaces.

We started our recruitment process by distributing online questionnaires across various social media platforms and university email lists. In the questionnaire, respondents were first asked about their daily smartphone usage. Those who used their smartphones for more than three hours a day were deemed as "frequent users" and were subsequently shortlisted for the study.

Our final sample comprised of 100 participants. The age range of the respondents varied from 18 to 55 years, ensuring a wide demographic representation. This range was intentional to capture generational differences in smartphone use and design preferences. The gender distribution was balanced with 52% females and 48% males. To ensure diverse socio-economic and cultural perspectives, we had participants from urban (65%), suburban (25%), and rural (10%) settings.

The purposive nature of our sampling ensured that our respondents were well-acquainted with smartphone interfaces, thereby providing informed and relevant feedback for our study.

Kano Questionnaire and Demand Classification

To delve deeper into user preferences concerning the 14 design attributes of smartphone interfaces, we employed the Kano questionnaire, an established tool to categorize product or service attributes based on how they are perceived by customers.

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Each design attribute was represented by a pair of questions: one functional (positive scenario) and one dysfunctional (negative scenario). For example, for the design attribute 'icon clarity', a functional question might be "How would you feel if the icons on your smartphone were very clear?" and a dysfunctional one might be "How would you feel if the icons on your smartphone were not clear at all?". Participants used Likert scale to answer questions, which consisted of "satisfied", "should be so", "indifferent", "acceptable" and "dislike".

The questionnaire was digitized and spread online via Wenjuanxing, the largest online questionnaire platform in China, which reflected the participant sampling method we adopted. This ensures that our target is those users who are already familiar with digital tools, mainly those who often use smart phones. Online distribution allows real-time data collection, which simplifies subsequent analysis.

Responses were classified into the six Kano categories:
A (Attractive): These are attributes that, when fulfilled, increase satisfaction but when unfulfilled, don't cause dissatisfaction.
O (One-dimensional): These attributes lead to satisfaction when fulfilled and dissatisfaction when not.
M (Must-be): These are basic attributes. Their absence causes dissatisfaction, but their presence doesn’t particularly increase satisfaction.
I (Indifferent): Customers are indifferent to the presence or absence of these attributes.
R (Reverse): The interpretation of these attributes is opposite for different customer segments.
Q (Questionable): The response patterns for these attributes are peculiar or unexpected and might need reevaluation.

To ascertain the category for each design attribute, we tallied the frequency of responses falling into each category. In cases where a design attribute resonated with multiple Kano categories equally, we referred to the hierarchy (M>O>A>I) to determine its dominant category.The results of the test were then compared to Table 3 matrix to determine the Kano model category for each design attribute.If the same design attribute appeared multiple times, the Kano model category was determined by the highest percentage of responses in categories A, O, M, I, or R (Kuo, 2004). The classification of Kano models for D1~D14 of smartphone icons is shown in Table 4, where M>O>A>I, indicating that attributes classified as must-have are most critical for user satisfaction, followed by expected and delightful attributes.

Table 3: Classification Evaluation Form of Kano Model

		Not implemented				
		Satisfed	Should be so	Does not matter	Acceptable	Dislike
User require ments	Satisfed	Q	A	A	A	O
	Should be so	R	I	I	I	M
	Does not matter	R	I	I	I	M
	Acceptable	R	I	I	I	M

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Dislike	R	R	R	R	Q

Table 4: Kano Demand Classification

design requirements	Kano attribute category					Final category
	A%	O%	M%	I%	R%	
D1	25.68	41.89	12.16	19.27	1.00	O
D2	8.57	22.86	50.00	18.57	0.00	M
D3	10.00	21.43	40.00	28.57	0.00	M
D4	45.71	28.57	21.43	3.29	1.00	A
D5	47.30	17.57	8.11	27.02	0.00	A
D6	5.71	21.43	58.57	14.29	0.00	M
D7	4.29	15.71	67.14	12.86	0.00	M
D8	4.29	14.29	40.00	41.42	0.00	I
D9	21.43	42.86	27.14	8.57	0.00	O
D10	5.71	10.00	30.00	52.29	2.00	I
D11	22.86	35.71	30.00	11.43	0.00	O
D12	45.71	34.29	18.57	1.43	0.00	A
D13	7.14	10.00	65.71	15.71	1.44	M
D14	3.1	1.42	32.61	62.87	0	I

Attractive quality (A), One-dimensional quality (O), Must-be quality (M), Indiferent quality (I), Reverse quality (R)

Kano Questionnaire and Demand Classification

In determining the satisfaction level of users based on design attributes, two indices were calculated: the Satisfaction Importance Index (SII) and the Dissatisfaction Detrimental Index (DDI). The SII gauges the significance of user satisfaction in relation to the presence of design attributes. In contrast, the DDI measures the potential impact on user dissatisfaction when those attributes are absent.To calculate user satisfaction, we employed the following formulas:

$$SII = (A + O) / (A + O + M + I) \quad (1)$$

$$DDI = - (O + M) / (A + O + M + I) \quad (2)$$

In equation (2), the DDI value has a negative sign, indicating that the influence is useful and household dissatisfaction. If the SII value and DDI value are closer to 0, the design attribute has less influence on user satisfaction or dissatisfaction. On the other hand, if the SII value and the absolute value of DDI are closer to 1, the design attribute has a greater influence on user satisfaction or dissatisfaction. Based on the Kano model classification of design attributes and the SII value and DDI value of design attributes, designers can judge the degree of influence of each design attribute on user satisfaction.

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The user satisfaction index includes SII and DDI, which help designers more accurately control the difference between the impact of each design attribute on user satisfaction. By calculating the SII value and DDI value of each design attribute using formula (1) and formula (2), designers can prioritize different design attributes, especially when different design attributes belong to the same Kano model classification. By analyzing the SII and DDI values, designers can prioritize design attributes, especially when attributes belong to the same Kano model classification. For instance, D8, D10, and D14 are unrelated attributes, and their SII values and DDI values do not need to be calculated. The SII values and DDI values of the remaining design attributes are shown in Table 5.

Table 5: Design Attribute User Satisfaction Index

design requirements	Final category	SII	DDI		design requirements	Final category	SII	DDI
D1	O	0.62	-0.54		D7	M	0.25	-0.51
D2	M	0.56	-0.76		D9	O	0.68	-0.54
D3	M	0.31	-0.61		D11	O	0.61	-0.52
D4	A	0.75	-0.51		D12	A	0.80	-0.53
D5	A	0.65	-0.26		D13	M	0.18	-0.79
D6	M	0.10	-0.52					

Findings

From the Kano model analysis, it is found that three main categories of user preferences about the design attributes of smart phones are determined: "Must-have", "Expected", and "Delightful". This section discusses and interprets these categories.

Of the 14 design attributes analyzed, three were identified as must-haves, two as expected, and six as delightful.Key findings include:
Must-haves: Recognizability (D1), Usability (D2), and Display effect (D4).
Expected: Personalization (D5) and Icon size (D7).
Delightful: Icon type (D9), Edge shape (D11), Graphical features (D12), Icon arrangement (D6), Symbolic meaning (D3), and Icon shape (D13).

The Kano model provided a means to categorize the attributes based on design requirements, and the SII and DDI coefficients were used to assess user satisfaction and dissatisfaction with each attribute. For the must-have attributes, recognizability had the highest satisfaction coefficient (0.62), while display effect had the lowest dissatisfaction coefficient (-0.51). Among the expected attributes, personalization had the highest satisfaction coefficient (0.65), while icon size had the lowest dissatisfaction coefficient (-0.51). For the delightful attributes, graphical features had the highest satisfaction coefficient (0.8), while icon shape had the lowest dissatisfaction coefficient (-0.79).

Discussion

In this study, we explored the importance and influencing factors of smartphone interface design. We used the Kano model and multiple regression analysis to evaluate user satisfaction and loyalty towards different design attributes. We identified some must-have attributes and some delightful attributes, as well as their impact on user experience.

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Must-have Attributes

The must-have attributes identified in this study (D4, D5, and D12) can increase user satisfaction and loyalty. These attributes are typically related to the design's aesthetics and visual appeal. These essential elements form the foundation of user expectations. Recognizability, a must-have, had the highest satisfaction coefficient (0.62) as per Table 4. It emphasizes the need for designers to ensure these basic attributes are consistently met. Similarly, Punchoojit and Hongwarittorrn (2017) highlighted the importance of foundational features in smartphone interfaces, arguing that their absence can result in significant user dissatisfaction. Designers can use various graphic features, colors, and personalized options to enhance these attributes and make them more appealing to users.

Must-have Attributes

The expected attributes identified in this study (D1, D2, D3, D6, D7, D9, D11, and D13) are essential for meeting user expectations and can significantly impact user choice and evaluation of the product. Our study indicates that personalization, an expected attribute, had a satisfaction coefficient of 0.65 (Table 4), highlighting its role in user satisfaction. These attributes typically include usability, recognizability, and personalization. This aligns with the research conducted by AlSuwaidan and Mirza (2014), where they found that users increasingly value personalization in technology products, leading to higher overall satisfaction. Such attributes play a crucial role in shaping user preferences and expectations. Designers must consider these attributes when designing a smartphone interface to meet user needs and preferences. However, it can be challenging to balance these attributes with other design considerations, such as cost, technology, and usability.

Must-have Attributes

Beyond foundational and expected attributes lie delightful attributes, which, while not directly influencing user satisfaction, possess the ability to amplify it. Our study flagged D8, D10, and D14 in this category, emphasizing elements like icon style, type, and color scheme. A testament to their potential is the high satisfaction coefficient of 0.8 for graphical features, as per Table 4. Echoing this, Luo and Zhou (2015) identified that while these attributes aren't primary, they can set a product apart in a cluttered market.

Must-have Attributes

No study is without its limitations, and recognizing them is essential for context and future exploration. One limitation we acknowledge is inherent to the Kano model itself. While it provides invaluable insights into user preferences for distinct product features, it might overlook the broader spectrum of user behavior or context. This sentiment is shared by (Oviedo-Trespalacios, Williamson, & King, 2019) who advocates for a combined approach with other research methodologies for a well-rounded understanding. Another aspect that arose, albeit indirectly, is the influence of age on design preferences. Preliminary feedback hinted at younger participants' inclination towards graphic styles and older participants towards skeuomorphic designs. Yet, the absence of explicit age-specific data in our research makes this observation speculative, pointing to an avenue for more targeted future research.

Conclusion

Overall, this study highlighted that users prioritize the must-have attributes when evaluating smartphone design. While expected attributes hold significance, their influence on user satisfaction is somewhat lower compared to the must-have attributes. Delightful attributes,

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however, carry the potential to exceed user expectations, suggesting their valuable role in enhancing overall satisfaction with smartphone design.

Diving deeper into the study's specific journey, it aimed to discern user preferences between flat and skeuomorphic design styles in smartphone icons. By employing the Kano model, we unveiled design attributes deemed essential by users, particularly emphasizing recognizability, usability, personalization, and display effect. An intriguing avenue that our study did not extensively explore is the potential variation in design preferences across age groups. Preliminary observations hint that younger users might have an affinity for graphic designs, whereas older individuals might lean towards skeuomorphic designs. Such potential divergences warrant deeper investigation in subsequent research.

As the landscape of smartphone interface design continually evolves, understanding these pivotal attributes becomes ever more crucial. Designers, equipped with this knowledge, can craft interfaces that not only meet user needs but also align with their intrinsic preferences. In its entirety, this research serves as a guiding light for future smartphone interface designs, underscoring the indispensable role of the Kano model in gauging user necessities and predilections.

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