
Studying and Designing for Mobile Social Awareness Cues in Urban Interactions

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Abstract

In making us aware of the experiences and actions of others while on the move, mobile social awareness cues have the capacity to transform and reconfigure our understanding of urban space, and influence our actions within it. These cues range from multimedia content (e.g., geotagged Flickr photos) to multimodal signals (e.g., tactile or audio feedback) that embody meaning to some social effect. In mobile contexts, presenting these cues comes at the cost of sensory and information overload, given already limited user attentional and memory resources. To deal with this challenge, we draw upon three methods (ethnography, urban spatial analysis, psychophysical experimentation) to study how social information is represented in awareness cues and communicated to mobile users, and how this informs the design of non-visual interaction methods that enhance urban interactions.

Keywords

Mobile social awareness cues, urban interactions, route recommendations, urban mobility, multimodal interaction

ACM Classification Keywords

H.5.m Information Interfaces and Presentation: *Miscellaneous*

General Terms

Human Factors, Design, Experimentation

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Introduction

With our cities becoming interfaces for computational experimentation that are intermixed with human activities, we are already confronted with a wide range of digitally augmented information while on the move [12], where much of it relates to the experiences and actions of others. By making us socially aware of other people and their activities, this awareness information has the capacity to not only transform our understanding of the urban spaces we traverse, but also influence our decisions and actions within it. Presenting this awareness information however comes at a cost of sensory and information overload, especially given the already quite limited attentional and memory resources of mobile users [11]. This requires a deeper understanding of the interaction and user experience (UX) such as digitally augmented spatiality affords, especially concerning the optimal encoding and communication of this social information to mobile users at the right place and time.

Theory, Problems and Objectives

Social awareness involves an understanding of the activities of others, which provides a context for our own activities [3]. This kind of awareness is communicated through awareness cues, which are pieces of information that allow the reconstruction of the social situation of others. They range from context-aware phone books that display the status of friends [10], asynchronous editor systems to support coordination and collaboration between shared workspaces [3], location-based social media content (e.g. geotagged Flickr photos) [4], to multimodal feedback cues (cf., [1] that embody meaning to some social effect. For example, the sound and speed of someone typing can notify us that this person is currently engaged in some important activity.

Importantly, social awareness cues require a representational form that can be communicated to mobile users while

keeping attentional and memory load to a minimum. The fundamental problem is how information processing effort required for interacting with these cues can be minimized, while still retaining the essential bits of social information that have the potential to enhance our experience of urban space. One possible solution is to present this social information in multiple modalities, such as audio or tactile cues [8]. The resulting non-visual interaction would confer clear benefits to not just accessibility issues (e.g., supporting visually impaired users), but also support pedestrian situational impairment and awareness [1].

To understand the potential of social awareness cues in mobile contexts, their encoding and afforded multimodal interaction, and their influence on urban interactions, we defined the following research objectives: 1) investigate and analyze the contextual factors involved in social multimedia content made at urban spaces (e.g., social presence, Point-of-Interest recommendations, etc.) and how they form social awareness cues 2) evaluate how user-generated social awareness cues in urban spaces transform our urban mobility experiences 3) investigate multimodal encoding and afforded multimodal interaction with social awareness information that optimizes and enhances urban human-computer interaction.

Methodology

To achieve the stated objectives, we use three distinct methods: a) ethnography b) urban mobility analysis and c) psychophysical experimentation. Ethnographic approaches form part of the embodied interaction approach to HCI which underscores the importance of both physical presence in the world and observation of embedded webs of practice within it over a period of time [2]. Urban mobility analysis uses an analytic approach that involves computational modeling and algorithmic experimentation that provides a structural understanding of urban mobility [9]. Finally, psychophysical ex-

perimentation relates to sensory and perceptual laboratory-based usability testing [7], where the aim here would be to tease out perceptual properties and limits of multimodal interaction with social awareness cues.

We employ both quantitative and qualitative methods to more fully study and design for the UX of interacting with social awareness cues. This encompasses both high-level analytical approaches as well as controlled empirical inquiry that reduces the problem space down to a few measurable variables. The need for multidisciplinary methods is especially relevant to the study of social awareness cues: on one hand, urban spaces become an experimental testbed that require analytical methods to unravel the structure of interaction behavior of communities and their relationship to social awareness cues, and on the other, individual interaction with these cues needs to be understood, from observed behavior to usability factors involving multimodal interaction in controlled settings. Below we describe our previous, current, and future efforts in studying and designing for mobile social awareness cues.

Previous, Current and Future Work

As a first step toward studying social awareness cues, an ethnographic diary study was carried out to investigate contextual factors involved in location-aware multimedia messaging [4]. We acquainted participants with a location-aware messaging prototype that allows creating multimedia content (text, drawing, photographs) and analyzed their subsequent diary-based multimedia production behavior for one week. We found that the most common use for the prototype was to leave messages to make others aware of something in the environment (e.g., recommendations of what to buy in a cafeteria). In short, participants were creating social awareness cues, disguised under brief textual statements and photos.

Looking closer at user interaction with these messages, we found they serve as triggers for playful experiences [5], which influence how people perceive a given location. However, the most important finding was that users do not always want to view this content while on the move, but rather receive meaningful notifications in accordance with their current context. From this initial study, three things became clear: first, social awareness cues can take multiple media forms, from user-generated content to multimodal signals. Second, they have the potential to transform our understanding of urban spaces (e.g., through playfulness). Third, urban experiences involve more than just interaction within digitally augmented locations, but straddle entire journeys that relate multiple locations together.

To investigate the last aspect of relating multiple locations together, we reasoned that the mobility behavior of people in a city, obtained through social media content services (e.g., Flickr¹), can provide awareness cues that socially inform what others are doing in a city. In line with our concept of social awareness cues, we made use of user-generated geotagged photos (obtained through Flickr) in Amsterdam to present interesting routes traversed in a city. However, we needed a method that not only captures the nuances of where people have been, but importantly, in what order they have been there, and to what extent these people's movements paralleled the movements of others. To do this, we used the bioinformatic methods of sequence alignment, which are well suited for capturing the sequential nature of human activities across space and time [6]. First results showed social awareness cues in the form of route recommendations can indeed be generated from the thousands of geotagged data digitally populating a city. Additionally, it provided us with a platform to further study individual interaction with this type

¹<http://www.flickr.com/> ; last retrieved: 23-03-2011

of social awareness cue, namely, route recommendations.

To study the interactional aspects of processing social awareness cues when mobile, we narrowed our research scope to multimodal and crossmodal feedback in mobile social interaction. Currently, we are investigating the potential for audio and vibrotactile feedback (and their redundant crossmodal mappings for visual information encoding [8]) to synergistically enhance the user experience of interacting with social awareness cues. By employing the different amodal parameters of audio and tactile signals (e.g., rhythm, duration, waveform), it becomes possible to represent a wide range of social awareness information. Here, empirical investigation will test both whether the meaning of these socially-imbued signals can be interchangeably and effectively disambiguated in a mobile context, and how these processed signals restructure our perception of urban spaces. Our future work will focus on fusing together the multimodal signal representations of social awareness cues into the route recommendation platform. This will facilitate the study and design of non-visual mobile interactions in urban mobile contexts, but importantly lead to a set of behavioral and design guidelines that optimize and enhance mobile social and spatial interactions.

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