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Presenting social media information on mobile devices using multiple contexts

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Abstract

Purpose – Research has shown that when presenting large amounts of social media information on small devices, design should consider multiple contexts which include user preferences, time, location, environment and so on. It should also take into account the purpose of use, for example, the kind of tasks undertaken by users. However, little research has been done on the organization of social media information by multiple context and tasks. The paper aims to discuss these issues.

Design/methodology/approach – Using tourism as a domain, the authors conducted a user evaluation study with a prototype to investigate users' preferred ways of organizing different types of social media information based on multiple contexts.

Findings – In this paper, the authors present a sequence of context types for organizing four types of social media information (recommendations, events, friends and media elements). The study revealed that users preferred to view recommendations by location and environment context, events by location and temporal context, contacts by location and identity context and finally, list of media elements by environment and identity context.

Research limitations/implications – There may be different sequences of context types for organizing social media information in domains other than tourism. Researchers are encouraged to analyze users' needs in other domains so as to find their preferred ways of organizing social media information.

Practical implications – This paper includes implications for the design and development of user interface, in particular, for mobile applications presenting large amount of social media information.

Originality/value – It presents a new way of organizing social media information using multiple context types and with consideration of users' needs.

Keywords Social media, Context, Information organization, Mobile application design, User interface design

Paper type Research paper

Introduction

Many research studies (Walsh, 2012; Kang *et al.*, 2010; Kuschnig *et al.*, 2010) have looked into breaking down and displaying information in chunks to improve readability and provide easy navigation on the small screens of mobile devices. Such chunked information should be clear and concise. This is consistent with mobile user interface design guidelines which propose to organize chunks of information in a top-down hierarchy so that users are presented with high-level information and can decide whether or not to retrieve detailed information (Hurst and Darzentas, 2012).

Hierarchical chunking facilitates better organizing and easy retrieving of information (Burigat and Chittaro, 2013; Hinze *et al.*, 2009; Steinberg and Brehm, 2010). Mobile applications also chunk and display content from the content providers' perspective so as

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to allow reusability and sharing of content among people (Nath, 2012; Cheung *et al.*, 2007; Ummi *et al.*, 2009). In addition, according to Albers and Still (2011), appropriate chunking of information can help to improve the overall impression of content and its readability when displayed. DiMarco (2010) emphasized that information should be chunked and arranged to inform users and to improve usability.

Existing mobile applications chunk information differently. For example, SocialSearchBrowser, a social networking application, chunks their information by temporal context. It displays friends' messages sorted by posted date (Church *et al.*, 2009). There is also a social recommender system which chunks recommendations by location or identity contexts (Barranco *et al.*, 2012; Biancalana *et al.*, 2011). Users can choose to view the recommended sites by location so that the sites near to them will be shown first as opposed to those further away. The users can also choose to view the recommended sites by importance, which involves ranking based on the users' settings such as their interests.

In addition, Bawden and Robinson (2009) have noted that the information environment has changed with the introduction of social media. Social media information comes in a large variety of forms and sources. This information is mostly user-generated content and is posted directly by users. Therefore, the chunking of this information is no longer controlled by developers or service providers; rather it is determined by users' social need and depends on the tasks that they are performing.

While research suggests that information chunking is a good technique to display a large amount of information on mobile devices, there are still concerns about presenting chunked information (Burigat and Chittaro, 2013). Users find it hard to browse a large amount of high-level information using small screen displays. They also find it difficult to navigate using the limited mobile user interface features in order to access more detailed content (Shneiderman, 1996). In addition, mobile applications tend to chunk their information by only one context, forcing their users to view information in a restrictive way (Church *et al.*, 2009; Barranco *et al.*, 2012). According to Li *et al.* (2010), it is necessary to consider multiple context sources when designing context-aware applications. Chunking of information based on a single context is insufficient. The granularity of information chunks would directly affect the usefulness of the information (Demian and Balatsoukas, 2012) and should depend on the type and context of use (Ally, 2005). By considering multiple contexts and contexts of use, users can specify their preferred ways of viewing the information (Ahmadi and Kong, 2012).

The study addresses the research question on how to improve user satisfaction in viewing social media information on mobile devices. Techniques for presenting social contextual information on mobile devices according to the preferences of users will be proposed. This is achieved through the examination of multiple contexts and tasks associated with mobile devices. We have chosen tourism as the domain of study because while there is much innovative work in the area of mobile tourism, research is still needed to provide pointers on how to organize and present contextual information in this field (Park *et al.*, 2012; Bergamaschi *et al.*, 2010). The behavior of tourists, for example, interacting and exchanging information actively with their social contacts during their trips, make the field of tourism a good basis for our work (Brown and Barkhuus, 2007). Equally important is the fact that social media has become an important source of information for tourists (Xiang and Gretzel, 2010). With the increase in adoption of social networking services, it is important to consider social media information when designing mobile tourist applications (Majid *et al.*, 2013; Kumar *et al.*, 2010).

Related work

This section describes existing work on the organization of information and different ways of chunking it.

Organizing information hierarchically

New user interface design techniques for organizing information hierarchically were studied by Park *et al.* (2012). Their research organized tourists' tasks and tourist information into two ontologies. The task ontology includes relationships between concepts such as accommodation, transportation and so on, as well as activities such as searching, comparing and recommending. The domain ontology includes tourist information about hotels or places of interest. They proposed a hierarchically organized menu and sub-menus. The main menu showed a list of concepts (e.g. accommodation) extracted from the task ontology which would trigger a sub-menu that showed the relationship (e.g. searching for accommodation). This sub-menu would in turn trigger another sub-menu that would show the extracted results from the domain ontology (e.g. a list of hotels).

Kenteris *et al.* (2009) proposed guidelines which included avoiding scrolling and using clear and consistent menus. They emphasized that information presented on mobile devices should be kept short and concise so that it takes little effort to interact with the application and suggested that information should be presented in a hierarchical multi-level structure so as to facilitate easy searching and browsing. The keywords and summary of the information should be displayed first and then the details later so that the users can easily understand it. This is consistent with the design guidelines of Shneiderman (1996), which described a three-step information seeking strategy; namely, overview first, zoom and filter and details-on-demand. The hierarchical information structure was also adopted by Ziefle (2010) who highlighted that good user interface design should allow comparison and cognitive discrimination between various hierarchical menu items. Their study proposed a sizeable preview with one function and large font size (12 pt) for menu options at a higher hierarchical level and five functions and smaller font size (eight pt) for menu options at the lower hierarchical level.

Chunking and organizing of information by context

Dolk *et al.* (2012) reported that users, while having to handle large amounts of information, find it difficult to access relevant information or make decisions about what to read. In response to this challenge, research suggested that information should be presented on mobile devices based on usage context, and should not be done simply by miniaturizing existing web pages (Schneider *et al.*, 2010). Existing works have categorized contextual information in tourism by context. Emmanouilidis *et al.* (2013) compiled a taxonomy of contextual information adopted by existing mobile tourist guides. They classified the information into five categories. They placed tourists' personalized information in the user category and technological limitations such as device configuration in the system category. They also placed ambient and surrounding information into an environment category and collaborative setting between tourists and people around them into a social context. Finally, the functionalities provided by mobile guides are placed in the service context.

As highlighted by Emmanouilidis *et al.* (2013), the most predominant category is the user context probably because users are at the center of personalized services. The personalization can be achieved by considering the preferences set by the users.

These preferences are pre-existing profiles which are used to adapt the content and services provided by the mobile guides. In the design of these mobile guides, these authors consistently placed contextual information about users in the same category. Feng *et al.* (2004) placed their contextual information about users in a "user-centric context". Hinze and Buchanan (2005) and Levandoski *et al.* (2010) unanimously placed contextual information about users under the "user context". Pires *et al.* (2010) and Park *et al.* (2009) placed them under the "profile context" and "tourist context," respectively. Feng *et al.* (2004) sub-divided their user-centric context into background, dynamic behavior, physiological state and emotional state categories. Hinze and Buchanan (2005) sub-divided their user context into static and fluid divisions. Static user information included such items as user interests and background while Fluent user information included such things as time, location and the direction of the user. Likewise, Levandoski *et al.* (2010) and Pires *et al.* (2010) also sub-divided their user context into static and dynamic data. Static data included information such as name, birthdate, income, profession and age. Dynamic data included information such as traffic, weather and current user location, at home and at office.

Chunking and organizing of information by semantics

With the widespread use of mash-ups, web pages are now frequently made up of visual blocks extracted from other sites. Harper *et al.* (2013) worked on chunking these web pages by visual blocks through the analysis of the document object model (DOM) structure. Web pages are chunked into parts and presented as thumbnails using semantics in the form of HTML tags. Kang *et al.* (2010) analyzed the nested HTML tags so as to segment web pages into parts. These tags carried meanings in terms of color, text font and size of the pages. They structured the web page into a DOM tree. Some nodes might consist of HTML tags, while others consist of pure content. Their work suggested that each node with pure content would be a target for further analysis and encoding of content. Funabiki *et al.* (2010) proposed that the web page could be divided based on its layout by analyzing the XHTML and CSS code. They suggested that these parts of the web page could be adjusted dynamically to fit the browsing devices' window size. The flow of the parts and font size used could be adapted so to achieve readability on different screen sizes.

It is interesting to note that all of the above chunking and organizing methods have adopted the hierarchical design approach because this allows for the expansion and easy addition of new context types and properties. This is consistent with the findings from Delort (2010) who suggested a tree structure to organize clusters of spatial data in interactive maps. This review also shows different ways of organizing information based on a single context type such as user profile or location (Levandoski *et al.*, 2010; Pires *et al.*, 2010). Such organization methods allow easy searching and retrieving of information and are designed to support backend system architecture (Park *et al.*, 2012). The present study focusses on organizing information for better presentation on the front end of the system. While research has been done to chunk content based on HTML tags and CSS code, these works focussed on breaking down and organizing existing web pages (Harper *et al.*, 2013; Kang *et al.*, 2010). This study, however, focusses on content which is gathered from the users and has yet to be organized. These existing works also explore the use of automatic content analytic techniques to chunk content whereas this research develops a user interface technique to organize and present chunks of content so to adopt the user-centered approach by considering preferred ways of viewing content. This present study addresses these gaps as we seek to

understand how tourists would like to view social media information during information seeking while on the move.

Method

Our prior research revealed that tourists frequently used social media information during tour planning, information comparing, information validating and information sharing stages (Tan *et al.*, 2009, 2012). Through a diary study and survey, our previous work found that social media information commonly used by tourists included the list of events, recommendations, media elements such as photos, video clips and information about friends. This study adopted these four types of social media information to investigate ways of organizing social media information using multiple contexts.

User evaluation using prototypes

A study was conducted to uncover users' preferred ways of chunking and viewing these four sets of social media information. The evaluation was conducted by giving users a choice of screen designs that presented different ways of chunking information through the prototype. E-mail invitations were sent to post-graduate classes in a local university. The invitations sought people who had travel experience (at least once a year). The participants were screened to ensure that they had experience in using smartphones. The selected participants were offered $10 as an incentive. There were 101 participants and the evaluation sessions were conducted in a classroom setting. In total, four sessions were conducted with between 24 and 26 participants each. Each session lasted about two hours. Out of the 101 participants, 51 (50.5 percent) were female and 50 (49.5 percent) were male. Their ages were between 18-25 (58.4 percent), 26-30 (26.5 percent), and 31-35 years old (15.5 percent). The participants normally travel alone or with their family and friends. They would communicate mostly with those people travelling with them, but also with new friends who were in the same tour group. They also communicated with people they met at places of interest, for example, passers-by and service personnel at information counters. In the evaluation, the participants were required to compare the screens and indicate their preferences.

In order to present these screens in a simple and easily understandable way, a scenario-based approach was adopted (Korn and Zander, 2010). Four tourist-related scenarios were designed to describe situations and tasks that the tourists had to execute. These tasks required the participants to make use of four categories of social media information. Through the scenarios, the participants had to evaluate the 16 screens for each of the four types of social media information. As an example, one of the scenarios described that during their tour, participants had to plan for an activity that would fit into their current agenda based on recommendations by others. The participants were to select their preferred screen to help complete their task. In the prototype, the screens were clearly labeled by screen numbers. For example, the screens showing recommendation information were labeled from R1 to R16 and the screens presenting a list of friends for communication were labeled F1-F16. The participants had full flexibility to view the social media information chunked and organized by different combinations of context types. They could also back track to the menu page to select a different screen so as to make comparisons. A short tutorial was also conducted so the users would know how to use and navigate the prototype. In the evaluation, the participants were given a form which only required them to fill in the screen number of their first, second and third choices for each of the four scenarios. At the end of the evaluation, the forms were collected and their choices were compiled and analyzed.

Prototype screen designs

The prototype consisted of 16 screens for each type of social media information. Out of these 16, four screens were based on the temporal context presented in a calendar view (iPhoneCalendar, 2013; SamsungCalendar, 2013). Another four screens were based on the identity context presented in a list format (Appstoreapps, 2013; Professional Networking, 2013). Four screens were based on the location context presented in the map view (Foursquare, 2013). Finally, the last four screens were based on the environment context presented in a table form (Paris Transport Guide, 2013; Google Weather, 2013).

Social media information viewed by the temporal context was presented in the form of a calendar because it is the most commonly used format when viewing information related to time (Asif and Krogstie, 2011). For example, the calendar view is used in the popular Apple iPhone (iPhoneCalendar, 2013) and Samsung Phone (SamsungCalendar, 2013) for managing events and personal agendas. Social media information viewed by the identity context was presented in a list because most mobile social network applications show friends in the form of a list. In popular social networking sites such as Myspace (Appstoreapps, 2013) and LinkedIn (Professional Networking, 2013), the members were shown in a list. A map interface was used when viewing social media information by the location context because it is a widely adopted format in location-based mobile applications (Rehrl *et al.*, 2012). There are also many existing commercial products that use maps to show nearby services (Foursquare, 2013). Finally, social media information viewed by the environment context was shown in a table format. This is because in most mobile applications environmental information such as weather forecasts (Google Weather, 2013) and train arrival times (Paris Transport Guide, 2013) are shown in the form of tables. A sample screen of the social contextual information shown by the environment context is shown in Plate 1.

These 16 screens were linked by navigation menus. The main menu linked up the four categories of features by icons representing each category as shown Plate 2(a). In order for the participants to understand the icons easily, the icon for the category of communication was labeled as "Friends", the icon for the category of recommendation was labeled as "Recommend", the icon for the category of planning was labeled as "Event", and finally, the icon for the category of sharing was labeled as "Sharing".

There were also other features such as maps, search function and tour agenda in the menu to make the prototype more complete and feel more like a mobile tourist application. By selecting one of the icons for a context-sensitive feature, the participants were presented with another menu. The menu consisted of icons to view the social media information by the context type, as shown in Plate 2(b).

The first row of icons allowed the participants to select and view the information by the first context type. The participants could further select the icons in the second row to decide on the second context type. For example, if the participants wanted to view the information by the temporal and environment contexts, they selected the "Time" icon in the first row and the "Environment" icon in the second row. By selecting the icon "Confirm selection", they viewed the list of recommendations by the temporal and then followed by the environment context. If participants selected the icon "Time" from the first row and the icon "None" from the second row, they viewed the list of recommendations by the temporal context only.

When conducting evaluation on mobile devices, there might be confounding effects due to differences in look and feel between different device platforms. To mitigate this

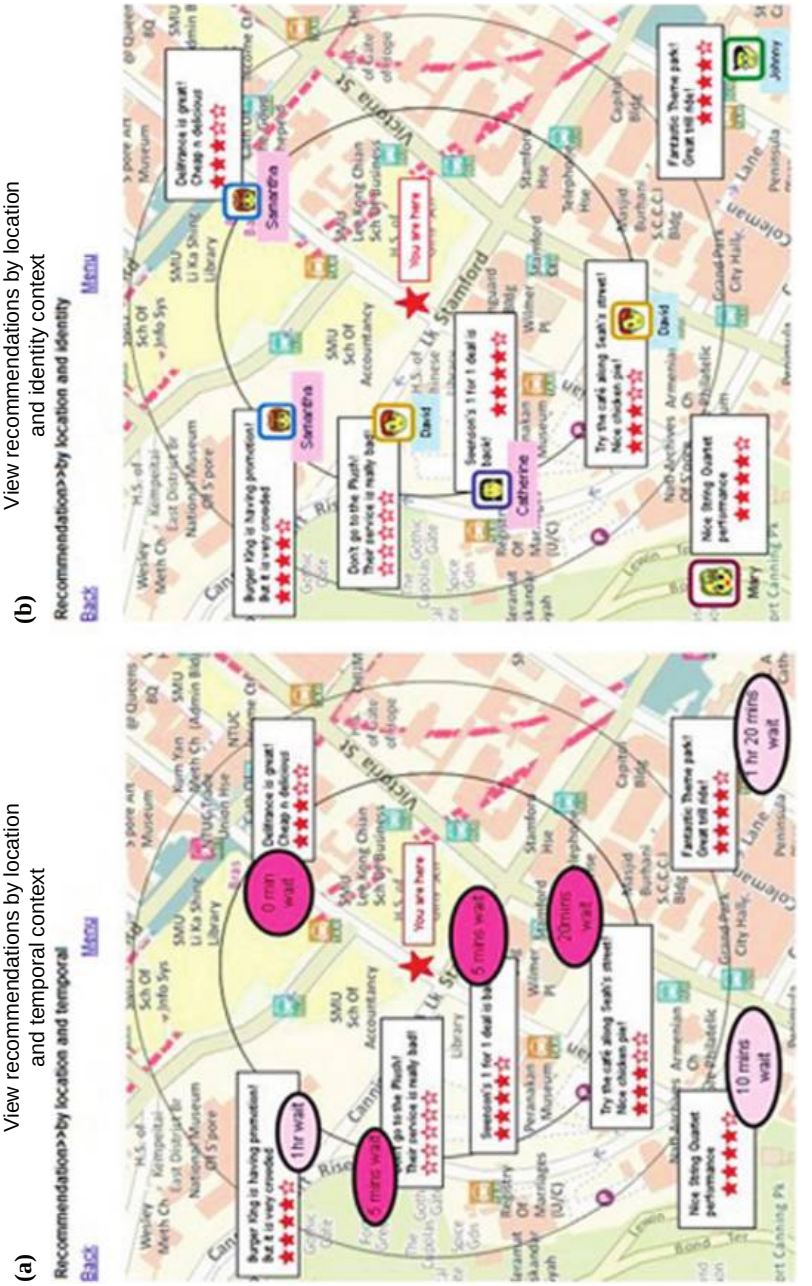

Plate 1.
Sample screen that presents social contextual information by the environment context

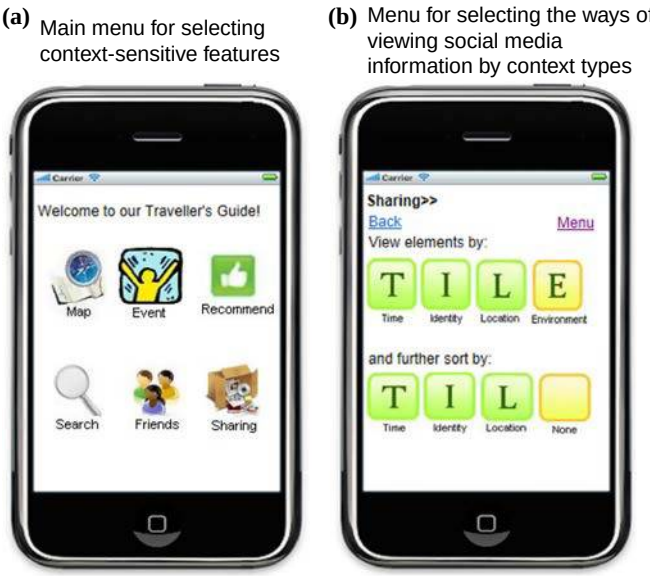

Plate 2.
Menus in the prototype

effect, the prototype user interface was designed to allow user interactions only through the touch screen. Therefore, it is independent of the different keypads and softkeys on different mobile devices. The prototype was a mobile web application; hence, the overall navigation was based on standard back and forward links available on all mobile browsers. Participants used only Apple iPhone or HTC Desire to view the prototypes. Both Apple iPhone and HTC Desire are popular models of smart phone (Nielson Wire, 2011; PC Advisor, 2011). They have similar functions such as web browsing capability and specifications such as screen size and touch screen display (T3, 2011). Hence, the look and feel of the prototype user interface was the same on both smartphones, as shown in Plate 3. To ensure that the study was conducted on a uniform platform, participants were not allowed to use any other device, laptop or desktop, for the evaluation.

Findings

The findings from the study are presented in charts showing the accumulated score which was computed based on the total number of participants who selected a particular screen as their first, second and third choices. This facilitated the ranking of choices in our work. The accumulated score for evaluation is also consistent with that used by Chen and Chen (2009), who worked on evaluating the outcomes of online learning using mobile devices. Using the Recommendation category in Table I as an example, we find that during the evaluation, screen R12 (location and environment context) was selected by 48 people as their first choice, 16 people as their second choice and six people as their third choice. In total, 70 people selected it as among their top three choices. These scores are also shown in the chart in Figure 1. The minimum possible score for a screen is zero when it was not selected by anyone as a top three choice. The maximum possible score for a screen is 101 when it was among the top

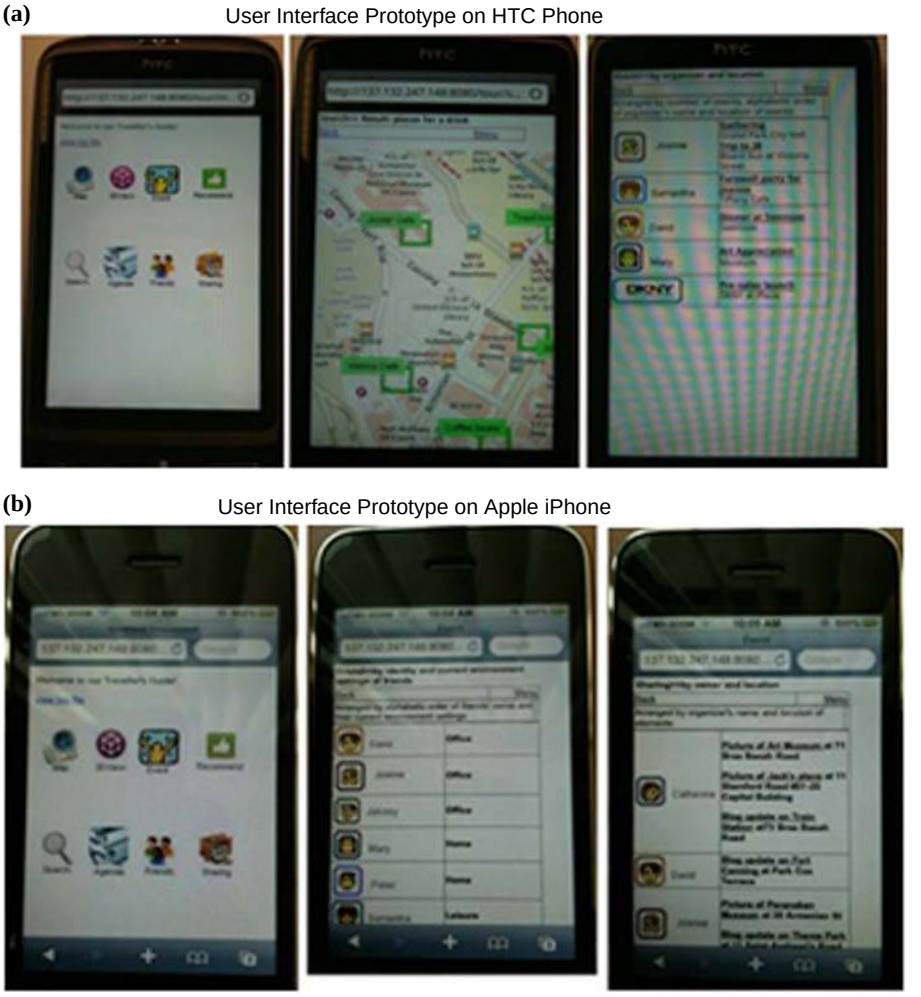

Plate 3.
User interface prototype on phones

three choices of all the participants. The scores are shown in Tables I-IV. The charts are shown in Figures 1-4.

Recommendation category

The participants' preferred screens for the Recommendation category are shown in Figure 1. The screens were labeled as R1-R16 where "R" stands for recommendation as shown in Table I.

The survey results for the Recommendations category showed that Screen R12 (location and environment contexts) was the most preferred way of viewing recommendations (score: 70) as shown in Table I. Screen R11 (location and identity contexts) was the second most preferred way of viewing recommendations (score: 42). The findings reveal that the participants preferred to view social media information in the Recommendation feature, first, by the location context, followed by the environment context.

Screen	Screen title	First choice	Second choice	Third choice	Accumulated score
R1	Temporal only	1	0	2	3
R2	Temporal and identity	1	0	2	3
R3	Temporal and location	2	3	3	8
R4	Temporal and environment	2	5	4	11
R5	Identity only	2	0	1	3
R6	Identity and time	2	4	7	13
R7	Identity and location	9	7	10	26
R8	Identity and environment	3	2	3	8
R9	Location only	2	6	13	21
R10	Location and time	10	10	9	29
R11	*Location and identity*	14	15	13	*42*
R12	*Location and environment*	48	16	6	*70*
R13	Environment only	0	3	1	4
R14	Environment and time	0	5	7	12
R15	Environment and identity	0	3	10	13
R16	Environment and location	0	3	10	13

Table I.
Accumulated scores for Recommendation category

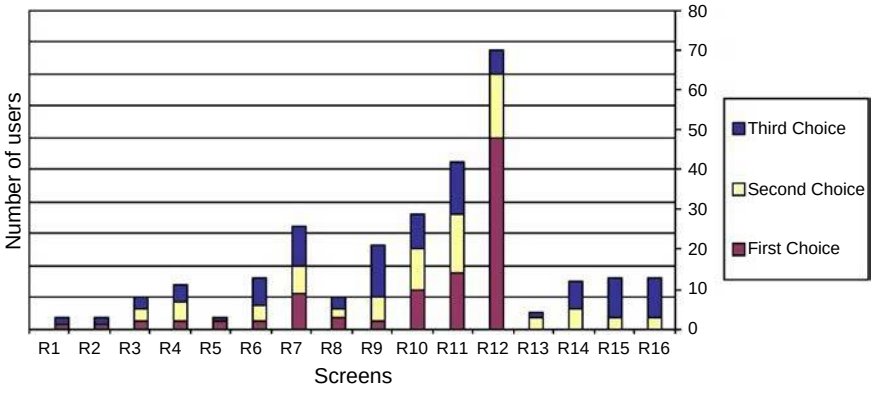

Figure 1.
Users' preferred screens for Recommendation category

Communication category

The participants' preferred screens for the Communication category are shown in Figure 2. The screens are labeled as F1-F16, where "F" stands for friends, as shown in Table II.

The survey results show that Screen F11 (location and identity contexts) is the most preferred screen (score: 76) as shown in Table II. The survey also showed that Screen F15 (environment and identity contexts) was the second most preferred screen (score: 47). Therefore, the findings show that participants preferred to view social media information in the Communication category, first, by the location context and then by the environment context.

Planning category

In the Planning category, the screens were labeled as E1-E16 where "E" stands for events as shown in Figure 3 and Table III. Screen E10 (location and temporal contexts) was the most preferred screen (score: 41). Screen E6 (identity and temporal contexts) was the second most preferred screen (score: 38).

Screen	Screen title	First choice	Second choice	Third choice	Accumulated score
F1	Temporal only	0	0	0	0
F2	Temporal and identity	2	1	3	6
F3	Temporal and location	2	0	4	6
F4	temporal and environment	0	0	2	2
F5	Identity only	1	0	1	2
F6	Identity and time	4	1	6	11
F7	Identity and location	7	14	14	35
F8	Identity and environment	8	11	6	25
F9	Location only	0	2	4	6
F10	Location and time	7	8	4	19
F11	*Location and identity*	36	27	13	*76*
F12	Location and environment	8	10	11	29
F13	Environment only	0	0	3	3
F14	Environment and time	3	4	3	10
F15	*Environment and identity*	16	16	15	*47*
F16	Environment and location	7	7	12	26

Table II.
Accumulated scores for Communication category

Screen	Screen title	First choice	Second choice	Third choice	Accumulated score
E1	Temporal only	1	1	1	3
E2	Temporal and identity	5	3	3	11
E3	Temporal and location	8	4	8	20
E4	Temporal and environment	4	1	5	10
E5	Identity only	3	1	1	5
E6	*Identity and time*	13	12	13	*38*
E7	Identity and location	9	10	8	27
E8	Identity and environment	3	5	7	15
E9	Location only	0	2	4	6
E10	*Location and time*	17	10	14	*41*
E11	Location and identity	10	18	9	37
E12	Location and environment	11	8	13	32
E13	Environment only	1	1	0	2
E14	Environment and time	8	13	6	27
E15	Environment and identity	4	7	5	16
E16	Environment and location	4	5	4	13

Table III.
Accumulated scores for Planning category

Sharing category

The participants' preferred screens for the Sharing category are shown in Figure 4. The screens were labeled as S1-S16 where "S" stands for sharing as shown in Table IV. The results show that Screen S15 (environment and identity contexts) was the most preferred screen (score: 44) and Screen S16 (environment and location contexts) was the second most preferred screen (score: 40).

Discussion

The following sections discuss the users' preferred ways of organizing social media information in each category for better visualization on mobile devices. For the Recommendation category, the score for each way of organizing information ranges from 3 to 70 as taken from Table I. For the Planning category, the score ranges from

Screen	Screen title	First choice	Second choice	Third choice	Accumulated score
S1	Temporal only	0	0	0	0
S2	Temporal and identity	1	3	2	6
S3	Temporal and location	1	0	3	4
S4	Temporal and environment	2	0	1	3
S5	Identity only	1	2	3	6
S6	Identity and time	10	6	9	25
S7	Identity and location	11	14	10	35
S8	Identity and environment	6	8	12	26
S9	Location only	1	1	6	8
S10	Location and time	7	1	5	13
S11	Location and identity	14	13	11	38
S12	Location and environment	10	9	9	28
S13	Environment only	5	1	1	7
S14	Environment and time	3	9	8	20
S15	*Environment and identity*	18	15	11	*44*
S16	*Environment and location*	11	19	10	*40*

Table IV.
Accumulated scores for Sharing category

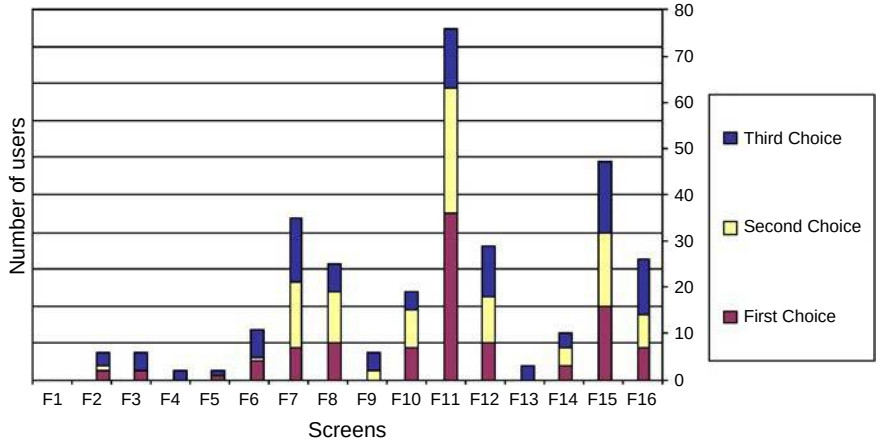

Figure 2.
Users' preferred screens for Communication category

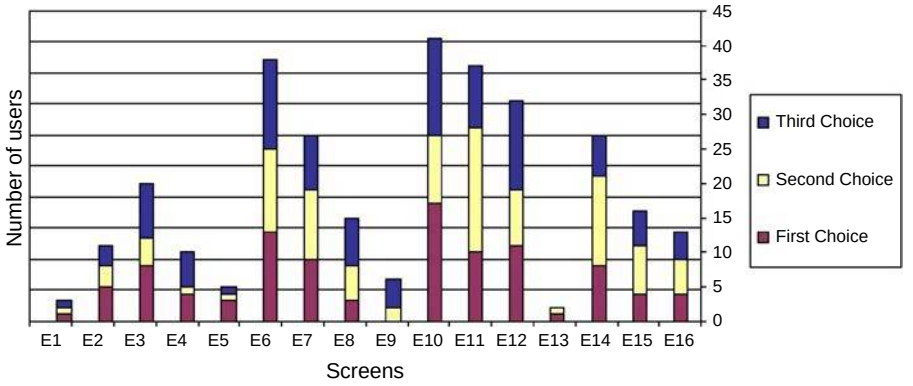

Figure 3.
Users' preferred screens for Planning category

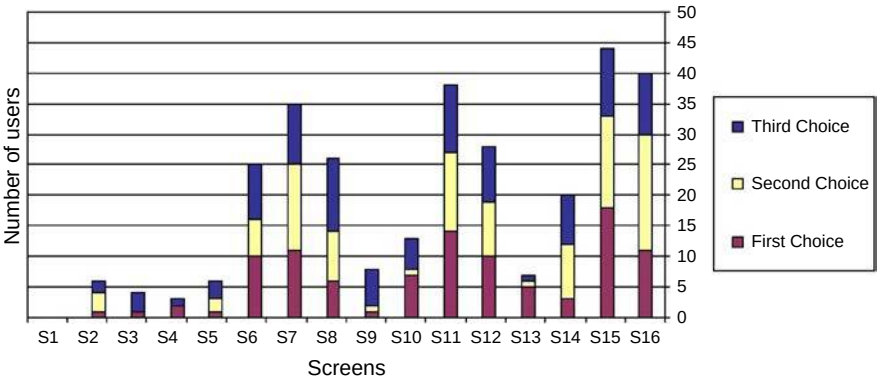

Figure 4.
Users' preferred screens for Sharing category

10 to 41 as extracted from Table III. For the Communication category, the score ranges from 2 to 76 as taken from Table II. Finally, for the Sharing category, the score ranges from 3 to 44 as extracted from Table IV. These scores are then used to construct Tables V-VIII. For each table representing a particular category, the most preferred pair of context types for viewing information is placed as the first choice and classified as the first and second layer of filtering. By keeping the context type of the first layer of filtering constant, the next two context types are included as the third and fourth layers of filtering based on their respective accumulated scores. The same analysis method is then repeated for the second, third and fourth choices for that category.

Organizing information in the Recommendation category

The users' preferred ways of organizing social media information in the Recommendation category is shown in Table V. The accumulated score in the evaluation showed that the

	Organizing of social media information in the Recommendation category by context types			
	First layer	Second layer	Third layer	Fourth layer
First choice	Location	Environment	Identity	Temporal
Screen number	R12 (location and environment)		R11 (location and identity)	R10 (location and temporal)
	Score: 70		Score: 42	Score: 29
Second choice	Identity	Location	Temporal	Environment
Screen number	R7 (identity and location)		R6 (identity and temporal)	R8 (identity and environment)
	Score: 26		Score: 13	Score: 8
Third choice	Environment	Location	Identity	Temporal
Screen number	R16 (environment and location)		R15 (environment and identity)	R14 (environment and temporal)
	Score: 13		Score: 13	Score: 12
Fourth choice	Temporal	Environment	Location	Identity
Screen number	R4 (temporal and environment)		R3 (temporal and location)	R2 (temporal and identity)
	Score: 11		Score: 8	Score: 3

Table V.
Organizing social media information in the Recommendation category

	Organizing of social media information in the Planning category by context types			
	First layer	Second layer	Third layer	Fourth layer
First choice	Location	Temporal	Identity	Environment
Screen number	E10 (location and temporal)		E11 (location and identity)	E12 (location and environment)
	Score: 41		Score: 37	Score: 32
Second choice	Identity	Temporal	Location	Environment
Screen number	E6 (identity and temporal)		E7 (identity and location)	E8 (identity and environment)
	Score: 38		Score: 27	Score: 15
Third choice	Environment	Temporal	Identity	Location
Screen number	E14 (environment and temporal)		E15 (environment and identity)	E16 (environment and location)
	Score: 27		Score: 16	Score: 13
Fourth choice	Temporal	Location	Identity	Environment
Screen number	E3 (temporal and location)		E2 (temporal and identity)	E4 (temporal and environment)
	Score: 20		Score: 11	Score: 10

Table VI. Organizing social media information in the Planning category

	Organizing of social media information in the Communication category by context types			
	First layer	Second layer	Third layer	Fourth layer
First choice	Location	Identity	Environment	Temporal
Screen number	F11 (location and identity)		F12 (location and environment)	F10 (location and temporal)
	Score: 76		Score: 29	Score: 19
Second choice	Environment	Identity	Location	Temporal
Screen number	F15 (environment and identity)		F16 (environment and location)	F14 (environment and temporal)
	Score: 47		Score: 26	Score: 10
Third choice	Identity	Location	Environment	Temporal
Screen number	F7 (identity and location)		F8 (identity and environment)	F6 (identity and temporal)
	Score: 35		Score: 26	Score: 6
Fourth choice	Temporal	Location	Identity	Environment
Screen number	F3 (temporal and location)		F2 (temporal and identity)	F4 (temporal and environment)
	Score: 6		Score: 6	Score: 2

Table VII. Organizing social media information in the Communication category

participants mostly preferred layering the social media information by the location context, followed by the environment context (score: 70).

With the location context as a basis, the next most preferred way of layering the information was to further filter the information by the identity context (score: 42) and then the temporal context (score: 29). It is intuitive for the location and environment contexts to be the two most preferred ways of filtering recommendations, since typically tourists would look at recommendations when deciding what to do and where to go. For example, when deciding on a restaurant, it may be important to search the recommendations by location and then further search the information by the

	Organizing of social media information in the Sharing category by context types			
	First layer	Second layer	Third layer	Fourth layer
First choice	Environment	Identity	Location	Temporal
Screen number	S15 (environment and identity)		S16 (environment and location)	S14 (environment and temporal)
	Score: 44			
Second choice	Location	Identity	Environment	Temporal
Screen number	S11 (location and identity)		S12 (location and environment)	S10 (location and temporal)
	Score: 38			
Third choice	Identity	Location	Environment	Temporal
Screen number	S7 (identity and location)		S8 (identity and environment)	S6 (identity and temporal)
	Score: 35		Score: 26	Score: 25
Fourth choice	Temporal	Identity	Location	Environment
Screen number	S2 (temporal and identity)		S3 (temporal and location)	S4 (temporal and environment)
	Score: 6		Score: 4	Score: 3

Table VIII.
Organizing social media information in the Sharing category

environment context, for example, the ambience of these restaurants. Tourists would further consider the identity context, such as who recommended them and temporal context such as the operating hours of these restaurants. It is also noted that filtering by the environment and location context has the same score as the environment and identity context (score: 13). In this case, the environment and location context is favored since participants most preferred to filter social media information in the Recommendation category by the location context.

Organizing social media information in the Planning category

The most preferred way of organizing social media information in the Planning category was by the location context, as shown in Table VI. The participants liked to further filter the information by the temporal context (score: 41). As the tourists plan their tour route, they would consider the location context such as where would the events be held and the temporal context such as the time and duration of the events. Therefore, in tourist applications location is often used a basic criteria to filter relevant services (Setten *et al.*, 2004).

With the location and temporal contexts as a basis, the next most preferred way of further filtering the information would be by the identity context (score: 37) and environment context (score: 32). In planning, the identity context, for example, the tourists' own agenda would also help them decide if the event will fit into their existing schedule. The tourists might consider the environment context such as the setting of the events. It is surprising to observe that tourists place more emphasis on the location of place and time of events than their own agenda. This is probably because during a tour, the tourists may have very few fixed appointments and consider visiting places of interests their most important tasks.

Organizing social media information in the Communication category

The users' preferred ways of organizing social media information in the Communication category is shown in Table VII. The location context is the most

preferred way of organizing the information. This is probably because tourists would like to find people by the location context such as where are they (O'Hara *et al.*, 2007).

The participants also preferred to filter the information further by the identity context (score: 76), followed by the environment context (score: 29) and the temporal context (score: 19). This showed that tourists prefer to rank the list of contacts by the identity context: who are they and their relationship to the user. This list can be further refined by the environment context, for example, if these people are at work or relaxing. In this way, family members and close friends will be shown at the top of the list with an indication as to their current setting. Lastly, tourists would filter the information further by the temporal context (score: 19) such as the time of the last status update of these people. For the fourth choice, filtering by temporal and location context has the same score as the temporal and identity context (score: 6). Here, temporal and location context is selected since participants most preferred to filter social media information in the Communication category by location context.

Organizing social media information in the Sharing category

In the sharing category, it is quite surprising to see that the participants' most preferred ways of viewing social media information is by the environment context, as shown in Table VIII.

The participants also preferred to filter the information further by the identity context (score: 44). This is probably because tourists might search for photographs and video clips by environment context, for example, using keywords that described their current situation or problem. They might further narrow their search by identity context such as the creator or poster of the information. With the environment and identity contexts as a basis, they next like to filter the information by the location context (score: 40) such as where the photographs are taken and then the temporal context (score: 20) such as when it is taken and when it is posted.

Conclusion

The study proposed to organize the social media information by chunks in terms of multiple contexts such that only an appropriate amount of information would be displayed to the users. This was in order to help present information according to the preferences of the users. The findings proposed a number of sequences for presenting these chunks of information according to participants' preferences. Chunking by context type was suggested for each category of social context-sensitive features. This proposed way of chunking and organizing social media information could be adopted by researchers when designing algorithms to segment content automatically (Lefevre and Vincent, 2010). As an example, when chunking information extracted from web search results, encoding algorithms could adapt the concept of chunking by tasks and multiple context types. In addition, the technique of organizing social media information for display on mobile devices offers additional guidelines for research into mobile user interface design. Designers could present different types of social media information by context type. For example, the list of recommendations can be shown by the location context. When more information has to be displayed, the user interface can further filter the list of recommendations by using the environment context. Depending on the amount of social media information handled by the applications, designers can decide whether to filter the information by one, two or more context types. When creating adaptive user interfaces, the designer can also incorporate the

technique of organizing social media information so that the interface can intelligently and automatically chunk and present the information based on the users' activity.

The proposed way of filtering the information by context types addresses the challenge faced by users when trying to understand a large amount of information and having to view a limited amount of information on a small screen. By allowing users to decide their preferred ways of chunking and presenting information, it also addresses the lack of control users experience over how much information they want to receive. This also avoids overwhelming users with too much information.

This study on organizing social media information was conducted in the tourism domain and based on the preferences of tourists. However, there may be differences in the sequence of chunking social media information by context types in other domains. Therefore, studies can continue to explore the preferred sequence of chunking by context types when presenting such information in other domains. In addition, it is important to consider the history of users' activities and patterns of use when designing applications (Chalmers, 2004). Hence, future research could study how the presentation of the information can adapt to users' past interaction and browsing habits. As an example, if the user frequently browses the screen that displays information on the distance between places of interest and current location, then the next time the user returns to the application, the user interface would automatically filter the information based on this property. The menu and interface could also intelligently adapt to the users' preferred way of viewing information using a voice-controlled interface and audio responses. For example, users could receive a regular audio update on the distance between places of interest and their current location. The use of adaptive user interfaces is consistent with existing findings (Truar and Kuhn, 2012; Bihler *et al.*, 2011) where an intuitive, adaptive user interface can address the challenges in mobile user interface design caused by limited user attention span during application use and the imbalance between the automated system and user-initiated actions. The ability to update users with the latest contextual information using a multi-modal interface, such as audio, could also address the challenge of changing contexts for user interfaces.

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