UbiTtention 2017: 2nd International Workshop on Smart & Ambient Notification and Attention Management

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Abstract

In a world moving towards ubiquitous computing, users are increasingly confronted with a tremendous amount of information proactively provided via notifications. Today, notifications are generated by a large number of applications and services, through multiple devices and screens in the users' environment. Thus, human's attention became a significant bottleneck. Further, the latest computing trends with emerging new devices including versatile IoT devices, and contexts, such as smart cities and vehicles, further amplify the challenges. For future computing systems, "attention management", including attention representation, sensing, prediction, analysis and adaptive behavior becomes crucial. Following last year's successful UbiTtention'16 workshop with more than 40 participants, the UbiTtention 2017 workshop brings together researchers and practitioners from academy and industry to explore the managements of human attention and notifications. The workshop considers versatile devices and smart situations to overcome information overload and overchoice.

Author Keywords

Notifications; Attention Management; Ambient Interfaces; Smart Cities; Internet of Things

ACM Classification Keywords

H.5.m. [Information Interfaces and Presentation (e.g. HCI)]: Miscellaneous

Background

In times of an increasing amount of information, human attention becomes a bottleneck. Many ubiquitous devices and services therefore proactively seek peoples attention through *notifications*: visual, auditory, or tactile alerts intended to draw attention to events that took place outside of a user's focus [10]. Notifications are rapidly becoming integral to many ubiquitous computing platforms, such as smartphones, desktop computers, or even cars, and are used by an increasing number of applications and services [28, 35]. Notifications inform us about new social network updates, announce the arrival of new emails, or inform drivers about potential trouble with the car.

Research in different contexts has repeatedly shown that notifications can be distractive, which may cause negative effects on task performance [3, 7, 10, 17, 31]. Since notifications in daily life are often created by messengers and social networks [6, 24, 28], social expectations towards responsiveness create pressure to attend notifications timely. Thus, disabling notifications, despite their known disadvantages, for many people is not an option [10, 17].

Yet, it becomes increasingly exhausting to pay attention and respond to all these interruptions in appropriate ways, especially in the advancing ubiquitous computing with emerging ICT-based contexts, such as IoT, smart cities and smart vehicles. As a consequence, users might miss crucial information and become less efficient or, in case of a missed personal message, appear rude [25]. In addition, the presence of so many different applications and services makes it hard to choose the best and most appropriate one, which can lead to stress and frustration. Eventually, this leads to the problems of *information overload* and *overchoice*—in our opinion two of the most relevant problems in information technology for the next few decades. In the era of the Inter-

net of Things (IoT) we have to handle incoming notifications from all "our" devices as well as "other" devices. Together with developments in smart city environments or with smart mobility the information overload will grow.

Recently, we have been seeing an increase in novel attempts to address these problems by using contextual data in order to deliver notifications at more opportune moments [13, 20, 21, 22, 26], the use of ambient information presentation (see Figure 1) or using augmentation, or by making it easier to deal with interruptions [1]. However, there are significant challenges still remaining to bring these works together and apply the right strategy in the right moment.

UbiTtention 2017 Workshop

The workshop brings together participants from industry and academia who are active in attention research, context-aware and ubiquitous computing, as well as ambient and multi-modal interaction. The main objective of UbiTtention 2017 is to share the latest research on user attention and notification management in across research areas and contexts. These areas include HCI, systems research, user studies, IoT, smart cities, smart homes and smart vehicles (as shown in Table 1). Further, the workshop aims to identify future research challenges, research opportunities, and applications of our research outcomes to the society. The workshop is a follow-on from the successful *Smart-tention, Please!* workshops at MobileHCI 2015 [27][1] and 2016 [34][2], and the *UbiTtention* [33] workshop at UbiComp 2016[3]. Last year, the UbiTtention workshop received 16 innovative papers and more than 40 participants on the venue of UbiComp'16. While the focus of the MobileHCI

Figure 1: This alarm clock uses ambient light to softly wake up its user. We envision that it could also be used as an helpful output device for other information, e.g., incoming phone calls or reminders.

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[1]http://mhci15.smarttention.com/
[2]http://mhci16.smarttention.com/
[3]https://projects.hcilab.org/ubittention/

1. Detection/prediction of users' status around attention and notifications, such as availability, interruptibility, attentional status and cognitive load for interruption
2. Exchanging/sharing, analysis and feedback on such capability above (beyond detection and prediction)
3. Versatile types of information presentation methodologies including ambient, peripheral, distributed and multi-modal presentation
4. Infrastructures, frameworks and tools for the development of smart attention systems
5. Strategies for attention management against emerging computing with IoT devices
6. Understanding users' behavior and habits around notifications and interruption, including longer term "user engagement" and "behavior change"
7. Use of ambient representations for "big-data analysis"
8. Management of information overload in various emerging computing venues such as smart city and smart mobility

Table 1: Non-exclusive overview of workshop topics.

workshops was more on mobile notifications, in this follow-on workshop we focus on a larger understanding of the different roles notifications can play in a wide variety of computing environments including the office, the home, in cars, and other smart environments.

Workshop Papers

The workshop received a substantial number of submissions. After a peer-review process, we accepted 16 submissions for presentation at the workshop. The accepted submissions span a broad range of topics.

A number of papers aims to develop a deeper understanding of the interaction with notifications. Chen et al. look at the effect of personal relationships on interruptibility [5]. Mishra et al. investigate contextual cues [19] and Lander et al. propose to use corneal images to learn more about users' context [15]. Kalanadhabhatta et al. are interested in application overchoice and present preliminary results from a longitudinal study [12].

A number of workshop submissions investigate the perception of notifications. Exler et al. are interested in perceptibility of notifications and the effect of a smartphone's position [8], Mark et al. investigate the effect of blocking distractions [16], and Chang et al. take a closer look what happens in the moment a notification is perceived [4]. Submissions are also concerned with the way information is presented to the user. Pescara et al. explore tactile feedback [23], Kucera et al. propose a calm display prototype [14] and Bolton et al. ask if message previews can help to mitigate interruptions [2].

Accepted papers also aim to develop models that describe the interaction with notifications in different ways. Sarker et al. propose an architecture for a system that manages call interruptions [29] and Tsubouchi & Okoshi describe the analysis of their breakpoint detection model in a large-scale study [32]. Sarker et al. also propose to get a deeper understanding of mobile users' behavior using recency-based models [30] and Ho et al. propose to model engagement for user studies [9]. Submissions are also concerned with the management of notifications. Jalaliniya et al. propose symbiotic attention management in the context of the internet of things [11] and the work by Mathur & Kawsar propose to work towards cognitive awareness by combining context modeling and notifications [18].

Workshop Structure

UbiTtention'17 will be held as a full-day workshop, bringing together researchers from industry and academia. After a round of introductions the workshop starts with a series of informative paper presentations.

Afterwards, we will have an extensive discussion phase in the afternoon. In this session we will productively discuss several topics, that will be proposed to the participants and identified by the organizers based on the workshop paper submissions in advance of the workshop. The possible themes include (but not limited to) (1) further significant research challenges and opportunities, (2) possible collaborative research theme, and (3) expected applications on top of our research outputs and deployment to the society.

In the discussion session, we will first split into small subgroups, which will be asked to come up with answers and solutions to a specific agenda. In the end of the workshop, each group is asked to present their findings, which will then be briefly discussed and summarized. The workshop will conclude with a wrap-up session that summarizes the key discussion points, and which will be used to discuss future collaborations and actions.

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