Interactive Public Displays for Everyday Security: The Case of Software Updates

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Abstract

Given the ubiquity of smartphones in everyday life and their role as gateways to personal and professional activities, timely software updates are critical for digital security. Although updates address known vulnerabilities, many users delay or ignore them. This happens not necessarily from a lack of awareness, but because updates interrupt device use. This paper investigates the use of interactive public displays in semi-public spaces to encourage security-enhancing behavior. We present and empirically evaluate *SmartUpdate*, a public-display application that guides users through performing manual updates and enabling automatic updates on their smartphone devices. A field study provides insights into how people notice, approach, and engage with educational content on public displays. Findings show that participants often updated their smartphones in parallel while interacting with the display, yet attracting engagement remained challenging, mainly due to time constraints. Overall, the results indicate that public displays can promote secure behavior effectively when location, timing, and audience are carefully aligned with application design.

CCS Concepts

• **Security and privacy → Human and societal aspects of security and privacy**; • **Human-centered computing → Human computer interaction (HCI)**.

Keywords

Interactive Public Displays, Usable Security, Smartphone Software Updates, Public Security User Interfaces

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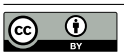

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1 Introduction

Smartphones have become deeply embedded in everyday and professional life, with more than half of the world's population[1] now owning one. As gateways to digital services across sectors [38], smartphones concentrate personal data and critical functionality; making timely operating system (OS) updates essential to mitigate known vulnerabilities and maintain device performance. Yet, a substantial share of users delay or ignore updates (i.e., over 50% do not install updates immediately after release[2]), leaving devices exposed to preventable risks.

Many users do not prioritize security and privacy actions [36], often lack motivation to act due to the absence of immediate rewards [32], or are unaware of potential risks and consequences [39]. System nudges, such as update notifications often occur at inconvenient times, leading users to postpone the task and rarely return to it. Even among those who are aware of the risks and would like to act to protect their privacy, a significant further barrier is a lack of knowledge how to do so. Moreover, concerns about potential issues, bugs, or unwanted changes can further discourage users from updating their devices [29].

Public and semi-public interactive displays offer a promising channel to address this gap. Situated within everyday environments, public displays can reach people at opportune moments. When placed in areas, such as subway stations, public buildings, or waiting halls, they have potential to prompt users to immediate action [2, 31].

Building on this premise, our work investigates how interactive public displays can support security-relevant behavior change by providing situated, lightweight learning experiences in everyday

[1] https://de.statista.com/statistik/daten/studie/309656/umfrage/prognose-zur-anzahl-der-smartphone-nutzer-weltweit/ (Last accessed: 22.10.2025)
[2] Kaspersky Daily https://www.kaspersky.com/blog/device-updates-report/ (Last accessed: 23.10.2025)

environments. We take smartphone software updates as an exemplary use case, as they represent a recurring, personally relevant yet frequently postponed action with direct implications for security. While notifications on personal devices often appear at inconvenient times and are easily dismissed, a brief interaction in a neutral space—such as a corridor, waiting area, or campus lounge—may offer a more receptive moment for reflection and action.

Our approach is informed by the concept of *Public Security User Interfaces* (PSUI) [25], which situate security education and nudging strategies within public or semi-public spaces. Rather than relying on users to seek out information, PSUIs bring accessible and contextualized guidance into shared environments, encouraging awareness and self-initiated action. Building on this conceptual foundation, we extend the PSUI approach by empirically evaluating and validating its effectiveness in practice—examining whether such a display can (1) convey actionable instructions on smartphone update procedures and (2) motivate people to enable automatic updates or perform them immediately on their own devices. To this end, we investigate the following questions:

RQ1: How do people currently approach and interact with security-related interactive public displays?

RQ2: How do users evaluate the user experience of a public-display application that instructs smartphone OS updates?

RQ3: How does prior knowledge about updates shape users' interaction with-and perception of-the application?

To answer these questions, we collect and evaluate two types of data: (1) passive observations of how individuals noticed, approached, and interacted with the system, and (2) user feedback on perceived usability and effectiveness, and the role of prior knowledge.

Contribution Statement. The main contributions of this work are twofold: (1) *SmartUpdate: a public-display application*, designed to foster secure smartphone behavior through concise micro-learning on software updates; (2) *Actionable empirical insights* into how people notice, approach, and engage with interactive public displays addressing security-relevant topics in semi-public spaces, including how situational and social factors shape willingness to interact.

2 Background and Related Work

This chapter outlines key developments in public displays and how they intersect with research on usable security.

2.1 From Pervasive Displays to Public Security Interfaces

Public displays have evolved from simple information boards to complex, interactive systems deeply embedded in everyday environments. Davies et al. [11] provide a comprehensive account of the emergence of pervasive displays. Early experiments in the 1980s explored how large-scale screens could connect distant places through audio-visual links; a formative example is Galloway and Rabinowitz's *Hole-In-Space*[3] installation, which enabled spontaneous, real-time encounters between pedestrians in New York and Los Angeles [11].

[3]https://www.ecafe.com/getty/HIS/ (Last Accessed: 22.10.2025)

With advances in sensing, networking, and visualization, research in the early 2000s shifted toward situated, everyday applications; such as electronic door and room displays that surfaced presence, availability, or meeting information and could be controlled remotely via mobile or web interfaces [10, 11]. Over time, public displays diversified across urban media façades, museum installations, shop windows, and civic spaces, with increasing attention to interaction techniques, content creation, and deployment at scale [4, 13, 17, 19, 24, 37].

These developments gave rise to interactive public displays (IPDs); large, situated screens supporting context-aware interaction through touch, gesture, or personal devices [16]. Their spread has been fueled by improvements in display hardware and a deeper understanding of user-centered interaction in socially exposed settings [11, 16]. A persistent design question is how to attract attention, motivate first touch, and sustain comfortable interaction [26]. Complementary work has established methods for evaluating such systems, including passerby behavior, user experience, social impact, and privacy aspects across lab and field studies [3, 27].

Building on these foundations, PSUIs sit at the intersection of IPDs and usable security: interactive interfaces placed in public or semi-public spaces that communicate security-relevant information or nudge security-supportive behavior [25]. Rather than relying on users to seek out information on their own devices, PSUIs deliver brief, contextualized, and walk-up-and-use content directly in everyday environments such as waiting areas, campuses, or workplaces. This situated model offers the opportunity to reach audiences who rarely engage with security guidance and aligns with the established attention dynamics and evaluation principles of interactive public displays.

2.2 Capturing Attention and Sustaining Engagement on Public Interfaces

Research on IPDs has identified several social and perceptual factors that shape how people notice and approach these systems. A well-documented challenge is *display blindness*: pedestrians often ignore displays because they expect them to show irrelevant or purely commercial content, such as advertisements, and thus fail to register interactive or informative content [28]. Subsequent studies have nuanced this phenomenon by identifying conditions that can mitigate it [21, 22]. Complementary research describes the *honeypot effect*, where visible interaction by one or more individuals attracts onlookers and stimulates further participation [40]. Together, these findings emphasize the importance of design strategies that both overcome initial neglect and leverage social contagion once interaction begins.

User behavior around IPDs is highly sensitive to the social context. When others are present, especially strangers, potential users may hesitate to interact; direct gaze from bystanders can further inhibit engagement, while the presence of acquaintances tends to increase dwell time [14]. Clear signaling of interactivity is therefore essential. Prior work highlights the role of motion, affordances, and peripheral prompts in making interactivity legible [7, 12]. Subtle visual stimuli such as peripheral animations have been shown to effectively attract attention and trigger first touches, thereby expanding the pool of potential users [15].

These insights into attention and engagement align with some well-known principles in *usable security*. Usable security and privacy research emphasize that protective mechanisms must be comprehensible, manageable, and effective for non-experts in real contexts of use [8]. Organizational practice often frames the goal as moving users toward *unconscious competence*, where safe behavior becomes routine rather than effortful. The *awareness maturity curve* conceptualizes this progression from exposure and sensitization to knowledge, acceptance, and ultimately consistent secure behavior [6, 34]. Recent overviews further highlight transparency and adaptivity as key levers for sustainable everyday security practices, ensuring that concepts and controls remain understandable and adjustable to users' needs [33]. Integrating these perspectives suggests that public displays designed for security awareness must simultaneously capture attention, foster social comfort, and convey security concepts in a transparent and actionable manner—turning momentary engagement into meaningful learning.

Beyond understanding display blindness and social inhibition, prior work has developed concrete mechanisms for eliciting approach and first-touch interaction on public displays. These include visual attractors such as idle animations or motion cues [7, 12, 15], proxemic interaction techniques that adapt content based on distance [15], peripheral prompts that reveal interactivity when users glance at the screen [12], and social mechanisms like the honeypot effect, where visible participation encourages others to engage [40]. Other strategies combine visual contrast, headline messaging, or spatial integration to clarify interactivity and reduce hesitation [23, 26, 27, 30]. Together, this work provides established mechanisms for increasing walk-up engagement, which our study leverages as background knowledge.

3 Design and Implementation of *SmartUpdate*

The development process consisted of four iterative phases: exploration, definition, design, and implementation. During **exploration**, we mapped the design space of interactive public displays and PSUIs. Reviewing work on interactive public displays [11, 16, 25], we examined how public displays can (i) attract attention, (ii) make interactivity legible, and (iii) sustain engagement in socially exposed settings. In parallel, we sketched usage scenarios and candidate content structures. Two components emerged as essential and equally weighted: an *eye-catching entry* to draw passers-by into first touch [24], and *instructional content* optimized for rapid micro-learning.

In the **definition** phase, we set the thematic and functional scope of the application. Smartphone OS updates were chosen as the central topic due to their relevance to everyday digital security and their recurring, often postponed nature. We identified two actionable learning outcomes: (1) enabling automatic updates and (2) performing a manual update. We designed an interaction flow balancing engagement (a short quiz to activate prior knowledge and motivation) with actionability (OS-specific step-by-step guidance). The final structure comprised four main components: a *start screen* introducing the topic and allowing language selection (Fig. 1-a), a *short quiz* designed to activate motivation and surface common misconceptions (Fig. 1-b), *OS-specific guides* providing concise, actionable steps for enabling automatic updates and performing manual updates (Fig. 1-c), and a *summary end screen* encouraging users to keep automatic updates activated (Fig. 1-d).

The **design** phase translated this structure into a concrete, visually coherent interface optimized for public use, focusing on four main aspects: *(1) Content Design.* We kept the content concise and directive (e.g., "Open *Settings* → *General* → *Software Update*") supported by clear visuals and optional contextual "Tip" pop-ups. Each step included brief rationales (e.g., "Automatic updates install security patches overnight") and essential prerequisites, such as Wi-Fi connection and battery level. *(2) OS-specific Guidance.* After selecting an operating system, users received tailored instructions. On *iOS*, the manual-update guide begins with a QR code that deep-links to the relevant *Settings* path, encouraging immediate action on the user's device. On *Android*, where deep linking is less consistent, the guide starts with manually opening *Settings*. *(3) Interaction and Navigation.* The application followed a linear, step-based flow with large touch targets, persistent back and cancel options, and visible progress indicators. *(4) Visual Design.* Low-fidelity wireframes defined structure and navigation, followed by high-fidelity iterations refining typography, iconography, and spacing. Short animations on a handset mockup visually demonstrate "where to tap," reducing the need for lengthy textual explanations.

We implemented a high-fidelity, interactive prototype in *Figma*[4] (see Appendix E) in portrait 9:16 public display format and 4K resolution (2160×3840), using components, such as buttons, cards, and tips, to maintain consistency and enable rapid iteration. Simple micro-animations communicated transitions and attention cues. Regular iterative reviews supported continuous refinement. Discussions focused on entry cues, microcopy clarity, visual hierarchy, and the balance between brevity and completeness in the guides. This feedback loop helped surface issues early (e.g., ambiguous labels, insufficient progress feedback) and informed targeted adjustments that improved overall legibility and flow.

For the **implementation** of *SmartUpdate*, we used the *React*[5] framework. We chose it due to its component-based structure, which aligns seamlessly with the prototyping tool and yields a modularized and reusable application. Scalability was implemented in a way that allows the application to function reliably regardless of screen size or resolution. Each interaction was automatically logged, with every button click generating a timestamp in a CSV file. These logs supported later analysis of user behavior, such as interaction duration and frequency of feature usage. For the distribution of the application, we used installation packages generated with *Electron*[6]. When launched, it automatically entered fullscreen kiosk mode, removing all window elements to support focused, secure, and distraction-free use in semi-public or public environments. Our goal was to follow established practices for public displays (e.g., legible start screen, visible touch targets, brief idle animations) to ensure that the application was understandable when noticed.

4 Pilot Study

To evaluate user engagement with the SmartUpdate application , we conducted a pre-study followed by a main study. Insights from

[4] https://www.figma.com/ (Last accessed: 03.10.2025)
[5] https://react.dev/ (Last accessed: 22.10.2025)
[6] https://www.electronjs.org/ (Last accessed: 22.10.2025)

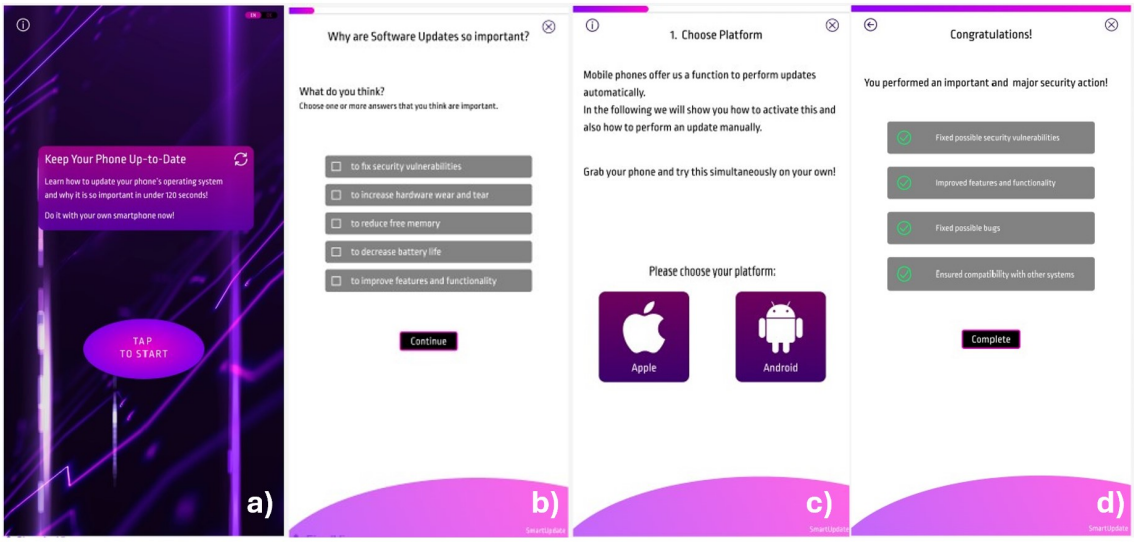

Figure 1: Overview of the final application structure: (a) Start screen introducing the topic and language selection; (b) Short quiz activating motivation and addressing misconceptions; (c) OS-specific guide selection (Apple or Android) with update instructions; (d) Summary screen highlighting achieved benefits and encouraging continued use of automatic updates.

the pre-study informed targeted design refinements and guided the preparation of the field deployment. The study was carefully designed in line with our federal and university's data protection regulations, and approved by the local ethics committee. Four participants were recruited through a user study channel on the university's communication networks and through personal contacts. Each participant attended an individual session in a prepared university laboratory. An interactive display running the application was placed in the middle of the testing room. Participants received no specific instructions about how to use the application before the interaction began. This allowed us to observe natural and intuitive usage patterns. We deliberately avoided giving hints or task prompts in order to capture spontaneous reactions and realistic usability problems. During each session we observed participants unobtrusively and measured the time required to complete the application flow. After the interaction we conducted semi-structured interviews [1] that covered user experience, interface design, content clarity, and suggestions for improvement. The interview questions are listed in Appendix B. Participants also completed a short demographic questionnaire. The questionnaire items are listed in Appendix A.

4.1 Pilot Study Findings

Sample. All four participants were male students between 18 and 25 years old. Three of them reported studying in an IT related field, the other one studies health sciences. Three participants used Apple devices in everyday life and one participant used a Samsung phone. All participants used the English interface. Each participant spontaneously took out their own smartphone and attempted to follow the instructions in parallel. Our analysis of the general experience statements (see Table 1) shows that participants had prior exposure to interactive public displays.

Interviews. We grouped coded statements from the interviews into five categories: *(1) General Experience*, *(2) Usability*, *(3) Design*, *(4) Content*, and *(5) Feedback*. For each category we summarized participant responses and counted recurring observations. **General feedback** confirmed that participants were overall satisfied. They generally considered such displays suitable for conveying cybersecurity information. Participants indicated that initiating concrete actions from a public display can be difficult. Many participants reported relying on automatic notifications for updates. They noted that unreliable or outdated public displays create a negative impression, and also mentioned that contextual factors such as location and time are important for effectiveness. Across all categories we identified recurring themes that informed targeted refinements.

The **usability** results (see Table 2) indicate that participants found the application broadly intuitive. The start screen was especially effective in motivating interaction. Animated and moving elements helped to draw attention. The limited number of UI elements supported guided action. Areas for improvement included offering two languages (English and German), the visual appeal of the start button, clearer labeling for operating system selection, and a better visible info button. Participants also motivated a more ergonomic placement of interface elements.

Design feedback (see Table 3) was overall positive. Participants appreciated typography and the color palette. They valued the use of familiar interaction patterns. Suggested improvements included repositioning the start button, enhancing progress feedback, adding an initial visual cue to establish context, and making the info button more prominent. **Content analysis** (see Table 4) shows that participants found the information relevant and well structured.

Table 1: General experience statements.

Participant statements	Freq.
Used a public display in a shopping mall	4x
Consider public displays useful for cybersecurity	4x
Performs updates depending on device and time	4x
Relies on automatic notifications rather	4x
Found public displays in malls unreliable	3x
Feels confident handling software updates	3x
Triggering actions via public displays is difficult	3x
Updates take time and this can be a barrier	2x
Updates require storage space	1x
Train stations are suitable locations for displays	1x

Table 2: Usability statements.

Participant statements	Freq.
Start screen is clear and motivating	4x
Interaction is understandable and intuitive	2x
Animated elements attract attention	2x
Language toggle is confusing	2x
QR code needs clearer explanation	2x
Few UI elements make operation easier	2x
OS selection is not always self explanatory	1x
Info button was overlooked or not seen as relevant	1x
Start button is visually unappealing	1x
Good readability due to contrast and structure	1x

Table 3: Design statements.

Participant statements	Freq.
Font is readable, modern, and appropriate	4x
Font size is adequate and legible	3x
Color scheme is pleasant and high quality	2x
Familiar UI elements support orientation	2x
Start button placed too low on the screen	1x
Remaining time in the progress bar is useful	1x
Loading and transitions are smooth	1x
A visual cue (smartphone icon) can clarify context	1x
Info button placement causes it to be overlooked	1x
Introductory texts help contextualize the topic	1x

Table 4: Content statements.

Participant statements	Freq.
Information on the answer screen is comprehensive	4x
Individual steps are clear and understandable	3x
Graphics help orientation and action execution	3x
Stating goals at the beginning supports understanding	2x
Correct answer explanations are useful	2x
Answer options could be optionally expandable	2x
Graphics are more effective than text alone	2x
One clear instruction per screen is helpful	1x
Animations match the device for high recognizability.	1x
Show alternative path to system settings for iOS	1x
Some Android users have automatic updates enabled	1x
One action per screen is sufficient, not overwhelming	1x

They valued the clear start screen and structured step-by-step instructions. Graphics and animations substantially supported comprehension and action. Participants suggested optional expandable answer fields and alternative navigation paths.

4.2 Derived Application Improvements

Based on pilot findings, several adjustments were made to enhance usability and visual clarity while preserving the overall flow. The most substantial update involved adapting the interface from the pilot's portrait layout to a horizontal 16:9 display for the main study, which required repositioning and redesigning interactive elements without altering the logical sequence. Further refinements included raising interactive elements on the start screen by about 10–15% to improve reachability, redesigning the start button for better visibility, explicitly labeling language options as *English* and *German*; and adding a smartphone graphic to clarify context. An alternative guidance path was introduced to assist users who struggled to locate system settings, and brand-specific Android graphics (e.g., Samsung, Huawei) were integrated to improve recognisability across devices. The final application prototype, including the complete interaction flow and assets, is provided in Appendix E.

5 Main Study

After implementing the improvements from the pre-study, we conducted the main study. The study took place in a realistic usage context so that findings could be interpreted with practical relevance. The field study combined qualitative and quantitative data collection methods. Interaction with the application occurred on a public interactive display installed in a busy corridor connecting two university buildings. Seating areas with tables and benches were located opposite the display (see Figure 2). The display used a standard 16:9 format and was mounted on a stable stand at a comfortable interaction height (see Figure 3).

The main study consisted of three parts, designed to capture different aspects of interaction with the public display and the *SmartUpdate* application, enabling a multi-layered understanding of security-relevant behavior in public settings. First, *passer-by counting and categorization* documented foot traffic near the display, recording all passers-by and their observable reactions. Second, *short intercept surveys* were conducted with individuals who showed interest but did not interact, to explore reasons for non-engagement. Finally, *think-aloud sessions* involved selected participants using the application on-site, then completing a short interview and questionnaire to gather insights on experience, comprehension, and potential learning effects.

For the interview and questionnaire part, we approached people who were waiting or seated nearby and invited them to use the display without any prior instruction. A core element of the protocol was to avoid giving any content information before use, since questions focused on an unprimed experience. Most people agreed to participate; refusals were rare and usually due to imminent exams. After a single self-guided run-through of the application, we conducted a semi-structured interview (see Appendix D) and then administered an online questionnaire (see Appendix C). The questionnaire covered *Demographics*, *User Satisfaction*, *Learning Effects*, *System Usability Score (SUS)* [9], and *User Experience (UEQ)* [20, 35]. The questionnaire items were self-designed to address specific aspects not captured by the standardized instruments or the interviews, related to background knowledge, perceived clarity, motivation to perform software updates, confidence in doing so, and willingness to recommend the application to others.

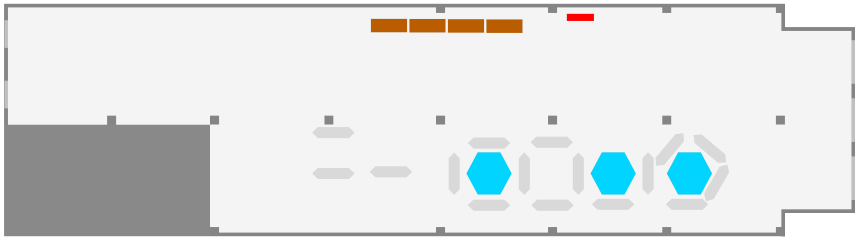

Figure 2: The bird's-eye view of the experimental setup. The display (red rectangle) was placed along the corridor wall facing the eating area. Tables with seating (blue hexagons and light-grey rectangles) were positioned opposite the display. Benches (orange rectangles) and rooms (dark grey rectangle) are shown for spatial context.

Figure 3: The public display setup used for the main study.

6 Results

All interviews were recorded with prior consent and fully transcribed. With the exception of one interview conducted in English, all were in German; the English interview was translated for analysis. We analyzed interview transcripts and open-ended responses through an inductive thematic analysis [18] using MAXQDA[7], to identify recurring patterns in participants' perceptions, motivations, and interaction behaviors. Two researchers independently coded 20% of the data to establish a shared understanding of the coding scheme. The remaining data were then coded individually, with regular discussions to refine categories and resolve ambiguities.

Sample. In total, 29 participants took part in the study. All participants were between 18 and 25 years old. Eighteen identified as male, ten as female, and one as other. Most were bachelor's students and reported studying as their primary activity. Academic backgrounds were varied.

6.1 Foot-Traffic Count and Categorization

Observations took place on a weekday during regular teaching hours from 11:10 to 12:10. This window captured a period with notably high foot traffic. This ensured coverage of both regular and peak flows. Out of 201 observed individuals, 149 ignored the display entirely, and another 23 did not notice it because they were engaged with their phones. Only 28 briefly looked at the display while continuing to walk. A summary of all the observed categories for the count period is presented in Table 5.

6.2 Short Intercept Surveys with Passers-by

Building on the foot-traffic observations, which showed only few interactions, we investigated reasons why people chose not to engage. We approached individuals who showed visible interest (for example, by making eye contact or slightly turning toward the display) but did not begin interacting, and asked them immediately why they did not stop and use the application. Table 6 summarizes the most frequently mentioned responses for non-interaction.

Time pressure was the most common reason for not stopping, followed by feeling uncomfortable using an interactive display under the gaze of others. The appearance of the display also mattered: some perceived it as a television and therefore did not expect touch interactivity. Design-related feedback included small banner elements. A participant noted that they already knew how to update their phones and did not perceive personal relevance. One person felt the display contrasted with the surroundings as "too futuristic."

Taken together, in a university corridor setting, people showed limited interest in engaging with the interactive display. No one

Table 5: Foot-traffic count.

Category	Count
Passed (no phone)	149
Passed (using phone)	23
Looked briefly	28
Slowed or stopped	1
Started, not done	0
Completed fully	0
Total	**201**

Table 6: Reasons for non-interaction.

Reason	Mentions
On the way to a lecture	8x
Felt uncomfortable	5x
Looked like a TV	4x
Unclear if interactive	3x
Banners too small	2x
Wanted to go outside	1x
Already knew how to update	1x
Futuristic look	1x

Table 7: Ideas to improve first interaction.

Idea	Mentions
Use bright colors	9x
Add a large headline	8x
Add a standee	3x
Provide privacy	2x
Move location	2x
Add staff nearby	1x
Link to topic	1x
Smaller display	1x
Motion detection	1x
Show statistics	1x
In walking path	1x

[7]https://www.maxqda.com/ (Last accessed: 18.10.2025)

interacted during the counting period. Reasons for non-use included time constraints, perceived social discomfort, uncertainty about interactivity, and legibility issues. Technical functionality alone is not sufficient; spatial context, design clarity, and situational factors must jointly support attention and actual use.

6.3 Questionnaire Results

From the 29 participants, two completed the interview and questionnaire together, resulting in 28 questionnaire datasets for analysis. One used a *OnePlus* device, 19 used iPhones, and eight used Samsung phones. All users spontaneously took out their own smartphones to follow the steps in parallel. The mean interaction duration with the application was 01:52 minutes. Two outliers were observed: one participant took 05:23 minutes and another 03:20 minutes. Neither case could be attributed to procedural issues and likely reflects individual differences in interaction pace.

User Satisfaction. Overall satisfaction with *SmartUpdate* was high, with most participants expressing positive experiences. The majority found the application helpful and effective in conveying its purpose, and several rated it as extremely useful. Participants also perceived a strong potential for the application to influence secure behavior, suggesting it could motivate users to perform updates more regularly. Likewise, willingness to recommend *SmartUpdate* was largely positive, indicating a generally favorable reception and engagement with the concept. The detailed results for satisfaction, usefulness, behavioral influence, and willingness to recommend are shown in Figure 4.

6.4 Learning Effects

Participants reported high perceived clarity of the instructional content. For enabling automatic updates, participants rated the instruction as "very clear" (22) "clear" (6). Regarding manual updates, 21 rated it as "very clear," six as "clear," and one as neutral. Confidence also increased after using the app: 20 participants felt "very confident," seven "confident," and one neutral regarding manual updates, while 15 felt "very confident," 12 "confident," and one "somewhat unsure" regarding automatic updates. Opinions on recommending update practices to others were divided, with 15 stating they would and 13 that they would not. Self-assessed smartphone knowledge was high overall, with six rating it "very good," ten "good," nine "average," and three "low" or "very low".

6.5 Usability and User Experience

The mean system usability score for *SmartUpdate* was 88.48 with a median of 90, assigning our application an "excellent" usability according to the classification of Bangor et al. [5]. Three outliers were observed at 57.5 and 70 (two cases). Results of the *User Experience Questionnaire (UEQ)* were very positive overall. *SmartUpdate* was rated highest on *Perspicuity* ($M = 2.64$), indicating a particularly clear and intuitive structure. *Efficiency* ($M = 2.20$), *Attractiveness* ($M = 2.05$), and *Dependability* ($M = 2.02$) also scored well, suggesting good usability and a positive experience. *Stimulation* ($M = 1.32$) and *Novelty* ($M = 1.19$) were somewhat lower but still clearly positive.

6.6 Interview Results

We conducted semi-structured interviews to obtain qualitative insights into how participants perceived and evaluated *SmartUpdate*. The full interview guide is provided in Appendix D. We summarized statements by theme and frequency.

6.6.1 General, Usability & Visual Design. Overall, participants used predominantly positive adjectives to describe their interaction. A few critical terms such as "uncomfortable," "weird," or "laggy" also appeared. After interacting, all participants could state the topic of the application and understood what automatic updates do and what a software update is. Twelve participants reported preferring automatic overnight updates to avoid disruption during the day. Seven tried to install updates promptly but only when their device was not in use. Six tended to ignore update prompts and acted later when time allowed. Two were generally skeptical and did not see much value in updates. One person reported proactively installing beta versions. The most frequent suggestions were to use more eye-catching colors and to add a prominent headline. Notably, "make it more private" and "place it in the walking path" pull in opposite directions, underscoring the importance of context. Twenty-six participants perceived the design as very good or were neutral, and 25 felt the design was appropriate for the application. Two associated cybersecurity more with the color blue. More than one third ($N = 11$) suggested larger buttons and text.

6.6.2 Content. All participants found the content easy to understand. Six felt it was too basic for them personally. One person wanted more detail on the concrete benefits of updates, and another asked where updates originate and how they reach the device. Five explicitly praised the stepwise structure. The smartphone animations were widely regarded as helpful; even two participants who did not notice them at first agreed after a prompt. One participant felt the information was unnecessary for younger users. The most common recommendation was to place the display where foot traffic is higher ($N = 8$). Conversely, three participants asked for a more private location because they felt observed. Additional suggestions included rotating the display to face traffic ($N = 2$), using a smaller portrait-oriented display ($N = 2$), and aligning internal screens more closely with the start screen ($N = 2$). Content-related suggestions included adding more phone brands ($N = 2$) and topics such as *phishing* ($N = 1$). Some asked for accessibility improvements, including larger text ($N = 1$) or audio transcription ($N = 1$). Others recommended deployment in electronics stores ($N = 1$) or on multiple displays ($N = 1$). Two further patterns emerged during use. First, some people did not notice the language toggle. One participant remarked that their phone was set to German, which they assumed explained differences in the on-screen presentation, indicating that the language control was overlooked. Second, several people initially perceived the device as a television. One participant therefore found it too large and interpreted it as general information rather than as a personal, interactive tutorial.

7 Discussion

This paper contributes to understanding how interactive public displays can communicate security-relevant content and support situated learning (RQ2/RQ3), while also illuminating contextual factors

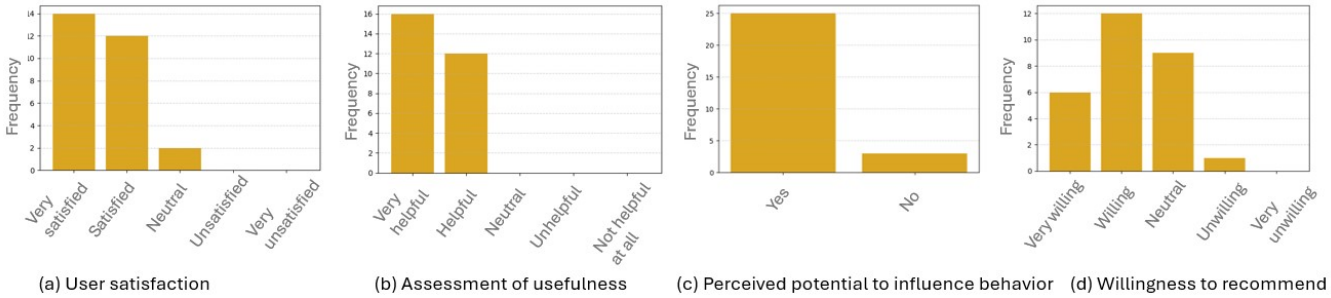

Figure 4: Overall results of user satisfaction (a), Asssessment of usefulness (b), Perceived potential to influence behavior (c) and Willingness to recommend (d).

that affect spontaneous engagement (RQ1). In line with prior research on attention and engagement on public interfaces [22, 28, 40], our findings highlight both the potential and the situational challenges of designing for spontaneous, short-term educational encounters in public space. Beyond evaluating the *SmartUpdate* prototype, we derive implications for others seeking to use public displays as instruments for security awareness and behavior change.

RQ1: Acceptance, Affordance, and Non-Use. Consistent with earlier work on display blindness and social inhibition around public interfaces [14, 28], many passers-by noticed the display but chose not to engage. Observations indicate that situational factors such as time pressure and uncertainty about interactivity shaped willingness to interact. Social dynamics were equally influential: several participants felt uncomfortable using the display when being observed, suggesting that public visibility remains a barrier for active engagement. In our setting, most passers-by were in transition between buildings, suggesting limited dwell time and attentional bandwidth for exploratory interaction. Furthermore, the theme of software updates is not socially visible or inherently curiosity-driven, reducing the likelihood of spontaneous engagement compared to entertainment or civic content. Together, this indicates that lack of unprompted interaction does not necessarily reflect rejection of the concept, but rather the combined effects of temporal pressure, content salience, and social visibility in this specific context.

RQ2: Experience of Educational Content in Public Spaces. Participants who did engage described the application as visually clear, informative, and easy to follow. The stepwise structure and short animations effectively guided users through the process, enabling them to reproduce actions on their own devices immediately. This aligns with prior work on peripheral learning and walk-up-and-use interaction [7, 12], showing that public displays can support concise, situated learning experiences if content is self-explanatory and directly actionable. For educational uses of public displays more broadly, this suggests the importance of short, modular sequences that users can enter and complete within seconds rather than minutes.

RQ3: Prior Knowledge and Perceived Usefulness. Participants' existing familiarity with smartphone updates influenced their perceptions but not their level of engagement. Both experienced and less experienced users interacted for similar durations, indicating that stepwise guidance can accommodate varying levels of prior knowledge. More experienced participants mainly perceived the content as confirmation of what they already knew, while others gained concrete procedural understanding. This reflects broader challenges in educational display design; content must balance novelty for knowledgeable users with clarity for novices, possibly through adaptive layers or variable depth of information. Content that merely confirms prior knowledge for experienced users can still serve a reinforcement function, while less experienced users benefit from concrete procedural guidance. Designing for multiple literacy levels may therefore require layered content structures (e.g., "quick actions" vs. "learn more") that preserve walk-up efficiency without sacrificing instructional depth. This suggests that future PSUIs should consider adaptive or branching content models that tailor both complexity and granularity to user needs without increasing interaction burden in a public setting.

Methodological Considerations and Limitations. Participants evaluated the display's interaction positively, emphasizing the clarity of navigation and visual guidance. Importantly, prompted interaction during interviews reflects a different behavioral pathway than unprompted walk-up use; the former reveals usability and instructional qualities, while the latter depends on contextual alignment, momentary motivation, and perceived social risk. The absence of unprompted use during our counting period therefore aligns with prior observations of display blindness and social inhibition in transient spaces rather than contradicting the positive user experience observed during prompted sessions. Contextual factors outweighed interface qualities: the display's placement in a busy corridor limited dwell time and comfort, leading to fewer spontaneous interactions. The QR-code approach for iOS worked effectively, and Android users were able to follow along even without deep links, supporting earlier findings that clear visual cues can substitute for technical affordances [27]. Importantly, the results indicate that an interactive display alone does not automatically attract participation; rather, it must be embedded in a spatial and social context that invites attention, reduces perceived effort, and signals openness for interaction. The sample size and demographic composition constrain generalization. The study primarily reflects experiences of a young, academic audience. The deployment site; a university hallway with high social density; likely amplified effects of time pressure and social visibility. Other settings such as cafeterias, or transport hubs may elicit different engagement patterns. Moreover, even though

we aimed for unobtrusive observation, researcher presence may have influenced participants' willingness to approach the display.

Implications and Future Work. The findings extend prior research on interactive public displays by demonstrating that concise, step-based guidance can effectively support micro-learning and behavioral reinforcement in semi-public settings. For researchers and designers of educational public displays, three takeaways emerge: *(1) attention capture* continues to be a design problem in its own right, requiring tailored attractor mechanisms and spatial integration; *(2) content* should afford instant comprehension and completion within a short timeframe; and *(3) trust and social comfort* can be strengthened through transparent feedback and minimal effort interaction. For PSUIs specifically, our results highlight that content clarity and instructional design are not sufficient conditions for spontaneous engagement; they must be complemented by contextual and motivational triggers that align with users' movement patterns and temporal windows of opportunity. In practice, this may involve placing displays in dwell-time settings (e.g., waiting zones, cafeterias), framing content through personally relevant prompts (e.g., "Is your phone up-to-date?"), or leveraging social proof mechanisms that reduce perceived exposure when interacting. These considerations are critical if PSUIs are to transition from niche prototypes to reliable vectors for everyday security behaviors. Future work should explore adaptive and context-sensitive display concepts that dynamically adjust engagement strategies depending on setting and audience. Beyond smartphone updates, similar principles could be applied to other security or digital literacy topics, broadening the scope of public display use.

8 Conclusion

This work presents the potential of interactive public displays to foster security-relevant behavior through concise, actionable guidance in everyday environments. Using *SmartUpdate* as a case study, we empirically evaluated the concept of *Public Security User Interfaces* and identified key design and contextual factors that influence engagement and effectiveness. Our findings show that attention capture remains the primary challenge for educational public displays. External conditions, such as location, spatial placement, and visual prominence; strongly shape whether passers-by notice and approach a display. At the same time, internal design choices, including clarity of content and stepwise interaction flow, determine whether engagement leads to meaningful learning or taking an action. In sum, the results suggest that success depends on the interplay between technical design, contextual integration, and audience-oriented presentation. For future work, this calls for a holistic perspective on public displays that can transform short encounters into teachable moments.

Acknowledgments

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A Pre-Study: Questionnaire

(1) What is your age?
- 18–25
- 26–35
- 36–45
- 46–55
- 56 and above

(2) What is your gender?
- Male
- Female
- Diverse

(3) What is your highest level of education?
- High school diploma or below
- Bachelor's degree or equivalent
- Master's degree
- Doctorate (PhD)
- Other (please specify):

(4) What is your current employment status?
- Student
- Employed
- Self-employed
- Unemployed
- Retired
- Other (please specify):

B Pre-Study: Interview Questions

General Questions

(1) Have you ever interacted with a public display before? If yes, what were your experiences with it?
(2) How familiar are you with software updates?
(3) What is your general experience with software updates?

Usability

(1) How would you describe your experience interacting with the display?
(2) Did you know from the beginning what to do?

Design

(1) What do you think about the design of the program (colors, icons, layout)?
(2) Are the font size, buttons, and icons suitable for easy interaction?
(3) What do you think about the font style?

Content

(1) How useful do you find the information about updates and automatic smartphone updates?
(2) How easy is it to understand the information about updating the smartphone?
(3) Is it easy to follow the content?
(4) What do you think about the questions at the beginning?
(5) What are your thoughts on the smartphone animations?

Feedback

(1) Do you have any suggestions for improving the usability, design, or content of the application?

C Main Study: Questionnaire

(1) **How satisfied are you with the application overall?**
- very satisfied
- satisfied
- neutral
- unsatisfied
- very unsatisfied

(2) **How helpful was the application in guiding you through the provided steps?**
- extremely helpful
- very helpful
- neutral
- not very helpful
- not helpful at all

(3) **Do you think the application could motivate people to take actions?**
- no
- yes

(4) **How likely are you to recommend this application to others?**
- very likely
- likely
- neutral
- unlikely
- very unlikely

(5) **How did the application explain the process to enable automatic update function on your smartphone?**
- very clearly
- clearly
- neutral
- unclearly
- very unclearly

(6) **How did the application explain the process to manually update your smartphone?**
- very clearly
- clearly
- neutral
- unclearly
- very unclearly

(7) **How confident do you feel in enabling automatic update function on your smartphone right now?**
- very confident
- confident
- neutral
- slightly confident
- not confident

(8) **How confident do you feel in manually updating your smartphone right now?**
- very confident
- confident
- neutral
- slightly confident
- not confident

(9) **Would you tell people to check their smartphones for updates now?**
- no
- yes

(10) **How would you rate your knowledge about smartphone usage in general?**
- very poor
- poor
- average
- good
- excellent

System Usability Scale (SUS)

(a) **Please rate how much you agree or disagree with the following statements:**
- I think that I would like to use this system frequently.
- I found the system unnecessarily complex.
- I thought the system was easy to use.
- I think that I would need the support of a technical person to be able to use this system.
- I found the various functions in this system were well integrated.
- I thought there was too much inconsistency in this system.
- I would imagine that most people would learn to use this system very quickly.
- I found the system very cumbersome to use.
- I felt very confident using the system.
- I needed to learn a lot of things before I could get going with this system.

Response scale: Strongly disagree ———> Strongly agree

User Experience Questionnaire (UEQ)

For each pair below, mark your response on a 7-point semantic differential scale.

annoying 1 2 3 4 5 6 7 enjoyable
not understandable 1 2 3 4 5 6 7 understandable
creative 1 2 3 4 5 6 7 dull
easy to learn 1 2 3 4 5 6 7 difficult to learn
valuable 1 2 3 4 5 6 7 inferior
boring 1 2 3 4 5 6 7 exciting
not interesting 1 2 3 4 5 6 7 interesting
unpredictable 1 2 3 4 5 6 7 predictable
fast 1 2 3 4 5 6 7 slow
inventive 1 2 3 4 5 6 7 conventional
obstructive 1 2 3 4 5 6 7 supportive
good 1 2 3 4 5 6 7 bad
complicated 1 2 3 4 5 6 7 easy
unlikable 1 2 3 4 5 6 7 pleasing
usual 1 2 3 4 5 6 7 leading edge
unpleasant 1 2 3 4 5 6 7 pleasant
secure 1 2 3 4 5 6 7 not secure
motivating 1 2 3 4 5 6 7 demotivating
meets expectations 1 2 3 4 5 6 7 does not meet expectations
inefficient 1 2 3 4 5 6 7 efficient
clear 1 2 3 4 5 6 7 confusing

impractical 1 2 3 4 5 6 7 practical
organized 1 2 3 4 5 6 7 cluttered
attractive 1 2 3 4 5 6 7 unattractive
friendly 1 2 3 4 5 6 7 unfriendly
conservative 1 2 3 4 5 6 7 innovative

C.1 Demographics

(1) **What is your age group?**
- 18–25
- 26–35
- 36–45
- 46–55
- 56 and above
- prefer not to answer

(2) **What is your gender?**
- male
- female
- other
- prefer not to say

(3) **What is your highest degree or level of school you have completed?**
- High school or below
- Bachelor's degree
- Master's degree
- PhD
- Other (please specify): _____

(4) **What is your current employment status?**
- Student
- Employed
- Self-employed
- Unemployed
- Retired
- Other (please specify): _____

(5) **What is your field of study?**
- Computer Science
- Health Science
- Mathematics/Physics
- Psychology
- Other (please specify): _____

D Main Study: Interview Questions

General & Usability

(1) How would you describe your experience interacting with the display?
(2) Can you tell me what the application was about?
(3) How do you currently handle notifications about software updates?
(4) How could we improve the first interaction with the application through adjustments in functionality or design?

Visual Design

(1) What do you think about the design of the application (colors, fonts, icons, layout)? What would you change?
(2) Did you find the font size, buttons, and icons easy to use? Were their size and placement appropriate?
(3) Do you feel that the design of the application fits its purpose?

Content

(1) How useful did you find the information about updates and automatic updates?
  (a) Was anything missing, or would you add something?
  (b) Were you able to perform a software update, or was your phone already up to date?
  (c) Was the automatic update function activated on your device?
(2) How easy was it to understand the information about updating your smartphone?
  (a) Were there any unclear steps?
(3) Was the content easy to understand?
  (a) Were any steps too fast or too slow?
(4) What do you think about the smartphone animations?
  (a) Did you find them helpful or overwhelming?

Feedback

(1) Do you have any suggestions for improving the usability, design, or content of the application?

E Interactive Prototype

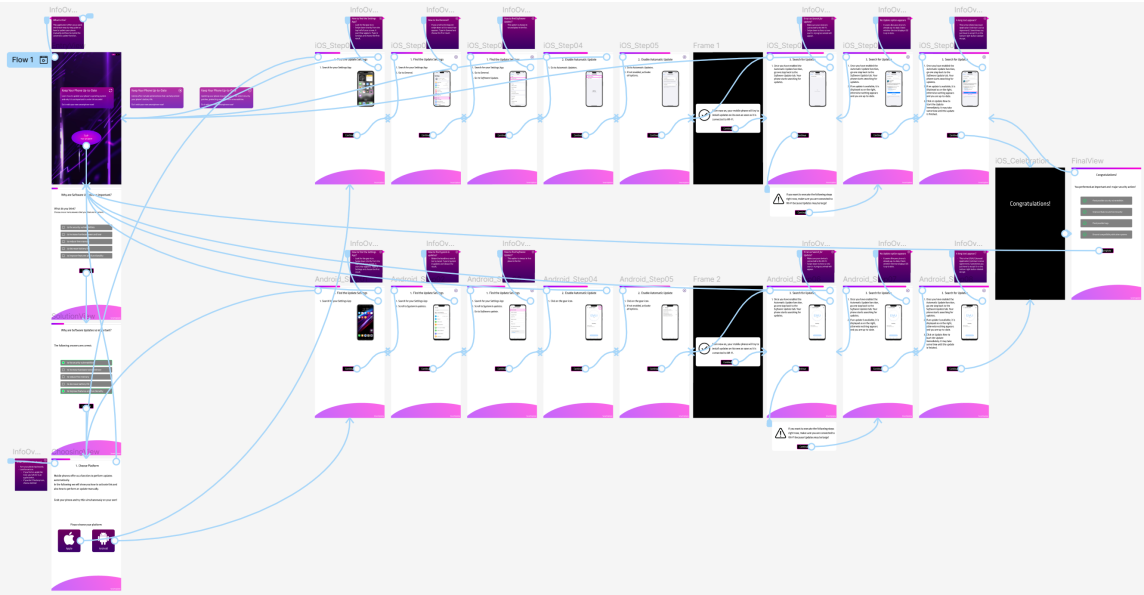

Figure 5: Final version of the interactive prototype with complete click connections.

Figure 6: Underlying components of the final interactive prototype.