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Indagator: Investigating Perceived Gratifications of an Application that Blends Mobile Content Sharing with Gameplay

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Abstract

The confluence of mobile content sharing and pervasive gaming yields new opportunities for developing novel applications on mobile devices. Yet, studies on users' attitudes and behaviors related to mobile gaming, content sharing and retrieval activities (referred simply as content sharing and gaming) have been lacking. For this reason, the objectives of this paper are three-fold. One, it introduces Indagator, an application which incorporates multiplayer, pervasive gaming elements into mobile content sharing activities. Two, it seeks to uncover the motivations for content sharing within a game-based environment. Three, it aims to identify types of users who are motivated to use Indagator for content sharing. Informed by the uses and gratifications paradigm, a survey was designed and administered to 203 undergraduate and graduate students from two large universities. The findings revealed that perceived gratification factors such as information discovery, entertainment, information quality, socialization, and relationship maintenance, and demographic variables such basic familiarity with features of mobile communication devices, and IT-related backgrounds were significant in predicting intention to use mobile sharing and gaming applications such as Indagator. However, age, gender, and the personal status gratification factor were non-significant predictors. This paper concludes by presenting the implications, limitations and future research directions.

Keywords: Mobile content sharing, social computing, mobile phone, gameplay, uses and gratifications model

1. Introduction

Mobile devices equipped with wireless networking, cameras, global position systems, and other advanced functionality are increasing in popularity, and this has correspondingly offered new

opportunities for social computing applications to be deployed on them. Put succinctly, social computing applications are those that support social behavior of computations carried out by groups of people, in effect, fostering interaction, content generation and participation among communities of users (Wang, Zeng, Carley & Mao, 2007). In terms of content creation (also known as user-generated content), the portability of mobile devices add a new dimension to social computing in which users can now co-create, seek and share multimedia information anytime, anywhere, and do these in new ways not possible with desktop applications (Goh, Ang, Chua & Lee, 2009). For example, Yahoo's ZoneTag (Ames & Naaman, 2007) provides a service for users to tag photos with location and other information using their mobile phones, and upload them to Flickr easily while CityFlocks (Bilandzic, Foth & De Luca, 2008) is a mobile application that allows users in urban communities to share experiences about their living environment.

In sum, mobile content sharing applications allow users to co-create, seek and share multimedia content such as text, audio and video, socialize anytime, anywhere, and do these in new ways not possible with desktop applications. Despite these benefits, a potential drawback could limit a more widespread acceptance of their use. For example, the motivations for creating and sharing content are mostly intrinsic to users, and may include both social (e.g. getting attention) and personal (e.g. future retrieval) reasons (Ames & Namaan, 2007), utilitarian or opportunistic behaviors (Flanagin & Metzger, 2001), altruism and social exchange norms (Lui, Lang & Kwok, 2002). Likewise, the motivations for retrieving and consuming user-generated may include trust and reputation (Bolton & Katok, 2004; Ridings, Gefen & Arinze, 2002), characteristics of the message (Hong, 2006), and characteristics of the creator, consumer and community (Brown Poole & Rodgers, 2004; Lee, Goh, Razikin & Chua, 2009). Put differently, current content sharing applications only provide limited

extrinsic motivational mechanisms, and are typically confined to viewership counts, content/user ratings and discussion facilities.

Beyond ubiquitous content creation, mobile devices also add a new aspect to play. Mobile games have evolved from casual games such as the popular Snake to sophisticated multiplayer, location-based ones in which players either compete and/or cooperate to achieve the games' objectives within a geographic area set in the real world. Also known as pervasive games, examples include early commercial successes such as Botfighters in which players take on the role of robots and search and destroy other robots within the vicinity, to recent, advanced, experimental games such as TimeWarp (Herbst, Braun, McCall & Broll, 2008) that employ mobile augmented reality to explore the history of a city in Germany by weaving both historical and fantasy story elements.

The confluence of social computing, mobile content sharing, and pervasive gaming yields new opportunities for developing novel, engaging applications for content sharing on mobile devices that can address the lack of extrinsic motivational mechanisms identified above. In particular, a central theme of these new applications is that content is created and shared as a byproduct of gameplay, and the gaming experience becomes an extrinsic motivator for content sharing activities. In addition, many of these games are social in nature, requiring multiple players to achieve the game's objectives. One example of a mobile game for data collection is the Gopher Game (Casey, Kirman & Rowland, 2007). Gophers are agents that represent missions to be completed, and are carriers of information between players. As players move about their physical surroundings, they pick up gophers and help them complete their missions by supplying them with camera phone images and textual content. By helping gophers complete their missions, content sharing among players is achieved since other users may pick up these gophers and view the images and text associated with them. Such games are

inspired by the success of Web-based casual games such as the ESP Game (von Ahn & Dabbish, 2004) and Google Image Labeler that use humans to label images to facilitate future retrieval.

Despite their potential, research in such applications that combine mobile content sharing and gameplay is nascent, and examples are few in number. As an emerging application genre, they have yet to attract sufficient research attention on a number of fronts, including their design and implementation, as well as user experience, perceptions and attitudes. Put differently, research is needed to understand how such applications can effectively blend gameplay into mobile content sharing to motivate such activities, and understand how users perceive and respond to them.

The objectives of the present paper are hence three-fold. The first is to extend current research in mobile content sharing games through the design and implementation of *Indagator* (a Latin word for investigator or explorer). Unlike existing mobile content sharing games which are primarily casual in nature, Indagator introduces multiplayer, pervasive gaming elements set in a persistent virtual world of content exploration. Given the increasing popularity of mobile communication devices, there is a need to understand who are likely to adopt various mobile applications and why they do so (Sarker & Wells, 2003). Our second objective is thus to uncover the motivations for content sharing within a game-based environment afforded by Indagator. This is important for applications design since the best approach starts with understanding end users' desires and needs (Jih & Lee, 2003-2004). To do so, we draw from the uses and gratifications paradigm (Chung & Kim, 2008; Katz & Blumler, 1974), which essentially examines how and why people select specific media to meet their needs or to obtain specific gratifications. This paradigm will be used to explain the psychological gratifications associated with the potential use of mobile content sharing games such as Indagator (Leung & Wei, 2000; Lin, 2002). Studies in this research stream have identified gratifications factors such as "sociability", "instrumentality" and"reassurance" from the use of fixed telephony (Dimmick & Sikan,

1994), "mobility", "immediate access", "socialibity", "information seeking" and " status" from the use of mobile telephony (Leung & Wei, 2000). Our study integrates and extends findings of such past research by identifying appropriate gratification dimensions for mobile content sharing games. Our third objective extends from the second and aims to identify profiles of users that are motivated to use applications that blend mobile content sharing and gaming by focusing on individuals' familiarity with features of mobile communication devices and their demographic profiles (Venkatesh, Morris, Davis & Davis, 2003). Specifically, the present study aims to explore the following research question: *What are the gratification, familiarity and demographic factors that influence potential users' intention to use an application that blends mobile content sharing and gaming?*

The remaining sections of this paper are structured as follows. Section 2 discusses related mobile content sharing gaming applications and our proposed mobile content sharing game. Section 3 presents the theoretical foundations. Section 4 describes the methodology of the study, while Section 5 discusses our findings and analyses. Finally, Section 6 discusses the implications of this work as well as opportunities for future research.

2. Applications that Blend Content Sharing and Gaming

2.1 Related Applications

Applications that combine content sharing and gaming elements first emerged on the Web. Also known as Games With A Purpose (von Ahn & Dabbish, 2008), content is created and shared through gameplay. The ESP Game (von Ahn & Dabbish, 2004) is one of the earlier examples in which two unrelated players are tasked to create matching keywords to randomly presented images within a

given time limit. Points are earned based on specificity of the keywords, and coupled with a countdown timer, these elements add excitement and hence motivation for players. While players have fun with the game, the matching keywords (content) can be used as tags for these images, and if sufficient data is collected, these tags can be used improve the performance of image search engines. Other examples include Google Image Labeler (http://images.google.com/imagelabeler/) which is a variant of the ESP Game, and a suite of games that can be found at the Games With A Purpose site (http://www.gwap.com).

Recently, similar ideas that blend content sharing and gaming have also be found in mobile applications. Two key distinctions between such mobile games and their Web counterparts are that the former are typically locative in nature, allowing players to create and share location-based content, and that they allow anytime, anywhere gameplay. One such example is the Gopher Game (Casey et al., 2007). As mentioned, gophers represent missions to be completed, and are carriers of information between players. The game is location-based and players collect gophers as they move about their physical surroundings. A player helps a gopher complete its mission by supplying it with camera phone images and textual content based on a task description. This information is submitted to a community of judges, and players earn points depending on the quality of the content submitted. Using these points, players can create new gophers and participate in other in-game activities. Through the process of helping gophers complete their missions, content sharing among players is facilitated because other users may collect these gophers and view the images and text associated with them. In MobiMissions (Grant et al., 2007), content sharing is accomplished through the completion of missions, which are defined by sequences of digital photographs and text annotations associated with specific locations. Players create missions for others to undertake, search locations for available missions, and create responses to missions created by others. To complete a mission, a player has to

capture up to five photographs and add up to five text annotations using his/her mobile phone. This content can then be shared with other players. Finally, CityExplorer (Matyas et al., 2008) extends the idea of games for labeling images to the physical world. The game treats a geographic area, such as a city, as a game board which in turn is subdivided into segments or game tiles. Within each segment, players need to label as many points of interest with category names as possible using their mobile devices. Categories are not predefined and players can develop their own. Examples can include general ones such as "food" to specific ones such as "bar" or "cafe". A player who creates the most number of labels in a segment wins credits for that segment at the end of the game.

2.2 Introducing Indagator

Indagator is an application that combines gaming elements into mobile content sharing activities. As its name suggests, the application is modeled after an exploration theme operating in two levels. First, Indagator provides an environment for users to create, share and seek location-based content. An Indagator user may use the application to explore and contribute content within his/her physical surroundings. Second, layered upon this information environment is a game of exploration, in which players navigate their physical world to amass treasure, overcome obstacles, and interact with other players. In sum, Indagator entwines gameplay with the collaborative creation, seeking and sharing of information. The application consists of the facilities for mobile content management, retrieval and discovery, and importantly the game engine that supports our approach to gameplay. In this section, we will first highlight the content sharing aspects of Indagator, followed by the gameplay features that it supports.

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2.2.1 Content Sharing Features

Indagator is fundamentally a location-based mobile content sharing system. The application provides features for creating, sharing and seeking content on their mobile devices, and is modeled after a system known as MobiTOP (Mobile Tagging of Objects and People) (Kim et al., 2009). Briefly, MobiTOP is a mobile annotation system that allows users to create, share and access location-specific multimedia annotations via their mobile devices.

In Indagator, as in MobiTOP, a map-based visualization is supported for exploring and discovering location-based annotations as shown in Figure 1. The map is centered around the user's current location, and annotations within the vicinity are displayed as markers (rendered as pins) on the map. Selecting a marker (shown as through a square cursor in the center of Figure 1) will retrieve the details of its corresponding annotation (see Figure 2). The map also offers standard navigation features such as pan and zoom, common in many Web-based mapping applications.

Individual annotations in Indagator consist of attributes such as title, tags, multimedia content (e.g. images) and textual information. At creation time, other implicit attributes are also captured such as contributor name, location where annotation was created (latitude and longitude), and date. As annotations are user-generated, a rating feature is also provided as a measure of information quality. Here, an average rating score of between one to five, aggregated from users' feedback, is displayed. Figure 2 shows an example of an annotation in Indagator which describes the Esplanade, a major performing arts venue in Singapore. In this annotation, the author provides an image of the location (top of the figure), and names it as the "Esplanade Theatre". A more detailed description is also provided in the annotation's description field and tags (e.g. "architecture", "durian", "theatre") are used to succinctly capture the content of the annotation for future retrieval. For example, clicking on a tag in Figure 2 will show annotations associated with it. Additional annotation access mechanisms in

Indagator include filtering by attributes such as date/time, location and user. A notification system that alerts users of new annotation updates is also supported.

=== Insert Figures 1 and 2 here ===

The current version of the Indagator mobile client was developed using the Java Platform, Micro Edition (J2ME) while the map-based visualization employed the J2ME Map API. The client uses the global positioning system (GPS) feature available in the phone to determine the current location of the user as well as the phone's camera function for capturing multimedia content. The client is currently tested for Nokia N95 8GB smart phones. The use of this particular phone model was to ease development and avoid multiple versions of the client to suit different mobile platforms. Indagator's server is patterned after MobiTOP and more details may be found in Kim et al. (2009).

2.2.2 Gaming Features

Layered upon Indagator's content exploration environment is a set of features that gives users the opportunity to concurrently engage with their content through play. As described, Indagator gameplay is inspired by tales of explorers who navigate unchartered territory in their quest for fame, fortune and adventure. The gaming environment is overlaid upon a player's actual physical surroundings so that interaction with game objects and other gaming features is done within the real world.

Gameplay in Indagator is deliberately designed to be simple to reduce the cognitive overhead of players who are on the go. In essence, players explore their environment to seek content they need, or create new content to be shared with others. As part of the game, their goal is also to amass wealth by interacting with Indagator's gaming features. Thus during exploration, players may engage various encounters, interact with other players, and earn in-game currency. Here, encounters, are the

interactive elements of the application, and can come in the form of mini-games, traps, or treasure. Further, the more currency (and hence the more wealth) a player gains, the higher his/her rank will be, and this is reflected in the game's leader board. Put differently, Indagator may be compared with pervasive, multiplayer games, but unlike these, there are no designated objectives. Instead, Indagator gameplay is open-ended, with the primary purpose of facilitating the exploration and creation of content as players move around in their physical environment. Thus, Indagator is more similar in genre to virtual worlds such as Second Life (http://secondlife.com/), with the addition of gaming elements unique to the system. In the current version of Indagator, these include the following.

Earning currency. Players earn in-game currency (called *aurum*) by enriching the environment through contributing content, rating existing content, or through successful engagement of encounters (see below). Aurum can then be spent on encounters, to acquire game objects and access other game-based features. In addition, the amount of aurum together with the objects acquired during gameplay constitutes a player's total wealth, which will determine his/her ranking.

Setting encounters. When creating content, players have an option to associate an encounter with it, which will be triggered when the content is accessed. Figure 3 shows an annotation with an encounter type and level of difficulty being selected. Encounters are meant to introduce the elements of entertainment and surprise into content sharing and seeking, and include mini-games, traps or treasure:

- Mini-games are primarily casual in genre and may include puzzles, shooting and board varieties, among others. Such games may be contextual in nature, such as a guessing game that present clues about a nearby attraction for the player to solve, or non-contextual, as in the case of a shooting game. Different games cost varying amounts of aurum, and a player is free to select any based on interest.

- Traps are designed to inflict damage on a player, and in the current version, this refers to aurum lost. That is, a player that stumbles onto a trap may cause him/her to lose aurum to the encounter setter.
- Treasure earns a player some amount aurum. This is system-generated and randomized across content. A player coming upon treasure will result in an increase in his/her wealth.

Setting encounters require various amounts of aurum depending on type and level of difficulty. Indagator may also randomly set encounters on annotations to increase diversity of play and introduce an element of unpredictability.

Engaging encounters. Players who access content associated with encounters will be alerted as such and have the opportunity to engage it. The player will not know the type of encounter until it is engaged. That is, players may choose to engage the associated encounter and earn aurum, or bypass the encounter to continue accessing the annotation with no penalty or reward. The latter was a design decision undertaken to ensure that content access takes priority over gameplay, and that content should not be denied access to those who need it. However, to encourage engagement, players who undertake an encounter receive a small amount of aurum (with the exception of traps), while successful engagements receive more. Figure 4 shows a contextual mini-game type of encounter in which a player is presented with an image and is asked to specify its location within a nine-grid map. Here, images are harvested from nearby content and the system randomly selects one for the encounter. Players who successfully specify the location will obtain aurum.

Socializing. Features that foster socializing among players are implicit within the Indagator content sharing and gaming environments. For the former, features include the creation of annotations, the possible responses to them via reply annotations, and the rating of annotations. In addition, the ability to filter annotations by user allows one to track contributions of friends or those sharing similar

interests. Gaming features that support socializing include the setting and engaging of encounters by players, and ironically, the sense of competition and achievement associated with acquiring wealth and being better ranked than other players (Ducheneaut, Yee, Nickell & Moore, 2006).

=== Insert Figures 3 and 4 here ===

2.2.3 Design Decisions

The design decisions incorporated into Indagator are primarily focused on motivating users to create and share content. Thus, we have adopted the following guidelines, culled from research in a variety of domains:

- *Ease of use*. As described, Indagator's content sharing features are adapted from the MobiTOP system. An earlier study of MobiTOP showed that participants generally rated the application favorably (Kim et al., 2009) in terms of being able to create and view annotations relatively easily. Further, user interface attributes such as the organization of features into tabs, map navigation, and the consistency of design helped enhance learnability and usability of the system.
- *Entertainment as motivation*. While the popularity of social computing services such as Twitter, Flickr and YouTube suggest that people do create and share information, the motivations for doing so are mostly intrinsic to them, and may include both social (e.g. getting attention) and personal (e.g. future retrieval) reasons (e.g. Ames & Namaan, 2007; Hew & Hara, 2007). Indagator introduces an additional impetus for content sharing through the use of gameplay. Thus, the application shares similar ideas with GWAPs and related games on the mobile platform in using entertainment as a motivational factor (von Ahn & Dabbish, 2008).
- *Gameplay control*. Although entertainment is one of Indagator's main components, content sharing, and not gaming is intended to be its primary objective. We have therefore deliberately

designed the application to allow for varying levels of usage of the gaming features, thus catering to a wide spectrum of users. That is, for non-gamers, gameplay can be dislodged from content sharing activities completely if desired, while those interested in gaming could fully explore Indagator's gaming environment. Further, by exploiting the duality of the "player-as-user" and "user-as-player" dynamics (Bell et al, 2006), users lacking the propensity to share information could be motivated to do so.

- *Community support*. In Indagator, we adopt the view that content sharing implicitly supports communities of players, and this was a design decision modeled after other user-generated content environments such as blogs, wikis, and social tagging application in which likeminded users come together to collaboratively create, share and seek information (Golder & Huberman, 2006). Further, competition in Indagator's gaming environment fosters a form of socializing beyond direct support and companionship reported by Ducheneaut et al., (2006). Specifically, gameplay may provide opportunities to interact with an audience of other players by broadcasting one's achievements and status in terms of wealth and gaming prowess.

3. Theoretical Background

3.1 Perceived Gratifications

Recent research concerning mobile content sharing and gaming applications suggests that users do find them entertaining and some useful content can be generated through gameplay (e.g. Casey et al., 2007). Despite these encouraging results, the underlying dynamics that explain why users find gaming and content sharing appealing have not been well explored. Clearly, a theoretically-informed perspective ensures that applications adopting this genre of gaming provide facilities that sustain players' motivations both in creating and retrieving content. Otherwise, such applications are unlikely

to succeed. Thus in our research, the uses and gratifications model (Chung & Kim, 2008; Katz & Blumler, 1974) is employed to study content sharing in a game-based environment. This model was originally developed to examine how and why individuals use and adopt mass media in their everyday lives (Katz & Blumler, 1974). Subsequent studies reveal that mass media are used for the purposes of both entertainment and utility (Flanagin & Metzger, 2001), and that individuals seek gratifications in mass media use based on their needs and motivations (Lin, 1996).

Recently, the scope of such research has been extended to video games, technologies, software and services, although this model has yet to be employed in a context related to ours. For example, early research identified three general gratifications; "sociability", "instrumentality" and "reassurance" from fixed telephony before the widespread adoption of mobile phones (Dimmick & Sikan, 1994). Subsequently, Leung and Wei (2000) studied mobile phone usage through a uses and gratifications perspective with the goal of understanding how people use mobile telephony technology. From an analysis of 417 respondents, major gratification factors included "affection" and "sociability", "immediate access", "entertainment", "reassurance (safety)" and "fashion and status", and these had a strong influence on how the mobile phone was used. Next, Sherry, Lucas, Greenberg & Lachlan (2006) employed the model to examine why people play video games and the types of gratifications they would experience. The findings pointed to six uses and gratifications dimensions including "competition", "challenge, "social interaction", "diversion", "fantasy" and "arousal". Since Indagator combines gaming elements in a mobile content sharing application, we expect users to particularly favor the "sociability", "leisure", and "entertainment" gratifications of mobile games, although they would also appreciate the "information quality" and "information discovery" gratifications for content sharing and retrieval. Hence, the following hypothesis is proposed:

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H1: Perceived gratifications have significant positive effects on intention to use a mobile content sharing and gaming application.

3.2 Familiarity with mobile phone

Generally, familiarity refers to experience with what is happening (Gefen, Karahanna & Straub, 2003). It lessens confusion and builds trust (Luhmann, 1979). As such, familiarity plays an important role in people's judgments and decision-making (e.g. Garcia-Marques & Mackie, 2001; Johnston & Hawley, 1994; Smith et al., 2006). Multiple studies have indicated that people tend to spend less effort to process familiar messages than the same message they encountered for the first time (e.g. Claypool, Mackie, Garcia-Marques, McIntosh & Udall, 2004; Garcia-Marques & Mackie, 2001). Similarly, in educational research, students were found to spend less effort to solve highly similar to previously presented problems as they tend to try to retrieve the answer from their memory (Reder & Ritter, 1992). In relating familiarity with technology use, multiple studies have indicated that when users are more familiar with the technology, their anxiety decreases and their perceptions of self-efficacy related to the use of the technology increases (Bohlin & Hunt, 1995; Todman & Managhan, 1994). This is because the more familiar people were with their materials or objects, the more positive outcomes and attitudes were expected (Winter, 1973). Hence, it is not surprising that Brown and Inouye (1988) asserted that familiarity is an important factor in determining one' s attitudes toward technology as such attitudes will consequently influence one's technology adoption decision (Davis, 1989; Venkatesh et al., 2003). More importantly, past research has also shown that familiarity with different features of the technology has implications on the usage outcome. For instance, Lee et al.

(2009) found that familiarity with different searching features have different influences on the effectiveness of tags created in social tagging systems.

Collectively, these studies indicate that higher familiarity implies an increasing amount of accumulated knowledge derived from experience from previous interactions (Gefen et al., 2003). Undoubtedly, a system holds the potential to be accepted by a wide user-base if it is intuitively designed and does not require users to be highly familiar with its features in order to use it well. Thus, in the context of mobile application usage, we deem that individuals who are familiar with the features of mobile communication devices are likely to be more motivated to use or adopt mobile applications to share or retrieve content. In particular, familiarity with different features of mobile communication devices may have different effects on individuals' intention to use mobile content sharing and gaming application. Hence, we put forward the following hypothesis:

H2: Familiarity with the features of mobile communication devices has significant positive effects on intention to use a mobile content sharing and gaming application.

3.3 User Demographics

Multiple studies on adoption of modern communication technologies such as Internet, electronic discussion forum, online services have found that demographic profiles such as age, gender and educational background have effects on the users' adoption decisions (e.g. Leung & Wei, 2000; Lin, 2002; Pew Center, 2001). With regards to age, Gregor, Newell & Zajicek, (2002) state that older people often have distinct attitudes and expectations towards technologies, making it sometimes difficult for them to see the possible benefits. However, some studies indicated that some elders are receptive towards more advanced communication technologies that help to strengthen social relationships and establish new lines of communication with like-minded people (McMellon &

Schiffman, 2002). Next, the gender gap was apparent in early studies on adoption of communication technologies (Venkatesh & Morris, 2000). Specifically, women seemingly lagged behind in Internet use during the early 1990s but this gender gap is closing (Lin, 2002). Effects of gender on the use and adoption of technology were also examined in multiple past studies on IT use and adoption. Djamasbi and Loiacono (2008) found that the effects of gender were significant on the use of computer-based feedback because men and women react to negative feedback differently. Venkatesh and Morris (2000) also reported that men's technology usage decisions were more strongly influenced by their perceptions of usefulness. In contrast, women were more strongly influenced by perceptions of ease of use and subjective norm. Conversely, the gender gap is also reported in the computer gaming literature (Cassell & Jenkins, 1998; Gorriz & Medina, 2000) which indicated that males were more likely than females to be computer game users. Recent trends however suggest that females are also interested in computer gaming but they have different preferences for their content, design and genre (Hartmann & Klimmt, 2006; Lenhart, Jones & Macgill, 2008; Kinzie & Joseph, 2008).

Finally, educational backgrounds such as those trained in IT-related fields were found to affect an individual's intention to use a technology (Alshare, Grandon & Miller, 2004). In particular, it has been reported that individuals with adequate IT knowledge are likely to accept and use technology when compared to those without (e.g. Agarwal & Prasad, 1999; Loyd & Cressard, 1984). Furthermore, computer gaming studies also reported that people who play computer games are more likely to have IT-related educational backgrounds (Culley, 1993).

In the current study, our approach of blending gameplay within a mobile content sharing application is likely to appeal to certain groups of users. In particular, some basic IT knowledge is needed to understand the usage complexities and to appreciate the entertainment elements of Indagator. Collectively, we contend that age, gender and educational background are likely to

influence the usage intention of Indagator and similar applications. Thus, we put forward the following hypotheses:

H3a: Age has significant effects on intention to use a mobile content sharing and gaming application.

H3b: Gender has significant effects on intention to use a mobile content sharing and gaming application.

H3c: Educational background has significant effects on intention to use a mobile content sharing and gaming application.

4. Methodology and Results

4.1 Sample

Students from two large universities in Singapore were invited to participate in the evaluation of Indagator. The concept of the application and its content sharing and gaming features were introduced. To help the students understand how Indagator is played, four possible usage scenarios were presented. These scenarios included using Indagator for: (1) creating content and setting encounters; (2) retrieving content and engaging encounters; and (3) socializing with other players. Thereafter, the survey, which sought to determine the perceived gratifications of using Indagator, respondents' demographics (i.e. age, gender) and familiarity with mobile phones as well as their intention to use Indagator was administered. Participation was voluntary and anonymous. A total of 203 students participated in the written survey.

4.2 Operational Definitions

4.2.1 Independent Variables

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4.2.1.1 Perceived Gratifications

To measure perceived gratifications for content sharing from using Indagator, we developed a survey instrument based on constructs from past uses and gratifications studies (e.g. Flanagin & Metzger, 2001; Leung & Wei, 1998; Leung & Wei, 2000; Lin, 2002; Payne & Dozier, 1988). Specifically, according to these findings, several factors (i.e. information quality, information discovery, escape problems, sociability, leisure, relationship maintenance, personal status, entertainment) were identified as potential perceived gratifications behind usage of Indagator, and were incorporated into the survey. A total of 42 question items were used to assess these perceived gratifications. A five-point Likert scale, ranging from "Strongly disagree" to "Strongly agree" was used on these questions.

Principal component factor analysis with Varimax rotation was run iteratively to determine the potential groupings of the perceived gratifications question items (see Table 1). Varimax rotation was used as potential factors were expected to be orthorgonal. We based the decision about number of factors to retain on a combination of methods such as eigenvalue > 1.0 and scree plots, as well as conceptual clarity, interpretability and theoretical salience of the rotated factors, and simple structure. To ensure the validity of the factor analysis results, a total of 12 items were dropped during the analysis due to high cross loadings to multiple constructs. The groupings of the remaining 30 items to the respective 8 gratification factors from the final run of the factor analysis are shown in Table 1 and discussed as follows.

- Information discovery : the application helps retrieve information quickly and efficiently
- Information quality: the information retrieved is credible and of good quality
- Escape Problems: the application helps users stop thinking about life issues
- Socialization: interaction and socialization with others can be supported

- Leisure: the application promotes relaxation and eases boredom
- Relationship Maintenance: the application can be used to help others and strengthen existing ties
- Personal Status: one's personal status may be improved through the use of the application
- Entertainment: enjoyment may be derived from using the application

The reliability constructs for the eight gratification factors were assessed using Cronbach's Alpha (see Table 1). The results exhibited acceptable alpha values (i.e. ranged from 0.64 to 0.89) for the given sample size.

=== Insert Table 1 here ===

4.2.1.2 Familiarity

We measured respondents' familiarity with the use of mobile phones by examining their familiarity with the commonly available features of these devices. Specifically, we asked them to indicate their frequency of mobile phone usage for different purposes (e.g. talking, sending messages, and surfing the Web). Here, a total of 14 question items were used. A similar factor analysis methodology (with Varimax rotation) was executed to determine groupings based on respondents' mobile phone usage frequency (see Table 2). Two familiarity factors emerged from the analysis. The first factor focused on the familiarity with basic or traditional features such as using the mobile phone for talking and sending messages, and so we labeled the factor as' Familiarity with basic features'. The second factor described items that were concerned with more advanced functions such as using the mobile phone for Web surfing and contributing to social networking sites. We labeled the second factor as 'Familiarity with advanced features'. Both factors exhibited acceptable alpha values (i.e. 0.80 and 0.77).

Lee, C.S., Goh, D.H., Chua, A., and Ang, R.P. (2010). Indagator: Investigating perceived gratifications of an application that blends mobile content sharing with gameplay. *Journal of the American Society for Information Science and Technology 61(6),* 1244-1257.

=== Insert Table 2 here ===

4.2.1.3 Demographics

As discussed earlier, respondents' demographics backgrounds were captured in the survey. In this study, three demographic variables were assessed: age, gender (dummy coded), IT-related educational background (dummy coded). The median age of our sample was in the category 20-29. Around 57% of the respondents had educational backgrounds related to Computer Science and Information Technology while the rest were from other disciplines (e.g. Humanities, Business). Forty-eight percent of the respondents were male.

4.2.2 Dependent Variable

4.2.2.1 Intention to Use

Two question items were used to measure intention to use. Specifically, respondents were first provided with four possible usage scenarios of Indagator and subsequently they were asked to indicate how likely they were to use Indagator to share information or to retrieve information using a five-point Likert scale ranging from "very unlikely" to "very likely". Factor analysis yielded a single category with Cronbach's alphas registering at 0.77 (see Table 3) and this single category was used in subsequent analyses.

=== Insert Table 3 here ===

4.3 Statistical Analyses

To ensure the absence of multicollinearity between all independent variables, we examined the correlation among the independent variables. We found that the Leisure factor was highly correlated

with the Escape Problems factor. As such, we dropped the latter from the analysis. Even though both factors have identical alphas, we dropped the Escape Problems because the factor loadings for the Leisure factor were higher than the Escape Problems factor. With the omission of this factor, the correlation results indicated no cause for a multicollinearity concern (Hair, Anderson, Tatham & Black, 1998). The rest of the independent variables were entered into a hierarchical multiple regression equation in three separate variable blocks. The perceived gratification block was entered first, followed by the variable block for familiarity which consisted of familiarity with basic features of mobile phones and familiarity with advanced features of mobile phones. The demographics block which consisted of age, gender and IT-related background was entered last.

4.4 Results

The multiple regression results in Table 4 revealed that 42% of the variance was accounted for in our model. Among the perceived gratification measures, only Leisure and Personal Status were not significant in predicting intention to use while the rest of the predictors were significant: Relationship Maintenance ($p<0.01$), Entertainment ($p<0.01$), Socialization ($p<0.1$), Information Discovery ($p<0.01$) and Information Quality ($p<0.05$). With regards to the measures on familiarity, we found that users' familiarity with basic features ($p<0.01$) was significant but familiarity with advanced features was not significant in predicting usage intention of Indagator. The demographic measure, IT-related background ($p<0.05$) was significant in predicting usage intention but the other two of the demographic measures (i.e. age and gender) provided little support for the model. We summarize our results below:

- Hypothesis 1 was partially supported. Our factor analysis yielded seven perceived gratification factors of which five were found to have significant positive effects on intention to use

Indagator for content sharing. In order of strength of association, these are Information Discovery, Entertainment, Information Quality, Socialization and Relationship Maintenance. In contrast, the Leisure and Personal Status gratification factors did not appear to significantly influence intention to use Indagator.

- Hypothesis 2 was partially supported. Respondents who reported being more familiar with the basic or traditional features of mobile phone (e.g. SMS and mobile media capture) were more likely to use Indagator for content sharing than those less experienced. However, we found that familiarity with advanced features (e.g. Web surfing and accessing social media sites) did not have any significant effect on intention to use Indagator.
- Hypotheses 3a and 3b were not supported but Hypothesis 3c was supported. Our findings showed neither age nor gender to have a significant influence on intention to use Indagator but we found that respondents who had knowledge in IT seemed more inclined to use Indagator for content sharing vis-à-vis those who had no IT backgrounds.

=== Insert Table 4 here ===

5. Discussion

5.1 Indagator and Similar Systems

To reiterate, this paper flows along two primary themes. First, we introduce Indagator, an application which incorporates multiplayer, pervasive gaming elements into mobile content sharing activities. Indagator provides an environment for users to share and access location-based content, anytime, anywhere through the convenience of their mobile phone. At the same time, layered upon

this information environment is a game of exploration, in which players navigate their physical world to amass treasure, overcome obstacles, and interact with other players.

In this regard, our work shares similarities with the Gopher Game (Casey et al., 2007), MobiMissions (Grant et al., 2007), GWAPs (von Ahn & Dabbish, 2008) and other such applications in that we aim to investigate the use of games for content sharing. Nevertheless, there are distinct differences between Indagator and existing applications that warrant the present research. The Gopher Game may be viewed as a task-based approach to content sharing in which players are given specific objectives to accomplish via gophers. On the other hand, Indagator players can independently create and share any content of interest. The Indagator environment is therefore more open-ended, requiring more complex player-player and player-system dynamics. Similarly, MobiMissions focuses primarily on generating and completing missions, which are well-defined sequences of locations and associated content. Here, Indagator offers a richer gaming environment that supports encounters, socialization features, in addition to content creation and access. In addition, current GWAPs are Web-based games and are primarily casual in genre. Indagator differs by catering to mobile users, and incorporates location-based, multiplayer gaming elements that existing GWAPs do not.

5.2 Perceived Gratification Factors

The second theme of the paper focuses on understanding the *gratification, familiarity and demographic* factors influencing people's intention to use Indagator and similar applications that blend mobile content sharing and gameplay. Our results demonstrate that the content sharing concepts embodied in Indagator appear to appeal to respondents in our study.

Our factor analysis yielded seven perceived gratification factors of which five were found to have significant positive effects on intention to use Indagator. In order of strength of association, these are

Information Discovery, Entertainment, Information Quality, Socialization and Relationship Maintenance. In contrast, the Leisure and Personal Status gratification factors did not appear to be significantly influence intention to use. From an application design perspective, it would be prudent to incorporate features informed by the significant gratification factors uncovered in this study. In terms of information discovery, mechanisms that facilitate efficient and effective should be explored. For example, context-aware information delivery that takes into account factors such as a player's history of interactions with the application, his/her social network, and current activity could be investigated. On a related note, the design of contextual mini-games that harness context attributes other than location could also be explored.

Further, the significance of the Entertainment gratification factor suggests the importance of creating different, exciting and enjoyable genres of encounters to cater to a wide spectrum of players with diverse interests and preferences (Pinelle, Wong & Stach, 2008). As well, the significance of the Information Quality factor demonstrates the need for assisting players to assess the quality of contributed content. This could be accomplished through features such as content and user ratings, comments and other feedback mechanisms (Bian, Liu, Agichtein & Zha, 2008). Although gratification factors associated with Socialization did not appear as strongly as the others, they are nonetheless important in environments that support user-generated content (Nardi, Schiano, Gumbrecht & Swartz, 2004) and the relatively small number of features that support such activities in the current version of Indagator could have contributed to this result. In future work, we therefore plan to provide more explicit support for socialization inspired from multiplayer gaming environments (Ducheneaut et al., 2006). For example, guilds may be formed by likeminded individuals and enjoy privileges such as exchanging messages that are accessible only to guild

members, trading items that may not be accessible by non-members, and participating in virtual events and gatherings.

Interestingly, the Leisure gratification factor was not significant while the Entertainment gratification factor was significant in predicting intention to use Indagator. We attribute this to the design and objectives of Indagator itself. Specifically, as discussed previously, Indagator focuses on content sharing with gameplay added as a motivational layer. Consequently, users of Indagator are primarily those with information sharing or seeking needs who are looking for some form of entertainment and enjoyment (i.e. Entertainment factor), rather than those who are seeking thrills or excitement to combat boredom as described by the Leisure factor. It was thus encouraging to note that respondents in our study were able to tease apart this subtle but important difference between mobile content sharing games such as Indagator, and those developed purely for fun.

Another important finding from our study is that Personal Status gratification factor was not significant indicating that respondents did not view the act of sharing content or gaming on the Indagator platform as a signal of an individual's competence. This is interesting because, studies on knowledge sharing in organizations reported that users contribute to get recognition from the peers (Kaiser & Muller-Seitz, 2008; Hew & Hara, 2007) or to establish status (Mauss, 1990). Lin (1999) further explained that the social network the individuals are in have a significant influence on their desire for status attainment within the network. This provides the explanation in our context because the respondents in our study did not get a chance to develop a sense of belonging to a particular online social network due to the cross-sectional nature of our data collection. In addition, the relative lack of explicit socialization features in the current version of Indagator further contributes to this observation. Future research needs to address this issue. In particular, a longitudinal study will be

appropriate because it allows players ample time to develop a sense of belonging within an existing social network or build their own online social network.

5.3 Familiarity and Demographic Factors

The blending of mobile content sharing with gameplay appears to appeal to respondents who were familiar with basic features of mobile phone usage than those who had either no experience at all or advanced experience with mobile phone functions. This could be attributed to Indagator's overall usability and intuitive gameplay. The implication is that Indagator has low barriers for adoption among mobile phone users and holds the potential to be accepted by a wide user-base. Among all users, those with backgrounds in IT showed a greater propensity towards intention to use Indagator than those with other backgrounds. One possible reason could be that gaming and content sharing, which were realized as technologically-oriented activities in Indagator, struck a greater resonance with those who were more IT-savvy. However, as time passes and if Indagator and similar applications are well-designed, our results suggest that those without IT backgrounds could be equally at ease with these activities as technology becomes more ubiquitous.

Surprisingly, age and gender were not significant in our results. Specifically, the non-significant effect of gender indicates that the design, content and genre of gameplay in Indagator appealed to both males and females. The issue of gender and computer gaming has been a major topic of research interest over the last two decades (e.g. Cassell & Jenkins, 1998, Gorriz & Medina, 2000; Mumtaz, 2001). Numerous studies have indicated that although males and females can be equally skilled at computer games, males are more likely than females to choose to play with them (Cassell & Jenkins, 1998; Jackson et al., 2008). Some authors have explained that such a phenomenon is due to the fact that most computer games have been designed for and marketed to males (i.e. Bryce & Rutter, 2003;

Gailey, 1996; Gorriz & Medina, 2000). Our finding supports this explanation and shows that females are as likely as males to play mobile games as long as the games' designs and content cater to their needs. As for the non-significant effect of age, we attributed this to the profile of our respondents. Specifically, the majority of the respondents in our study belonged to the 20-29 age group, and past research has suggested that younger people tend to have more accepting attitudes towards games than older people (e.g. Ha et al., 2007). However, other studies have also shown that older people do play games, and many do so more frequently than other age groups (e.g. Lenhart, Jones & Macgill, 2008). However, our available data cannot be used to confirm either observation, and future research needs to extend our work to more diverse age groups to examine the impact of age.

6. Conclusion

Arising from our results, the following are some design considerations for Indagator and similar systems:

- Mobile applications that blend content sharing and gaming must ensure the usability of features from both components. We note that the five gratification factors that had positive effects on intention to use Indagator included both information-related (e.g. Information Discovery) and gaming (e.g. Entertainment) aspects. Consequently, such applications have to address the twin challenges of overall mobile usability design (Ji, Park, Lee & Yun, 2006) as well as game design (Pinelle et al., 2008).
- On a related note, in Indagator (and typically in similar applications), games are the facilitators to effective content sharing. Therefore beyond usability, the importance of creating diverse and enjoyable genres of games to cater to players with different profiles cannot be overlooked (Ha et al., 2007). Thus for example, genres of games that appeal to either or both genders should be

incorporated (e.g. Hartmann & Klimmt, 2006), as should games that cater to different age groups (e.g. Griffiths et al., 2004).

- Our results suggest that games are not universal motivators, and applications that blend gaming and content sharing should consider supporting the flexibility of decoupling these two components to attract a wider range of users (Bell et al., 2006). For example as described earlier, Indagator supports an "Information Mode" so that gaming elements are turned off, and only features for content creation and access are available. The goal is to appeal to both non-gamers and gamers alike so that a rich information environment can be created.
- Next, social networking appears to be important in mobile content sharing games as two of the gratification factors that were significant predictors of intention to use Indagator were Socialization and Relationship Maintenance. For content sharing, annotation ratings, comments, browsing of content by author, and collaborative filtering are mechanisms that could be considered to foster socialization by allowing users to share their experiences or access interesting information among likeminded others (e.g. Bellotti at al., 2008). For gaming, the goal would be to enhance game-oriented, meaningful and purposeful social interaction. As such, future versions of Indagator are likely to incorporate game triggers and structures (e.g. quests, events, factions, and guilds) to motivate users to communicate and interact socially (Jegers, 2007).

To conclude, our study suggests that understanding the factors influencing usage intention for mobile content sharing and gaming applications such as Indagator has important implications for research and practice. From a research perspective, where existing work has primarily described applications that incorporate information sharing and gaming, we delve deeper into user-oriented issues by exploring intention to use factors from the lens of the uses and gratifications paradigm. Our

work can also serve as a springboard for investigating how mobile content sharing and gaming applications differ from mobile content sharing applications without gameplay, or Web-based applications that blend content sharing and gaming. From a practical standpoint, our results can be used to inform software developers on the important sets of features to implement for such applications. The fact that respondents in our study were relatively positive towards Indagator also suggests the viability of deploying and marketing such applications. Related to this, our results also suggest that applications such as Indagator have the potential to motivate users to create and share content, thus enriching environments that support user-generated content.

Caution, however, should be exercised when interpreting our results because the nature of this study may reduce the generalizability of its findings. Specifically, respondents were primarily undergraduate and graduate students. Replication of this study in other contexts (e.g. other countries, more diverse age groups, other organizations) or in a specific domain (e.g. education, tourism) would be useful to uncover and understand the motivational factors influencing people's intention to use Indagator. Next, the nature of the present study lent itself well to the survey methodology, but observations of respondents using Indagator in their actual context of use (Göker & Myrhaug, 2006) were not conducted. Future work could thus augment our research to better understand the attitudes, behaviors and motivations of players with other evaluation methodologies including observational methods, diary studies and transaction log analyses. Further, while our work has identified the critical gratification factors (e.g. Information Discovery, Entertainment, Information Quality), the actual set of features to be implemented for each factor have to be investigated in future refinements of Indagator. Here, leveraging on existing research in mobile content sharing, pervasive gaming as well as usability techniques would be instructive. Finally, expanding the study to compare Indagator with other non-game oriented mobile content sharing applications would allow researchers to investigate

the impact of gameplay and its influence on why people share and retrieve content via mobile communication devices.

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Indagator: Investigating Perceived Gratifications of an Application that Blends Mobile Content Sharing with Gameplay

Figures

Figure 1: Map interface.

Figure 2: Annotation details.

Lee, C.S., Goh, D.H., Chua, A., and Ang, R.P. (2010). Indagator: Investigating perceived gratifications of an application that blends mobile content sharing with gameplay. *Journal of the American Society for Information Science and Technology 61(6),* 1244-1257.

Figure 3: Creating an annotation with an encounter.

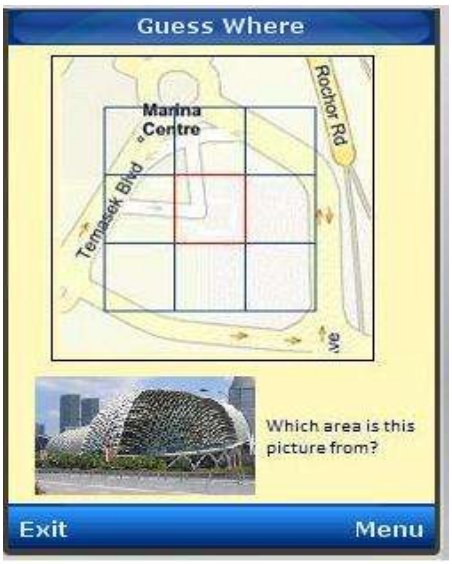

Figure 4: Engaging an encounter.

Lee, C.S., Goh, D.H., Chua, A., and Ang, R.P. (2010). Indagator: Investigating perceived gratifications of an application that blends mobile content sharing with gameplay. *Journal of the American Society for Information Science and Technology 61(6),* 1244-1257.

Indagator: Investigating Perceived Gratifications of an Application that Blends Mobile Content Sharing with Gameplay

Tables

Table 1: Factor analysis for perceived gratifications

N=203	**Factors**								
I intend to use the mobile content sharing and gaming application …..	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	Alpha
1.Information Discovery									0.88
because it provides access to up-to-date information and news)	**0.82**	-0.02	0.00	0.07	0.02	-0.02	0.05	0.16	
because it helps me find locations, required products and services	**0.79**	0.11	-0.08	0.01	0.06	0.03	0.17	0.07	
because it is easy to get information I need	**0.75**	0.01	-0.01	0.14	0.22	0.05	-0.07	0.07	
to get information about something	**0.73**	-0.02	0.15	0.06	0.24	-0.10	-0.08	0.05	
because I can have immediate access to information anywhere anytime	**0.73**	0.08	0.05	0.02	-0.06	0.05	0.09	0.05	
to keep up to date on the latest news and events	**0.70**	0.23	0.14	0.02	-0.03	0.09	0.20	-0.03	
because it is more convenient than accessing information from other sources	**0.70**	0.23	0.03	0.02	0.18	0.04	-0.03	-0.05	
2.Socialization									0.84
because I can interact with people when sharing contents	0.13	**0.84**	0.09	0.03	0.12	0.05	0.12	-0.02	
to keep in touch with people when retrieving contents	0.10	**0.78**	0.02	0.25	0.21	0.06	-0.11	0.11	
because I can interact with people when retrieving contents	0.16	**0.77**	0.22	0.12	0.13	0.04	-0.02	0.15	
to keep in touch with people when sharing contents	0.12	**0.75**	0.02	-0.04	0.06	0.29	0.14	0.07	

because I need to interact with people when sharing contents	0.05	**0.68**	0.06	0.28	0.01	0.19	-0.01	-0.02	
3.Leisure									0.89
because it helps me pass time	0.09	0.08	**0.84**	0.06	0.05	0.12	0.18	0.00	
because I can interact with people	0.11	0.00	**0.84**	0.08	-0.04	0.22	0.12	0.06	
because it helps combat boredom	0.02	0.19	**0.83**	0.20	0.00	0.02	0.07	0.04	
because it helps to relax	-0.04	0.10	**0.82**	0.36	0.06	0.01	0.03	0.04	
4.Escape Problems									0.89
to get away from pressures and responsibility when retrieving contents	0.12	0.15	0.16	**0.84**	0.07	0.12	0.09	-0.02	
to get away from pressures and responsibility when sharing contents	-0.08	0.04	0.20	**0.75**	0.11	0.09	0.08	0.14	
to role play or experiment with my identity when retrieving contents	0.22	0.29	0.11	**0.71**	0.14	0.18	0.12	0.07	
because it is a pleasant break from my routine when retrieving contents	0.14	0.18	0.34	**0.61**	0.06	-0.07	0.30	-0.05	
5.Information Quality									0.83
because I can trust the information	0.14	0.17	0.03	0.06	**0.85**	0.21	0.06	0.02	
because I know the information will be accurate	0.08	0.14	-0.02	0.20	**0.82**	0.17	0.05	0.07	
because I know I can rely on the information when I need it urgently	0.23	0.12	0.04	0.06	**0.72**	0.13	0.07	0.04	
6. Personal Status									0.77
because it helps me feel important when sharing contents	0.06	0.12	0.10	0.19	0.21	**0.83**	0.04	0.02	
because it helps me to gain status when sharing contents	0.04	0.15	0.10	0.07	0.16	**0.77**	0.24	-0.02	
because it helps to look good when sharing contents	-0.02	0.26	0.14	0.05	0.15	**0.70**	-0.03	0.12	
7. Entertainment									0.81
because it is exciting	0.13	0.07	0.15	0.17	0.13	0.07	**0.85**	0.04	
because it is entertaining	0.09	0.00	0.23	0.23	0.03	0.18	**0.80**	0.12	
8. Relationship Maintenance									0.64

to thank others when sharing contents	0.00	0.13	0.11	0.10	0.04	0.15	0.05	**0.85**	
to help others when sharing contents	0.27	0.06	-0.01	0.02	0.07	-0.04	0.08	**0.80**	
Variance Explained	26.23	12.07	9.03	6.37	5.20	4.69	4.39	3.47	
Eigenvalue	7.87	3.62	2.71	1.91	1.56	1.41	1.32	1.04	

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Table 2: Factor analysis for familiarity

N=203	**Factors**		
How often do you use	**Basic Use**	**Advance Use**	**Alpha**
Familiarity with basic features			0.80
your mobile phone to share pictures, videos, music, etc. with others?	**0.96**	0.27	
your mobile phone to communicate with others using SMS/MMS?	**0.96**	0.27	
In general, how do you rate the frequency of use of your mobile phone?	**0.96**	0.27	
your mobile phone to talk?	**0.96**	0.27	
your mobile phone to take pictures or video?	**0.96**	0.27	
your mobile phone to listen to radio/music?	**0.96**	0.27	
your mobile phone to play games?	**0.96**	0.27	
Familiarity with advanced features			0.77
the mobile phone to contribute information to Web 2.0 sites such as Flickr, Twitter, etc.?	0.25	**0.96**	
your mobile phone to watch T.V. programmes?	0.25	**0.96**	
the mobile phone to access information from Web 2.0 sites such as Flickr, Twitter, etc.?	0.25	**0.96**	
your mobile phone to surf the Web?	0.21	**0.90**	
your mobile phone to chat via instant messaging?	0.31	**0.76**	
Variance Explained	73.89	71.62	
Eigenvalue	8.87	2.6	

Table 3: Factor analysis for Intention to Use

N=203	**Factor**	**Alpha**
Intention To Use		0.77
for content sharing	0.90	
for content retrieval	0.90	
Variance Explained	81.32	
Eigenvalue	1.63	

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Table 4: Hierarchical Regression Analysis, N=203

Dependent Variable = Intention To Use		
Independent Variables	**Standardized Beta**	**t-values**
FIRST BLOCK		
Relationship Maintenance	0.10	1.74+
Entertainment	0.26	4.13**
Leisure	0.01	0.160
Socialization	0.12	1.78+
Information Discovery	0.32	4.90**
Information Quality	0.15	2.15*
Personal Status	-0.03	-0.46
Adjusted R2	0.36**	
Multiple R	0.62	
SECOND BLOCK		
Basic Use	0.15	2.42**
Advanced Use	0.01	0.16
Change in Adjusted R2	0.02**	
Adjusted R2	0.38	
Multiple R	0.64	
THIRD BLOCK		
Age	0.00	0.06
Gender	0.07	1.29
IT-related Background	0.11	1.95*
Change in Adjusted R2	0.02	
Final Adjusted R2	0.39	
Multiple R	0.65	
Multiple R	0.65	
R2	0.42	

Note: * $p < 0.05$; ** $p < 0.01$; + $p<0.10$