A Case Study Exploring Users' Perceptions and Expectations of Shapes for Dialog Designs

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ABSTRACT

Shape is a fundamental visual characteristic in the design of common UI components like buttons, switches, and dialogs. It has commonly been used to enhance the visual aesthetic of a UI, or to express a distinct perspective in style or brand. However, it remains understudied how the shape of UI components convey semantic meaning and impact user perception of the information displayed in those UI components. As a first step to address this gap, we chose to study the dialog UI component. We first explored the shape of a dialog and created 6 different designs (e.g., dialogs with rounded corners, circle, and wiggly-circle) for an online survey study with 200 participants. We examined whether different dialog designs alter user perceptions and expectations of different messages displayed within them. This work serves as a practical study to explore the opportunity for shapes to be used intentionally in UI design.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in interaction design**; **Empirical studies in HCI**.

KEYWORDS

shape, UI design, dialog UI, user perceptions

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1 INTRODUCTION

With the proliferation of mobile applications, it is critical to design to offer easy-to-use and visually pleasant interfaces to enhance user experience [1, 19, 21, 23, 26, 27]. Visual characteristics such as shapes and colors are basic and necessary to constitute different objects and containers of a user interface. As mobile UI gradually evolves to a more flat design [3, 5, 28], shapes serve as clues for users to distinguish UI components (i.e., interactive building blocks and layouts in an interface) [5, 25].

One noteworthy change in current mobile UI is the use of more diverse shapes for UI component containers [5, 8]. These diverse shapes are used to suggest functions, match with branding, and increase aesthetics of a product [14, 27, 33, 37]. For example, shapes of buttons can be used to distinguish different functions or group similar features. A Floating Action Button (FAB) is a completely circular button that performs the most primary action on a screen [9], whereas buttons with slightly-rounded corners can be placed in alignment to display multiple options, such as accept or decline an in-app promotion. Building on basic functions, to represent and augment the personality of a product, designers sometimes intentionally tailor shapes of UI components to express branding to the audience [29, 39].

While being understood to be aesthetically pleasing and valuable in expressing branding, it remains underexplored how the shapes of UI components influence user perceptions and expectations of the displayed information as users interact with them. In this paper, the term *shape* is referred to as both the basic contour of a graphical object (e.g., rectangular, circle) and the rounded corners of that contour (border-radius). Important dimensions of user perceptions include perceived trustworthiness [30], security, and playfulness [44], which all affect the adoption of and experience with mobile apps and should be well-considered in design [15, 35]. Prior literature has shown 3D shapes of a haptic user interface or robots can indicate different meanings or personalities of the robots [4, 17]. While moving to a flat interface design , we lack the knowledge whether different shapes still alter user perceptions (e.g., trust). Additionally, existing guidelines of shape design for mobile UI vary with design systems (e.g., Human Interface Guidelines offered by Apple and Google Material design), for instance, these systems suggest different corner radius parameters for UI containers [2, 5]. The long-term use of a certain mobile operating system (e.g., iOS) would increase user familiarity with the offered design and thus potentially influence user preferences for shape designs. In light of this, we are interested to learn whether iOS users and Android users perceive shape designs differently. Insights in this regard will enhance our knowledge about user mental models shaped by different design systems [38].

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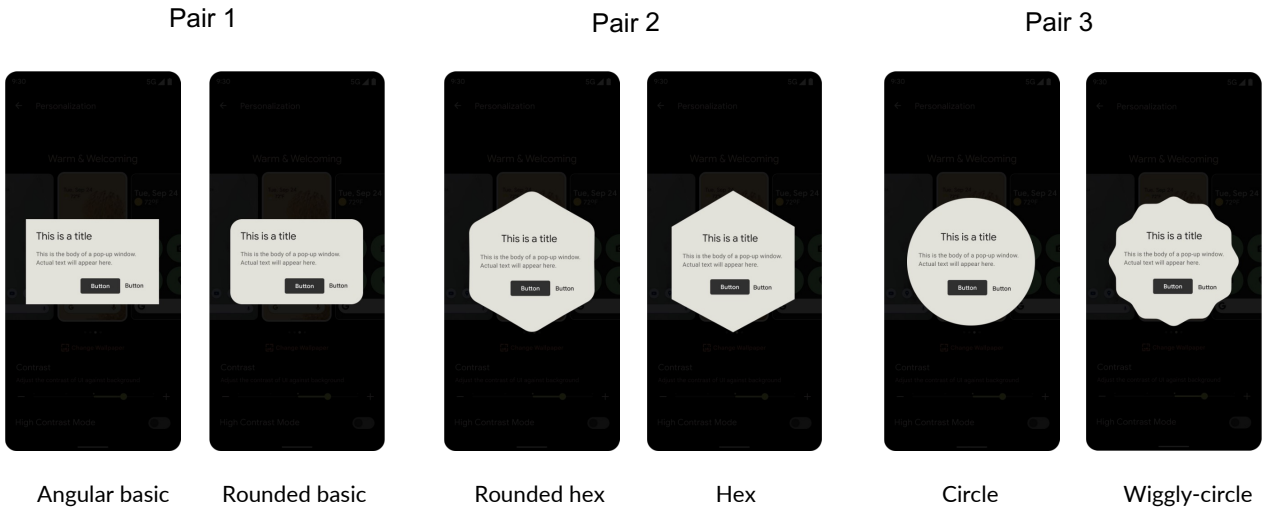

Figure 1: We created six dialog designs that vary in the shapes and grouped them into three meaningful pairs (Hex is short for Hexagon).

Thereby, the goal of our research was to investigate how shape impacts user perceptions of UI components and the information displayed within them. To begin our investigation of the impact of shapes, we chose to focus on the dialog UI component and explored different dialog shapes. A dialog window is a type of modal window that appears in front of app content to sometimes provide critical information or ask for user decision [12]. Modal dialogs disable all app functionality until the user makes an input (e.g., confirmation, dismiss the message, or enter information such as account information) [18]. The diversity of possible messages displayed in a dialog offered a great opportunity to evaluate the influence of shapes varying both the content displayed and the contexts where users would encounter that content. By examining different dialog shapes, we aimed to identify whether certain shapes might convey meanings to users that influence their perception and expectations of the dialog messages. Furthermore, we also aimed to understand user expectations around the importance of the dialog messages and how users relate contexts to different dialog shapes.

We conducted an online survey where participants rated six dialog UI designs that only vary in shapes on a number of measures (e.g., trust, attractiveness, and perceived importance of messages displayed in the dialog). Specifically, we grouped the six designs into three meaningful pairs and had users compare two dialog interfaces in each pair regarding their characteristics (e.g., aesthetics, trust) and what types of messages expected to be displayed in those dialogs. Our findings highlight that the shapes of dialogs can embody meanings that impact user expectations of how important the displayed messages are supposed to be. Additionally, our findings show that (1) users in general preferred rounded shapes for dialog designs (e.g., circle or dialogs with rounded corners) and (2) Android and iOS users had significantly different perceptions between certain shapes such as circle and wiggly-circle.

The contribution of this case study is threefold: (1) Our study recommends the inclusion of rounded shapes in dialog UI based on findings that users showed preference for rounded designs in characteristics like attractiveness; (2) We suggest designers to be intentional and careful about selecting rounded or angular shapes for UI design as they can impact the perceived criticality of the displayed information; (3) We share experience and lessons learned during the research process, including exploring the shape story of UI components, being mindful of the semantic meanings that visual characteristics (e.g., shapes) can offer, and situating the study of UI visual characteristics under specific scenarios.

2 METHOD

2.1 Exploring Dialog UI Designs with Different Shapes

The goal of this case study was to examine how users perceive different dialog UI designs and if a design fits a specific user scenario (e.g., displaying an Ad) better than another. Following an iterative

design process with designers and researchers, we extended the current dialog UI design by adopting different shapes, which include hexagon, circle, and wiggly-circle. With some variation in the rounded corners, we created 6 dialog designs (see Figure 1): angular basic, rounded basic, angular hexagon, rounded hexagon, circle, and wiggly-circle. Angular containers have 4 density-independent pixels (dp) rounded corners and rounded containers have 28dp corners, based on the guidelines of Material Design 2 and 3 [11, 12]. The 6 dialog designs covered typical shapes and were able to fit in necessary dialog texts: title, main body, and two interactive buttons [10]. We controlled other visual characteristics such as color to be consistent in order to minimize their effects on user perceptions. For example, the background color and the anatomy of the dialog container were kept constant, as they could hint to meanings and may mislead participants during the study. As shown in Figure 1, we used placeholder text (i.e., "This is the body of a pop-up window. Actual text will appear here.") for all dialog designs and only changed shapes to present the design variations.

2.2 Study Design: A Survey Investigating User Perception Through Comparisons of Different Interfaces

We used 6 dialog designs to probe user perceptions and expectations of the content displayed within the six dialogs. A common approach to examining user perception of interfaces is to have participants evaluate a single interface at a time [41]. We started with this approach and tried the provisional survey within the team. Initial feedback showed that the variations in these dialog designs may be easily ignored by actual participants if evaluated separately. Also, some of the designs such as a wiggly-circle dialog are rarely seen in current mobile interfaces, making it more challenging for participants to translate their perceptions into numerical values in survey responses. Thus to assure the quality of the data we had users compare different dialog designs side by side and select which one best fits the description, as suggested in the literature about comparison-based surveys [28, 42]. While it is ideal to conduct an exhaustive pairwise comparison (15 pairs in total for 6 designs), it would be daunting for participants and require a large sample size to meet the statistical power [28]. Hence, we generated three meaningful pairs of dialog designs for comparisons (see Figure 1). Pair 1 and 2 represented the comparison between shapes with angular and rounded corners. Pair 3 was created to help understand how users perceive different shapes in displaying messages, where the wiggly-circle represents a more novel design compared to circle. Certainly, there can be other combinations of these six dialog designs. As an initial step in this space, we aimed to gain a preliminary understanding with three meaningful pairs of dialog interfaces.

We conducted a within-subject survey study where participants compared three pairs of dialog designs on a number of characteristics (e.g., aesthetics, trust) informed by the literature, perceived importance of the displayed content, and which design is more expected to display certain messages (e.g., asking permission to share location). The eight user scenarios were selected based on a pre-survey that asked participants (n=60) to categorize common dialog messages based on the perceived importance and whether they are seen as app/system messages. As shown in Table 1, we used the results to label different messages presented to participants in the formal survey (more details are discussed in Section 5.4). To note, system messages were mostly perceived as important. Participants answered all questions for each pair at one time and then moved to the next pair. For each question, we offered three response options: Interface A (the dialog design presented on the left side), B (the dialog design presented on the right side), or No difference (i.e., A and B are perceived equally on a particular measure). At the end of the survey participants rated the six dialog designs individually regarding their overall preference. The survey was implemented and administered through Qualtrics (https://www.qualtrics.com).

2.3 Data Collection and Analysis

We disseminated our survey via the CINT panel (https://www.cint.com/) and applied the quota sampling method in order to reach out to participants of different age groups and balance participants from different user groups (iOS or Android users). 328 participants filled out the survey and we screened out responses that failed the quality-check item (i.e., "Please select answer choice 'yes' below"), with 200 responses included for data analysis (10% aged between 18-24, 25% aged in the following three groups: 25-34, 35-44, and 45-54, and 15% aged above 55). Among the 200 valid responses, 52% were from Android users and 47% were from iOS users (1% users were unsure about their operating system).

We first conducted descriptive analyses and focused on the main trends (i.e., which option was most or least chosen by participants) for items about the characteristics of shapes and general perceived importance of the displayed dialog messages. We also applied a generalized estimating equation model (GEE) [6] to estimate the effect of messages (important/non-important and app/system dialog messages) on which dialog design is more expected. The GEE model is a statistical approach used for within-subject repeated measures and is flexible for the unbalanced dataset (i.e., more messages are labeled as important messages) [6], and we chose it because in our study each participant contributed multiple data points for each message and dialog design. Regarding the differences between Android and iOS users' perceptions, we applied Chi-square test of independence [43] to examine whether user response is independent of user type (iOS or Android users). For the overall preference question, we applied Analysis of Variance (ANOVA) [34] to compare across different dialog designs.

3 FINDINGS

3.1 Users Preferred Rounded Dialog Designs

For the overall preference question, participants rated rounded basic dialog UI as their most preferred design among six interfaces and the circle dialog as the second favorite. From ANOVA analysis, there was no significant difference in the overall preference between rounded basic and circle but users showed a significantly higher preference for rounded basic than angular basic (95% C.I. = [-1.01, -0.33], p<.01). When comparing characteristics of Pair 1 and 2, the majority of participants either chose dialogs with rounded corners to be more *attractive, unique, and playful* or selected the no-difference option (see Figure 2). Relatively, few participants chose angular basic or angular hexagon for these three characteristics. For Pair 1 and 2, the majority of users (>60%) perceived no difference in

Table 1: We asked users to compare each pair of dialog designs in their characteristics, perceived importance of the displayed messages (general and eight scenario-specific items), and overall preference.

Measures	Specific items	Question framing
Characteristics	Attractiveness, uniqueness, playfulness, trustworthiness, security, the necessity of design (i.e., if the design seems unnecessary or over-complicated)	"Which of the above pop-up windows looks more/less xxx?"
General perceived importance	Not applied	"Which of the above pop-up windows looks more likely to display an important message?"
Scenario-based perceived importance	**App & non-important**: Ads, in-app promotion; **App & important**: an app crash message, permission to share location; **System & important**: unknown device signed-in, low-battery alert, critical system upgrade, new iOS/Android system feature available	"Which of the above pop-up windows looks more likely to display the following messages?"
Overall liking	Not applied	"How do you like this pop-up window?" (5-point Likert scale)

terms of trustworthiness, security, and the necessity of the design. This means whether a round or angular dialog is used it does not seem to impact user trust, security and the necessity of design.

3.2 Shapes Could Impact the Perceived Importance of the Displayed Content

In Figure 2, we presented participants' selections of the more expected dialog design for different messages. Here, we highlight some observations from user responses on the scenario-specific items. For important app messages like an app crash message, few participants (<15%) expected rounded basic to display such messages. For non-important messages like an Ad, the majority of our participants perceived no difference between *rounded and angular hexagon* and few participants (<20%) chose angular hexagon to be more expected. The GEE model showed that for Pair 1 and 2, whether the message was an app or system-related message did not significantly impact user selection of which dialog design was more expected. For *hexagon* dialogs in particular (Pair 2), users had a significantly higher tendency to expect the *angular dialog* to display an important message (e.g., an App crash message) over the rounded dialog (coef=0.16, p<.001). For basic dialogs (Pair 1), the importance of a dialog message did not significantly alter user selection of the more expected dialog design.

3.3 Android and iOS Users Perceived Differently about Circle and Wiggly-circle

Android and iOS users expressed significantly different perceptions about circle and wiggly-circle with regard to *attractiveness* (p<.01), *trustworthiness* (p<.01), and *security* (p<.01). Chi-square test of independence showed that user selection between circle and wiggly-circle in these three dimensions were not independent of the type of users who they are (Android or iOS users). In other words, the distributions of user selections in the aforementioned dimensions were significantly different between Android and iOS users (see Figure 3). To be more specific, regarding *attractiveness*, over half of Android participants perceived circle as more attractive, whereas iOS participants' response evenly fell between circle and wiggly-circle. When choosing the dialog design that is less trustworthy or secure, the majority of Android users perceived no difference, whereas nearly half of iOS users perceived wiggly-circle as less trustworthy or secure (see Figure 3).

4 DESIGN IMPLICATIONS

We briefly discuss the insights from the survey study and share the implications for future design practice with the design community.

4.1 Being Intentional of Selecting Rounded or Angular Shapes for UI Designs

Our findings confirm that rounded shapes are more liked by users as dialog designs, since they increase perceived attractiveness, uniqueness, and playfulness. This echoes the literature that round shapes look more visually playful and vivid than angular ones [26, 36, 37]. In this regard, our findings show that rounded designs are meaningful on the UI component level and may offer more delightful user experience, and therefore designers may pay more attention to the fine-grained level of UI design. However, our GEE model showed that angular hexagon design was significantly more expected to display an important message than a rounded one. This finding suggests that the roundness of a shape may impact users' alert level and perceived importance. An urgent message like "Unknown device logged into your account" may appear less stress-inducing if presented in a rounded dialog UI. In this regard, shape may impact user perceptions (e.g., perceived importance of a message) and actions in response to the displayed messages, for example, with a rounded dialog design, users may dismiss an important message that they are supposed to attend to. This suggests a more intentional consideration of using shape in UI design patterns. Future work may explore whether a seemingly standardized UI pattern, such as shapes, need to be designed to adapt to the displayed information. To note, our model did not show a significant difference between angular and rounded basic dialogs regarding which one to display an important dialog message. Such results might be due to a mixed use of both dialog designs in real-world apps and thus users did not perceive a salient difference when reflecting on their experience

Figure 2: Participants compared three pairs of dialog designs regarding their characteristics (yellow: positive descriptions including more unique, more attractive, and more playful; blue: negative descriptions including less trustworthy, less secure, and less necessary) and which design better fits specific scenarios (green: app message, purple: system messages).

with different dialog designs. Future design would benefit from additional research to understand how shapes offer semantic meanings for UI components. Moreover, going beyond the UI component

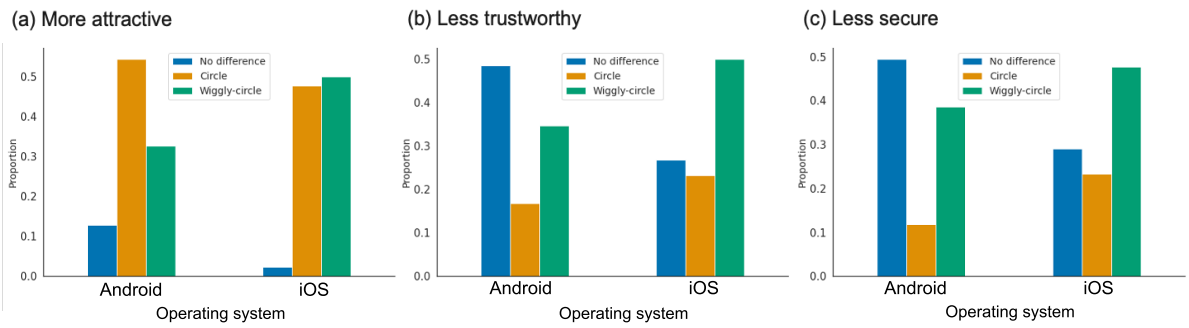

Figure 3: iOS and Android users showed significantly different perceptions regarding (a) attractiveness, (b) trustworthiness, and (c) security between circle and wiggly-circle.

level, it is worth continuing to study how shapes (e.g., rounded and angular ones) impact the user's general perception of a digital product and how it might be connected with the meanings embodied in UI designs. Overall, our work suggests that in addition to offering an aesthetically beautiful design, it is also important and necessary to understand the semantic meanings that UI elements or patterns can convey.

4.2 Envisioning the Design Space of Shape for Dialog UI

We applied three unique shapes to design dialog containers (i.e. hexagon, circle, and wiggly-circle) in addition to the basic rectangular shape. While these three shapes do not cover the full potential of shapes used for dialog designs, our findings preliminarily suggest the possibility of applying diverse shapes to augment the content displayed in a dialog. For example, compared to a circle, a significantly higher proportion of users expected a wiggly-circle to display in-app promotion or Ads, which were all categorized as non-important messages. This implies that users may attach semantic meanings to the shape of dialogs and use that to read the context within them, which goes together with prior literature on the connection between shape and semantic meanings [4, 17, 20, 24]. Building on our findings, future work may study how the semantic associations of UI elements alter user perception and could be leveraged to facilitate user interaction. Shapes, including rounded corners, might have the potential to signal the positiveness or criticality of a dialog message. They may also be used to mitigate situational impairments, such as reading a message under sunlight or on-the-go [32]. With the shape of a dialog container indicating the displayed content, users may easily determine if the message requires immediate attention by glancing at the shape of the dialog container.

5 LESSONS LEARNED AND EXPERIENCE

While conducting our research, we overcame several challenges ranging from the survey design to data analysis. We share lessons and experience with the broader community.

5.1 Exploring the Shape Story of UI Components

This case study made an investigation on the shapes of dialog interfaces and how they alter user perception of the displayed content. In many current design systems [11, 12, 18, 31], the shape of a dialog container is by default rectangular. Our work explored different shapes and suggests that the shapes of dialogs, or more broadly speaking, the shapes of UI components, present a promising design space to explore in the future. Some shapes and corner radius of a shape are found to offer semantic meanings, for example, they may indicate the importance of a message. In light of this, a collaborative effort between designers and researchers would be valuable to map different shapes with the semantic meanings they convey in UI components and furthermore identify an appropriate range of shapes that could be potentially used for UI components. This implies that designers may want to push the boundary of the shape story and potentially include more shape candidates in user interface design. Unlike creating unique and stylish components for individual products to express branding, it requires comprehensive research and design to formulate guidelines about shape and its use in UI components. In this regard, our work provokes the conversation of exploring the shape story of UI components.

5.2 Being Mindful of Semantic Meanings that UI Visual Characteristics Offer

Visual characteristics of an interface usually include color, shape, typography, and icon, which all embody semantic meanings according to academic and industry research [16, 20, 36, 40]. It is well-known that colors can signal emotional valence and urgency of information [19, 22, 33]. They are often combined with other elements like icons to constitute the feedback of user actions and interactions. For example, a design system may use a green check mark to convey success or completion as user feedback. These elements are also applied to enhance system-user communication by indicating current interaction status, for example, color and icons are used to make selected items more visually prominent

for switches in UI [7]. As discussed in Section 5.1, designers may want to explore more design variations for UI elements, such as using diverse shapes and playful motion effects [11, 18]. However, one thing to keep in mind is the semantic meanings these designs might convey and how they impact user perception and interactions. For example, using playful motion effects could make user interactions more vivid, but maybe decrease user perceived trust with the product as the product could look less serious or secure. Thereby, we suggest the designer community be very mindful of the semantic meanings that UI designs may offer and how those could be leveraged to facilitate user interactions.

5.3 Situating the Study of UI Visual Characteristics Under Specific User Scenarios

We realized that asking participants to respond to "which of the following pop-up window do you expect to display an important message?" (general perceived importance item) may be particularly challenging given the difficulty to recall important or unimportant messages. From a methods standpoint, we wanted to be careful to avoid this ambiguity. To address this issue, we provided participants with specific user scenarios and had them compare dialog interfaces under each scenario in order to obtain response data of higher quality. We believe that such scenario-based evaluation of UI components has the potential to be extended in future research, for instance, researchers can adopt the similar method to identify a mapping between different UI motion designs [13] and their appropriate contexts of use (e.g., the motion effect signaling important or non-important user actions). In our exploration of dialog designs, as dialog messages can be seen under a variety of situations, it is critical to include representative messages while controlling the number of scenario-based questions in the survey. To identify representative dialog messages, we distributed a pre-study survey to have participants categorize a list of 14 typical dialog messages based on the perceived importance and whether they are app or system messages. Using the pivot table analysis, we sorted out dialog messages that had a higher agreement (i.e., over 70%) among the 60 participants and labeled them as either important or non-important (see Table 1). With a similar method, researchers can use a set of representative scenarios to examine if UI designs are received well by users across different scenarios.

5.4 Considering Comparison-based Survey Design to Investigate User Perception Toward Specific UI Visual Characteristics

Users interact with different UI components in their everyday mobile experiences, however, some patterns of the UI components, such as rounded corners, may not be salient to users. One of our challenges was to seek a way to probe the possible underlying influence of UI patterns (i.e., shape and rounded corners) on user perception. In general, it is more common to present interfaces with different design variations one by one to users and collect their data responses separately. During our survey design and pilot study of initial versions, we realized that without comparison, it presented a challenge to users to translate their perception into numerical values. For example, asking users to rate the perceived importance of displayed messages in a certain dialog container could be particularly challenging. On the other hand, it was also difficult to have users rate a relatively novel user interface (e.g., wiggly-circle dialog design) and provide a hypothetical value of perception due to a lack of real-world interactions. In this regard, when studying the role of specific UI patterns, it would make more sense and possibly yield data of higher quality if researchers present interface prototypes side by side to have users make comparisons.

6 CONCLUSION

Designing mobile user interfaces to offer an enjoyable and delightful user experience is a constant effort for UX designers and researchers. This case study has presented work on examining how the shapes impact user perceptions and expectations for dialog messages displayed within them. Findings from this study show the potential for the shape of a dialog to convey specific meaning to users, including the criticality of the message displayed within them. Findings also reveal that the use of different operating systems (Android or iOS) can impact user perceptions of different dialog designs. In addition to presenting our data insights, we have offered implications for future design practice and shared experience and lessons learned with the broad design and research community.

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