Poster: Exploring User Contexts and Needs for Context-aware Smartphone Distraction Management

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ABSTRACT

Interruptions, such as disruptive smartphone notifications or habitual smartphone use, can cause people to make mistakes and reduce their efficiencies in daily contexts. People can manage smartphone distraction by reconfiguring smartphone settings or using limiting tools to avoid such issues. However, it is difficult to manage smartphone distraction proactively according to the user's context. To explore the feasibility of context-aware distraction management, we collected and analyzed user contexts and needs relevant to smartphone distraction. Our results show the heterogeneity of distracting contexts and suggest the opportunity for a rule-based system to provide context-aware distraction management.

CCS CONCEPTS

• **Human-centered computing** → **User interface management systems**; **Ubiquitous and mobile computing**.

KEYWORDS

Context-awareness; Smartphone distraction; Rule-based systems

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1 INTRODUCTION

Smartphones are often distractions. For example, smartphone notifications can deliver interruptive notifications which disrupt users' work (i.e., external interruptions) [4]. People also can be *habitually* distracted without external events due to smartphones' functionalities and the pervasive accessibility (i.e., internal interruptions) [3]. To avoid such distractions, users can reconfigure phone settings such as ringer mode to silence notifications or switch on the Do Not Disturb mode, or launch apps for limiting smartphone use (e.g., Forest). However, manually executing functions or launching the apps whenever necessary is cumbersome and requires explicit efforts, which may not be practical due to a lack of self-regulation [5]. Thus, we can consider leveraging context-awareness to provide users with *proactive* smartphone distraction management.

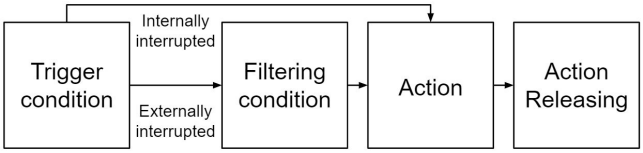

Figure 1: Key components constituting user-generated rules for distraction management

We can possibly consider two directions of system building for context-aware distraction management [1]: (1) Recognition-based system and (2) rule-based system. A recognition-based system integrates sensed context data for context-aware distraction management to interpret whether the user is distracted and automatically provide actions. For this, understanding users' situational contexts where users perceive smartphone distractions is essential. In contrast, a rule-based system allows a user to define contexts where smartphones are distracting and corresponding actions for handling distractions. To develop this system, we need to understand how users want to handle smartphone distractions and provide a framework to allow users to define their needs as a rule. To consider the feasibility of each system, we collected two datasets: (1) in-situ user contexts and corresponding experience of smartphone distractions through a mobile ESM and (2) user-generated rules by asking users to describe how they want to manage distraction. Results showed a diversity of contexts relevant to smartphone distraction and significant inter-person differences in perceiving smartphone distraction. We also found four components constituting distraction management rules (Figure 1). This work addresses the opportunity of context-aware distraction management by supporting a rule-based system with improved expressivity. This poster summarizes our prior work [2] and discusses future research directions.

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2 INVESTIGATING USER CONTEXTS RELEVANT DISTRACTIONS

We developed a mobile ESM app for sampling users' in-situ context (i.e., location and activity) and perceived smartphone distraction (5-point Likert scale) [2]. We conducted field data collection and collected 9,180 ESM responses from 34 participants (10 females; mean age = 22.37, SD = 2.43) during three weeks. We checked data integrity for valid results and removed 49 contradictory cases (e.g., drying hair on the bus). We categorized user contexts into 15 locations and 18 activities by performing the affinity diagramming. We built linear regression models for each participant to identify contexts where participants perceived smartphones are distracting. Figure 2 describes the relationships between the degree of perceived smartphone distractions and contexts, and colored cells denote statistically significant relationships. Orange (Blue) color presents a positive (a negative) correlation with perceived smartphone distraction which means more distracting (less distracting). The darker the color, the stronger the correlation. Results indicate that different participants had different sets of contexts where smartphones were perceived as distracting, and there are significant inter-participant differences in perceiving smartphone distraction even in the same context. Considering individual differences is more critical than just considering users' contexts. There are many user contextual factors relevant to perceiving smartphone distraction, such as states of engagement, which was identified in our earlier work [2]. Therefore, building a recognition-based system for context-aware distraction management may be challenging. This is because the system should integrate abundant contexts far beyond environmental contexts and optimize the model iteratively by receiving feedback relevant to the user's distractions for a long time.

3 INVESTIGATING USERS' NEEDS FOR DISTRACTION MANAGEMENT

We asked participants to describe how they want to manage distraction using a format of trigger-action programming (e.g., "*If I am in a library, silence all notifications*") and collected 216 rules. Then, we drew state diagrams by reviewing the rules one by one to clarify a process of distraction management until the diagram was no longer improved. We identified *diverse* user needs for distraction management and found four critical components for distraction management rules: (1) Trigger condition, (2) filtering condition, (3) action, and (4) action releasing (Figure 1). Trigger conditions are environmental contexts requiring distraction handling (e.g., in a library, taking a class). If internal or external interruptions occur while trigger conditions are satisfied, actions are executed. Whether external interruptions (e.g., notifications) should be handled is checked by filtering conditions (e.g., Where it originated, what topic is related). Actions describe how to handle interruptions (e.g., restraining phone use, muting, or hiding notifications). Action releasing conditions demonstrate when actions will be released. Actions should be released when users no longer need to handle interruptions since most actions are related to restraining smartphone interactions. This result indicates that for providing a context-aware distraction management system, users should be able to generate context rules by defining four components above with improved expressivity to meet diverse user needs.

4 CONCLUSION AND FUTURE WORK

Due to the heterogeneity of user contexts relevant to smartphone distraction, we concluded that a rule-based system is more feasible than a recognition-based system for context-aware distraction management. Also, we suggested a framework for defining context rules for distraction management. Next, we plan to explore how to support the expressivity and essential features within the proposed framework. Then, we will design and evaluate the system to validate the system's usefulness.

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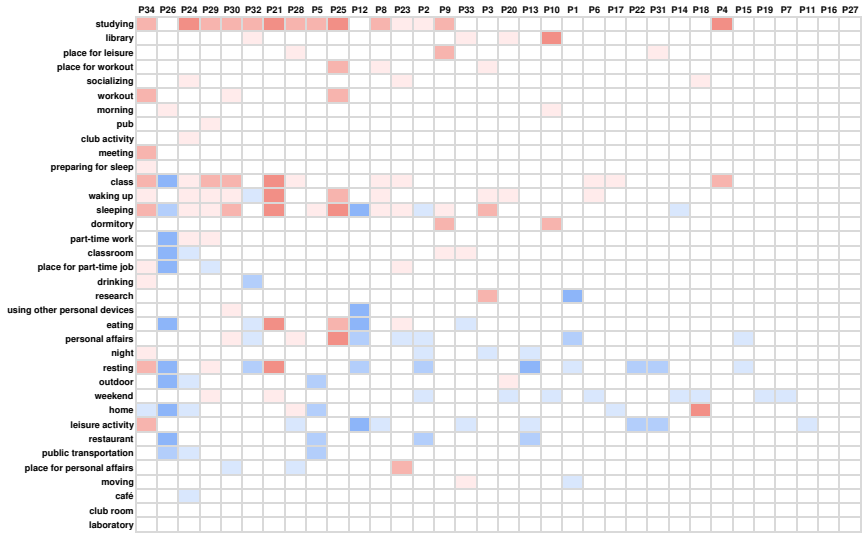

Figure 2: Visualized user perceptions of smartphone distraction in daily contexts