INVESTIGATING DESIGN ISSUES IN MOBILE COMPUTER-MEDIATED COMMUNICATION TECHNOLOGIES

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ABSTRACT

Mobility is the new reality of business and stands to have a significant impact on the implementation of mobile computer-mediated communication (mCMC), such as mobile texting, mobile video, and mobile presence. Information systems researchers are faced with the challenge of how to design these artifacts to maximize the benefits of social interaction among potential communication partners. We develop a theoretical model that examines the relationship between user experience, perceived richness, perceived social presence, interactivity, and satisfaction in mCMC. Findings suggest that user experience, perceived richness and interactivity are important in the design of social presence in mCMC. Both social presence and perceived richness influenced user satisfaction with mCMC. The influence is greater in mobile instant messaging than mobile texting.

Keywords: user experience, social presence, user satisfaction, media richness, mobility, interactivity, computer-mediated communication.

INTRODUCTION

As the concept of virtual worker is increasingly embraced by businesses, mobile presence is becoming an essential key for the success and survival of a business. It is important to supply these employees with the information and communication they need in real time in order to function effectively from wherever they are. Presence (or awareness) is the ability of users to know the location, activities, surrounding, and nearby resources close to potential partners in real time. With presence, employees can quickly locate resources and colleagues, get questions answered, and respond to client requests.

Presence technologies allow users of mobile devices such as smartphones to know when a person is connected to a network and if they are available to communicate. According to Cisco, Inc [8], presence is one of the key technologies that enable virtual workers to be connected to the rest of the organization. In addition, integrating mobility into the presence architecture is critical because mobility is the new reality of business and stands to have a significant impact on the implementation of mobile presence, mobile texting, mobile video, and the ability to see correspondents' availability in real time and to know if they can be reached by voice, text or video. As a result, the use of mobile computer-mediated communication (mCMC) technologies with presence capabilities such as mobile instant messaging has been growing rapidly.

One important aspect of presence is location-based presence which allows users to know location of other users in real time. Location-based technologies are one of the most significant developments in mobility and therefore locating those devices will be the key to locating the users as users are rarely without their mobile devices. The mobile industry has come up with a number of location-based technologies that enable mobile presence. People are rarely without their mobile phones, so if we can find the mobile phones, we can find users. These capabilities are becoming more prevalent in smartphones. Frost & Sullivan [16] attribute the growth of these technologies to the heightened awareness of the increased productivity and the ability to accelerate business processes. Added to this is the growth in telecommuters and increasing mobility of workforce constantly demanding for better communication solutions.

The growing interest in and demand for presence capabilities of mCMC technologies is pushing Information System designers to provide communication solutions to maximize the benefits of social interaction through social presence.

Computer-mediated communication (CMC) refers to communication that is facilitated by computers, such as email and chat. Mobile CMC (mCMC) is the exchange of information and data between two or more people facilitated through a mobile device such as the smartphone. The International Telecommunication Union [24], refer to this information exchange as communication services, including mobile texting (mText), multimedia message service (MMS), mobile instant messaging (mIM) and mobile email.

mIM is an evolution of the computer based IM, which has been around for several years. Mobile IM is an example of a synchronized one-to-one text based communication [23,34] and allows users to conduct one or more real time conversations in text windows on mobile communication device screen. mIM is very popular because it is easy to use and efficient than email. It allows users to exchange instant messages with other communication partners using different Internet services. Muller, Raven, Kogan, Millen, & Carey [34] suggests that it is mostly suitable for: (1) questions and clarification, (2) coordination and scheduling of work task, (3) coordination of impromptu meetings, and (4) reaching out to friends and family.

Mobile texting (mText) is a service which allows a mobile terminal to send, receive and display messages of up to 160 characters in Roman text and variations for non-Roman character sets. Messages received are stored in the network if the subscriber terminal is inactive and relayed when it becomes active. Mobile texting (MText) has become very popular over the last few years. In 2008, in the U.S. alone mText users sent 601 billion text messages, an increase of 954% over 2005 [9]. According to Forester Research, 35% of mobile phone users send or receive text messages with 76% of 18-24 year olds using it [39]. MText is a resilient messaging service and is expected to remain popular with mCMC users in the near future despite the emergence of several enhanced messaging services [40].

The purpose of this study is to develop a theoretical model that examines factors important in design of social presence in mCMC (Figure 1). The study draws mostly from prior IS research work

to explore the role of user experience, social presence, perceived richness and interactivity [26,28] on mCMC. This study is unique in two ways: First, prior research on CMC has largely focused on media richness, social presence and satisfaction. Secondly, current study expands the scope of this literature by examining a key theoretical antecedent of social presence — interactivity — that has so far received very little attention in the IS literature.

LITERATURE REVIEW

User Experience

The role of user experience in CMC is best explained by the communication channel expansion theory proposed by Carlson and Zmud [5]. This theory conceptualizes user experience as follows: (1) experience with messaging topic, (2) experience with communication partner and (3) experience with communication channel. Experience with the messaging topic is the degree to which an individual acquires knowledge enhancing experience with the topic of discussion [6]. When the topic of experience is similar for two parties involved in the communication then richer messages can be facilitated by using jargons that facilitate shared meaning. Experience with topic also facilitates learning and interpretation of the messages more richly. Timmerman and Madhavapeddi [53] found that experience with topic is correlated to perceptions of email richness. However, Carlson & Zmud [6] observe that "over time communication channel experience becomes less important determinant as other experiences begin to play an increasing role in shaping the user perception" [6, pg. 165].

Experience with communication partner is the degree to which an individual acquires knowledge enriching experience with an identified communication partner. When two parties who are familiar with each other communicate, they will use cues containing familiar experience with richer meaning and relevant for each other. Individuals learn to interpret messages from their specific communication partners more richly. Previous studies suggest that IM users display different behaviors when communicating with long-time IM-communication partners than with new partners [23,25,34]. Timmerman and Madhavapeddi [53] suggest that an experience with communication partner is correlated to perceptions of email richness. Muller, Raven, Kogan, Millen & Carey[34] observed that users of Instant Messaging show different patterns of use depending on experience with a communication partner.

Experience with communication channel is the degree to which a user acquires knowledge enhancing experience with an identified communication channel (mCMC). Carlson & Zmud [6] posit that users with more knowledge enhancing experience will perceive communication channel as rich, and will therefore participate in rich communication. On the other hand users with less knowledge experience may not perceive the richness of such a channel. Consistent with this argument prior studies have shown that people with higher levels of email experience and training rated email as richer than those with less experience [6,17]. Muller et al. [34] add that users of Instant Messaging show different patterns of use depending on their intensity of use.

Interactivity

Interactivity is closely related to social interaction. Social interaction design is an approach that focuses on the social dimension of interactivity between users and the communication technology. Anytime users use communication technologies such as mCMC social interaction becomes an integral part of it. Dryer and Eisbach [12] argues that humans respond socially in their interaction with technology. They identify accessibility, familiarity and usefulness as important design dimensions. Other variables identified in the literature as important design dimensions include: accessibility, restrictiveness and ease of use [7].

Although relationship between interactivity and social presence is well documented and supported in the advertising literature [28], it is not well covered in the IS literature. In the advertising literature, interactivity is conceptualized as:(1) direction of communication, user control and time [32], (2) active control, two-way communication and synchronicity [31] and (3) synchronicity, no-delay, and engaging [28]. Active control is "characterized by voluntary and instrumental action that directly influences the user's experience" [28, pg. 550]. No-delay is the ability to reciprocate a message exchange and includes relevance and response contingency. Synchronicity is the ability of the communication to occur in real-time (synchronous) or to be delayed (asynchronous) [28].

Social Presence

Social presence is an important concept in this study because of its role in the development of social presence technologies such as mobile and wireless telecommunications [3]. Social presence influences the design of communication technologies and is a key construct in the study of computer-mediated communication systems [4].

In the presence literature, presence has been shown to consist of two interrelated dimensions: telepresence and social presence [3]. Telepresence is defined as the aspect of being physically present in an environment simulated by a medium [3], whereas social presence represents the concept of being together with another person [3]. Both dimensions have been used in prior IS literature [18,33,37,54].

Fulk, Steinfield, Schmitz & Power [17] define social presence as the degree to which a communication channel facilitates awareness of the other party and interpersonal relationship during the interaction. In the IS literature social presence is conceptualized as the extent to which an individual perceives the communication channel as unsociable-sociable, insensitive-sensitive, cold-warm, and impersonal-personal [18, 27, 33, 37, 44, 54].

Research suggests that social presence is positively correlated to CMC choice [48,54], bandwidth [55], and relationship between sender and recipient [28], satisfaction [55], higher system usage [55].

Perceived Richness

Research on media richness with information technology is extensively covered by the literature. However, most research has focused on richness and choice of CMC and little has been done to investigate the how richness enhances social presence in mobile CMC.

Media richness (or information richness) is defined as "the capacity to process rich information" [11, p.560]. The concept of media richness is explained in Media Richness Theory (MRT) [10]. This theory suggests that individuals match a media (or communication channel) with the task at hand, and choose rich

medium for ambiguous or equivocal tasks [10].The premise of this theory is communication channels fall along a continuum of information richness based on four criteria: (1) speed of feedback, (2) type of communication channels employed, (3) personalities of source, and (4) richness of language [10] .

The potential for immediate feedback is defined as the ability of the medium to allow for feedback (e.g. two way audio systems) and the speed of the feedback. The ability to convey natural language is related to the use of a variety of signs and symbols in written form, for example, using numeric data or pictures to send a message, and using different language formats, for example, non-word utterances that convey meaning [14]. Personal focus or personalness is the degree to which a message conveyed through a certain medium is perceived to be personal [14].

Research on media richness has produced mixed results [11,13]. Several predictor variables have been added to previous research models on media richness, for example, task characteristics and social influences in an effort to explain media perception and selection behaviors [17,40,41,42].

User Satisfaction

Satisfaction with information technology has been widely accepted as an indicator of IT usage, which is considered an important driver of IT success (DeLone and McLean, 1992). Research on end-user satisfaction with information technology is abundant [1]. However, in the CMC literature research has mainly focused on the effectiveness and choice of a communication channel but overlooked the satisfaction with the technology. Satisfaction with CMC has been linked to ease of use, mode of communication (asynchronous or synchronous), communication medium, task-medium interaction, and individual perception of the other party [5,11,37,55].

RESEARCH MODEL AND HYPOTHESES

To guide our enquiry we draw on Channel Expansion Theory (CET), Media Richness Theory (MRT), Social Presence Theory (SPT) and Interactivity to develop a research model shown in Figure 1. We argue that user satisfaction with mobile CMC is directly influenced by user experience, the richness and social presence. Likewise, we also argue that interactivity is an antecedent of social presence. We borrowed the construct of interactivity from the advertising literature because not much is mentioned about it in the IS literature. Therefore, the relationship between interactivity and social presence is particularly important in this study because it provides a theoretical groundwork for understanding user satisfaction with mCMC.

We examine three dimensions of user experiences that influence the perception of channel richness in a mobile

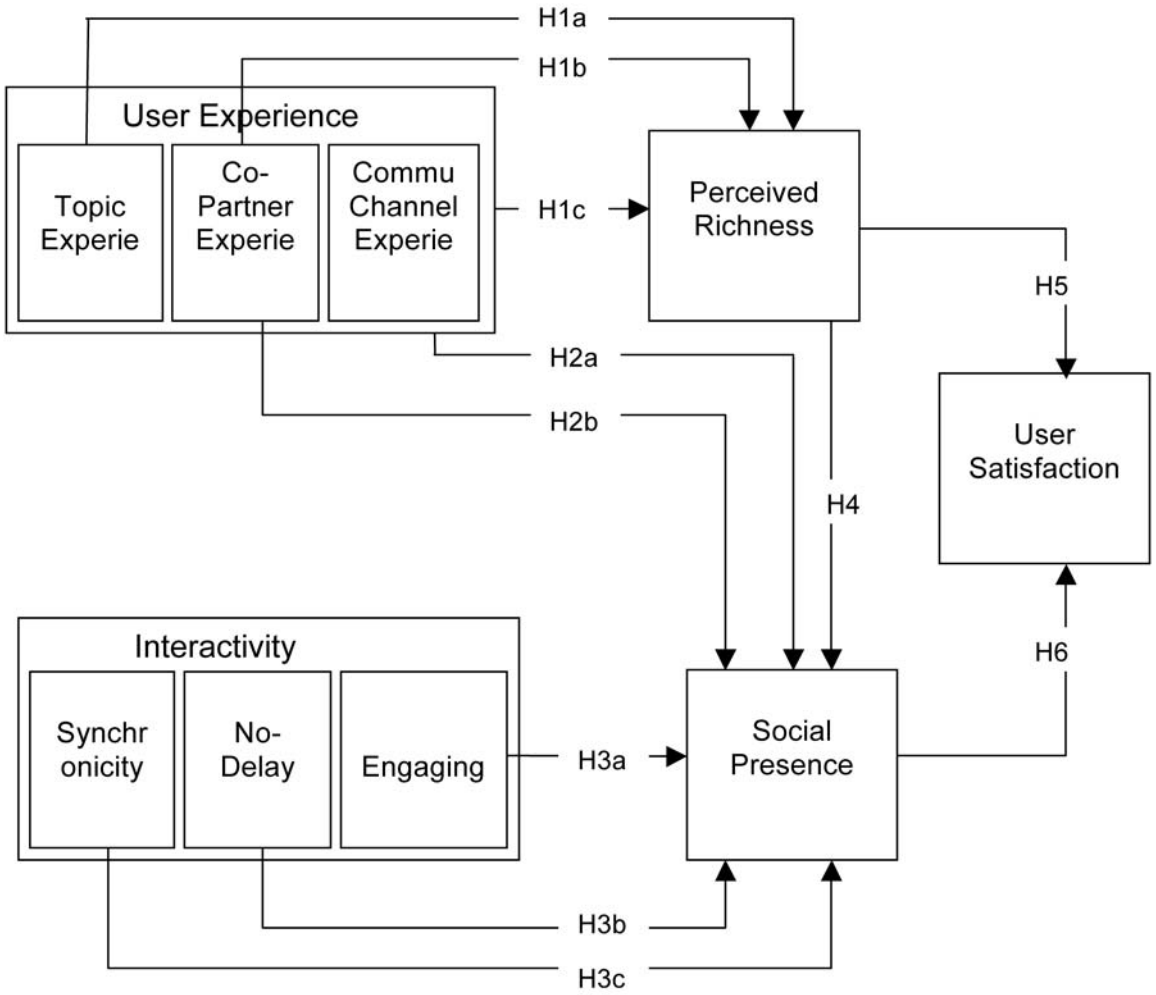


FIGURE 1: Research model

environment: (1) experience with messaging topic, (2) experience with the communication partner, and (3) experience with the communication channel [5,6].

We use three dimensions of interactivity from the advertising literature as follows: (1) synchronicity, (2) no-delay, and (3) engaging [28]. According to our model, social presence mediates the relationship between satisfaction and user experience, perceived richness, and interactivity.

In summary, research suggests that social presence is associated with user experience, interactivity and perceived richness. We use the proposed model to test if these relationships hold with mobile devices. We therefore propose the following hypotheses:

H1a: User experience with topic will be positively related to the individual's perception of richness in both asynchronous and synchronous mCMC.

H1b: User experience with communication partner will be positively related to the individual's perception of richness in both asynchronous and synchronous mCMC.

H1c: User experience with communication channel will be positively related to the individual's perception of richness in both asynchronous and synchronous mCMC.

H2a: User experience with communication channel will be positively related to the individual's perception of social presence in both asynchronous and synchronous mCMC.

H2b: User experience with communication partner will be positively related to the individual's perception of social presence in both asynchronous and synchronous mCMC.

H3a: Engaging will positively influence perceived social presence in mCMC

H3b: No-delay will positively influence perceived social presence in mCMC

H3c: Synchronicity will positively influence perceived social presence in mCMC

H4: Users' perceptions of mCMC richness will positively influence perceived social presence for both asynchronous and synchronous mCMC technologies

H5: Users' perceptions of perceived richness will positively influence user satisfaction in both asynchronous and synchronous mCMC technologies

H6: Users' perceptions of social presence will positively influence perceived user satisfaction for both asynchronous and synchronous mCMC technologies

RESEARCH METHODOLOGY

To empirically validate the proposed model, we conducted a survey among students from a state university in the U.S. The choice of students was driven by experience and exposure to mCMC. The use of students for research is well documented in the literature. Students are often used as surrogates for professionals since they are convenient and easy to access. Experience is often considered in determining whether students are suitable study subjects [2]. One of the guiding factors for the choice of students was the Nielsen's research that analyzed the popularity of mCMC services for different age groups and found that mCMC was widely used among users between the age of 13 and 24, an age group where majority of our sample fall.

An e-mail message requesting participation in our online survey was sent out to 573 students. The survey targeted two groups of users: mobile texting (mText) and mobile instant messaging (mIM) users. Respondents were randomly administered either an instrument designed for mText users or mIM users. Potential respondents were asked a priori if they had used mCMC technologies in the past. Only respondents with prior knowledge of either mText or mIM were asked to participate in the survey. Respondents were assured that their identity would remain anonymous, and they would have access to the study findings.

TABLE 1: Demographics

Gender Distribution (mIM and mText)

	mIM		mText	
	Frequency	Percent	Frequency	Percent
Male	149	62.1	141	50.9
Female	90	37.5	134	48.4
Total	239	99.6	275	99.3

Age Distribution (mIM and mText)

	mIM		mText	
	Frequency	Percent	Frequency	Percent
<18 yrs	2	.8	3	1.1
18-22 yrs	156	65.0	199	71.8
23-27 yrs	58	24.2	50	18.1
28-32 yrs	10	4.2	12	4.3
>32 yrs	13	5.4	11	4.0
Total	239	99.6	275	99.3

Employment (mIM and mText)

	mIM		mText	
	Frequency	Percent	Frequency	Percent
Part-time	108	45.0	127	45.8
Full-time	52	21.7	48	17.3
Unemployed	79	32.9	100	36.1
Total	239	99.6	275	99.3

Race Distribution (mIM and mText)

	mIM		mText	
	Frequency	Percent	Frequency	Percent
White/Caucasian	121	50.4	174	62.8
Black/African American	34	14.2	27	9.7
Hispanic/Latino	30	12.5	40	14.4
Asian/Pacific	40	16.7	25	9.0
Other	14	5.8	9	3.3
Total	239	99.6	275	99.3

They were also informed that participation was voluntary, and respondents could opt out at any time without completing the survey.

The survey was conducted in two phases over a six week period during which 542 responses were received of which 28 responses were discarded as incomplete and unusable. By the end of the third week, 235 students (early respondents) participated in the survey. We sent out email reminders requesting those who had not participated to do so. We received additional 307 responses in the second phase (late respondents) at the end of the sixth week. A t-test was performed to compare the early response group and the late response group for their responses [28] on four dependent and demographic variables: perceived social presence, perceived channel richness, perceived channel satisfaction, and age. The results show that the variances are not statistically significant since the *p*-value of Levene's test is more than 0.05. Likewise the t-value based on equal variances is not significant with a two-tailed *p*-value of more than 0.05. These results suggest that there is no significant difference in the means of early and late respondents for both mText and mIM.

ANALYSIS AND RESULTS

Assessment of Reliability

Reliability refers to the degree to which the variables are consistent with what they are supposed to measure. The Cronbach's alpha was used to measure internal consistency. According to Straub [50], high correlations between items produce high Cronbach's alpha and are usually signs that the measures are reliable. While there is no standard cut-off point for the alpha coefficient, the generally agreed upon lower limit for Cronbach's alpha is .70 [48], although it may decrease to .60 [21]. Table 2 lists the reliability scores of the constructs used in the model. The values of Cronbach's alpha ranged from 0.598 to 0.928. The low value may be attributed to the fewer number of items that measure this construct. The construct reliability values suggest that the instrument is reliable.

Reliability can also be measured by examining the loadings or simple correlations of the measures on their respective construct. Composite reliability developed by Fornell and Larcker [15] is used to measure the composite reliability. These reliabilities take into account the actual loadings used to construct the factor score and are considered a good measure of internal consistency. The general rule is that both the composite reliability and the Cronbach's alpha coefficients should be equal to or greater than 0.7 [15,35,36]. A more conservative approach is that one of the two coefficients should be equal or greater than 0.7. This typically applies to the composite reliability coefficient, which is usually higher than the Cronbach's alpha [15]. In some cases a threshold of 0.6 is acceptable [35]. Table 2 shows that this criterion is met since all composite reliability values are greater than .80, which suggests good internal consistency.

Assessment of Convergent and Discriminant Validity

Evidence of construct validity is demonstrated by presence of both convergent and discriminant validity. Convergent validity is assumed when items correlate strongly with other items in the same constructs. If the items correlate weakly with items in other constructs then that is considered discriminant validity.

We tested for convergent validity using confirmatory factor analysis (CFA) in WarpPLS [30] (Tables 3 and 4). In CFA you specify a priori, a pattern of factor loadings for a specific number of orthogonal or oblique factors, and then check whether the correlation matrix obtained can be reproduced given these specifications. CFA specifies the pattern of loadings of the measurement items on the latent constructs. The pre-specified model fit was analyzed by looking at the pattern of loadings of the measurement items and comparing it to the theoretically anticipated factors. Loadings and cross-loadings were examined and items with p-values less than 0.05 and loadings less than 0.5 were removed [20].

Discriminant validity was also assessed by comparing the average variance extracted (AVE) values associated with each construct to the correlations among constructs. AVE represents the percentage of variance captured by a construct and is shown as the ratio of the sum of the captured variance to the measurement variance [19].

In order to claim discriminant validity, the square root of the AVE for each latent variable, given in the diagonals (shown in Table 5 and 6) should be larger than any correlations of latent variables [15]. The results show that the square root of the AVE (diagonal values) are larger than any correlations of the latent variables (all values above and the respective AVEs) thus suggesting evidence of discriminant validity.

TABLE 2: Latent variable coefficients

Construct	Variance Explained (R^2)		Composite Reliability		Cronbach's Alpha	
	mIM	mText	mIM	mText	mIM	mText
Experience with mCMC			0.928	0.957	0.903	0.874
Experience with comm. partner			0.862	0.835	0.759	0.701
Experience with topic			0.955	0.969	0.928	0.563
Perceived Richness	0.30	0.13	0.790	0.759	0.598	0.895
Social Presence	0.42	0.37	0.907	0.945	0.863	0.922
Synchronicity			0.880	0.908	0.793	0.848
Nodelay			0.901	0.822	0.835	0.673
Engagement			0.892	0.900	0.758	0.779
User Satisfaction	0.29	0.03	0.943	0.935	0.909	0.895

A variance inflation factor (VIF) is a measure of the degree of multicollinearity among the latent variables that are hypothesized to affect another latent variable (predictors). VIF were calculated for the predictor latent variables. Conservatively, VIF should be lower than 5 although a more relaxed criterion is that they should be lower than 10 [20,29]. A higher VIF between two latent variables indicates that the two latent variables measure the same thing and hence the need to remove one of the latent variables from the model. All values met the criterion with the highest value being 2.575, thus suggesting that there are no latent variables that measure the same thing.

Structural Model Analysis

The research model and its related hypotheses were assessed with WarpPLS [30]. WarpPLS produces path coefficients with their respective p-values, and R-squared coefficients. In PLS-based SEM analysis, path coefficients are referred to as beta (β) coefficients. The explanatory power of the structural model is evaluated by examining the squared multiple correlation (R^2) value in the final dependent constructs. The R^2 measures the percentage of variation that is explained by the model. The R^2 for each of the dependent variables for mIM are as follows: perceived social presence (0.40), perceived channel richness (0.32), and perceived channel satisfaction (0.29). On the other hand the R^2 for the dependent variables for mText are as follows: perceived social presence (0.55), perceived channel richness (0.26), and perceived channel satisfaction (0.04). The path coefficients along with their probability values and the explained variances (R^2) are presented in Figure 2.

TABLE 3: Confirmatory factor analysis (mIM)

	SOPR	EXCHA	EXPAT	EXTOP	ENGA	SYNC	NODEL	PRICH	CHSAT
SOPR1	0.988								
SOPR2	0.753								
SOPR3	0.845								
SOPR4	0.846								
SOPR5	0.763								
EXCHA1		0.877							
EXCHA2		0.903							
EXCHA3		0.848							
EXCHA4		0.854							
EXCHA5		0.757							
EXPAT1			0.713						
EXPAT2			0.852						
EXPAT6			0.866						
EXPAT7			0.656						
EXPAT8			0.836						
EXTOP1				0.881					
EXTOP2				0.974					
EXTOP3				0.948					
ENGA2					0.685				
ENGA4					0.578				
ENGA5					0.689				
ENGA6					0.755				
SYNCH1						0.611			
SYNCH2						0.660			
SYNCH3						0.697			
SYNCH4						0.726			
SYNCH5						0.865			
NODEL1							0.771		
NODEL2							0.955		
NODEL3							0.889		
NODEL4							0.732		
PRICH1								0.613	
PRICH2								0.794	
PRICH3								0.929	
PRICH4								0.811	
CHSAT1									0.569
CHSAT2									0.936
CHSAT3									0.872
CHSAT4									0.947

TABLE 4: Confirmatory factor analysis (mText)

INDIC	SOPR	EXCHA	EXPAT	EXTOP	ENGA	NODEL	SYNCH	PRICH	CHSAT
SOPR1	0.838								
SOPR2	0.912								
SOPR3	0.891								
SOPR4	0.847								
SOPR5	0.660								
EXCHA1		0.913							
EXCHA2		0.873							
EXCHA3		0.916							
EXCHA4		0.912							
EXCHA5		0.903							
EXPAT1			0.989						
EXPAT2			1.038						
EXPAT6			0.689						
EXPAT7			0.667						
EXPAT8			0.655						
EXTOP1				0.915					
EXTOP2				0.997					
EXTOP3				0.953					
ENGA3					0.882				
ENGA4					0.931				
NODEL1						0.731			
NODEL2						0.990			
NODEL3						0.889			
NODEL4						0.788			
SYNCH1							0.680		
SYNCH2							0.752		
SYNCH3							0.813		
SYNCH4							0.554		
SYNCH5							0.780		
PRICH3								0.873	
PRICH4								0.955	
CHSAT1									0.790
CHSAT2									0.940
CHSAT3									0.859
CHSAT4									0.866

TABLE 5: Correlations and AVE (mIM)

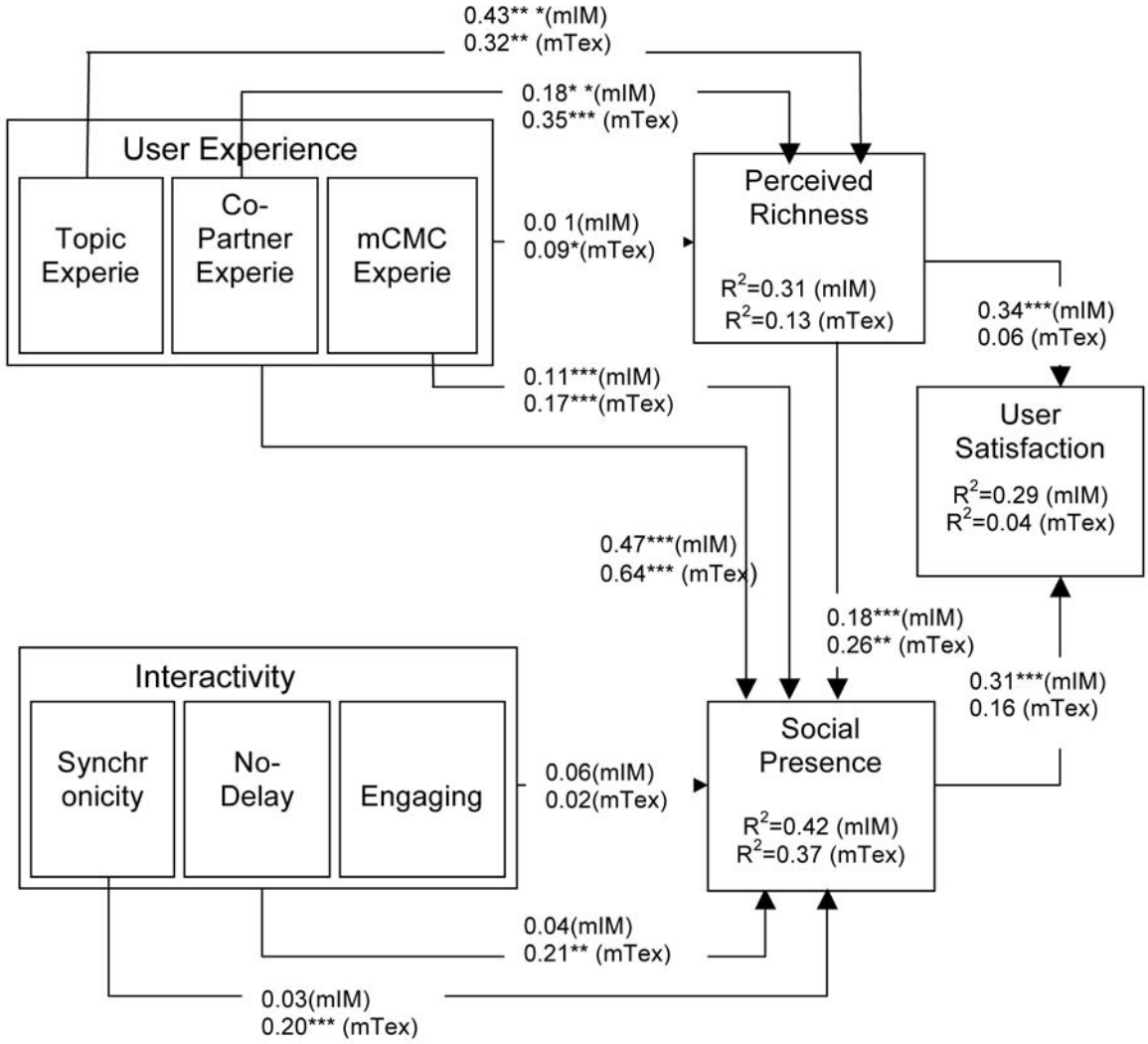
Variable	SOPR	EXCHA	EXPAT	EXTOP	ENGA	SYNC	NODE	PRICH	CHSAT
SOPR	**0.837**								
EXCHA	0.31***	**0.849**							
EXPAT	0.687***	0.295***	**0.785**						
EXTOP	0.456***	0.244***	0.531***	**0.935**					
ENGA	0.358***	0.406***	0.495***	0.464***	**0.675**				
SYNCH	0.215***	0.416***	0.313***	0.187**	0.537***	**0.698**			
NODEL	0.433***	0.363***	0.534***	0.433***	0.601***	0.522***	**0.839**		
PRICH	0.515***	0.196***	0.571***	0.579***	0.493***	0.299***	0.537***	**0.746**	
CHSAT	0.448***	0.372***	0.499***	0.367***	0.552***	0.427***	0.622***	0.498**	**0.844**

Square roots of AVE's shown on diagonal; *** indicates $p < 0.001$; ** indicates $p < 0.05$; * indicates $p < 0.5$

TABLE 6: Correlations and AVE (mText)

Variable	SOPR	EXCHA	EXPAT	EXTOP	ENGA	NODEL	SYNCH	PRICH	CHSAT
SOPR	**0.832**								
EXCHA	0.398***	**0.903**							
EXPAT	0.727***	0.429***	**0.811**						
EXTOP	0.537***	0.36***	0.634***	**0.955**					
ENGA	0.164**	0.216***	0.103*	0.065	**0.907**				
NODEL	0.496***	0.536***	0.565***	0.558***	0.205***	**0.853**			
SYNCH	0.378***	0.388***	0.379***	0.395***	0.35***	0.623***	**0.717**		
PRICH	0.234***	0.151**	0.325***	0.245***	0.028	0.358***	0.217***	**0.914**	
CHSAT	0.058	0.252***	0.158**	0.057	0.069	0.152	0.204***	0.046	**0.865**

Square roots of AVE's shown on diagonal; *** indicates $p < 0.001$; ** indicates $p < 0.05$; * indicates $p < 0.5$



*** indicates $p < 0.01$; **indicates significance at < 0.05; *indicates significance at < 0.1

FIGURE 2: Research model path coefficients probability values and the explained variances (R^2)

DISCUSSION AND IMPLICATIONS

Research Findings

Most of the hypotheses were supported as shown in the Figure 2 above. The results show that user experience, perceived richness and interactivity explained 42 percent and 37 percent variation in social presence in mIM and mText respectively. These findings however suggest that the influence of predictor variables were more pronounced in mIM than mText. Interestingly experience with mCMC did not show any correlation with perceived richness. This finding is supported by previous research which found that this relationship diminishes over time as users become familiar with the technology [6,52].

However, user experience with communication partners showed a positive relationship with both perceived richness and perceived social presence as hypothesized for mCMC. This finding is also supported by Timmerman and Madhavapeddi [55] who found that experiences with communication partner contributed to perceptions of CMC richness. Other studies show that IM users display different behaviors when communicating with long-time IM-communication partners than with new partners [23,25,34].

The study also established that perceived social presence and perceived richness of mCMC had a direct influence on user satisfaction in mCMC. The two explained 29 percent and 4 percent variation in channel satisfaction for mIM and mText respectively. The result is a replication of prior studies which suggest that social presence is correlated to CMC choice [48,54], satisfaction [55], and higher system usage [55].

The hypothesized relationship between interactivity and perceived social presence was not observed especially among the mIM users. Synchronicity and No-delay where the only dimension that showed a positive relationship with perceived social presence among mText users. Prior studies have suggested that synchronicity may contribute to social presence through enhanced perceived immediacy [28]. Perceived immediacy enhances richness which leads to higher social presence [55]. We believe that interactive dimensions may influence social presence indirectly through perceived richness. We failed to investigate this relationship although it is likely that these dimensions may have an influence on perceived richness. We suggest that future research should examine if the relationship between interactivity and perceived social presence is indirect through perceived richness. Also, most of the items used for measuring interactivity were borrowed from the advertisement and marketing literature. There is need to develop better scales in information systems literature. This might help overcome some of the setbacks we experienced. Another possible explanation might lie in the fact that only two items were used for No-delay and engagement constructs after the rest of the items were removed because of reliability and validity reasons. A backward multiple regression between interactivity and perceived social presence established that No-delay is positively associated with perceived social presence.

These findings suggest that other factors may be acting as major players in user satisfaction with mCMC besides perceived richness and perceived social presence. Other possible variables that are likely to influence user satisfaction with mCMC include: mobility, flexibility, convenience and social influence.

Implications for Researchers

This paper provides some theoretical implications for IS research. There is growing need for more focus on the design of communication technologies that enhances social presence for more effective interaction and communication [55]. Previous research on CMC has largely focused on factors relating to richness, satisfaction and user experience. This study however, expands the scope of the current literature by: (1) testing these variables with mobile devices and (2) examining a key theoretical antecedent of social presence (or mobile presence) — interactivity — that has so far received little attention in the IS literature. Our findings suggest that future studies examining mobile presence, should also look at various ways in which interactivity influences social presence and satisfaction in mCMC. Although some questions remain unanswered regarding interactivity as an antecedent of social presence, we believe that this represents a major step towards understanding the theoretical basis for mobile presence and satisfaction with mCMC.

Implications for Practitioners

This paper provides some practical implications for the practitioners as well. Organizations could borrow a leaf from these findings and take advantage of the emerging market of mobile computer-mediated communication technologies. Teens in the U.S. represent the largest group attracted to mobility. Perhaps, by investing in mobile communication technologies, business have an opportunity to reach out to a very important demographic in advertising.

The findings of this study provide a general guideline for practitioners on better design that enhances interactivity through social presence (or mobile presence) in mCMC. We believe that the findings would help practitioners better understand how user experience, richness of the technology and the level of interactivity among users shape satisfaction with mCMC. Most importantly, designers of these technologies will appreciate the importance of integrating presence(or location awareness) and richness in mobility.

Additionally managers focused on promoting adoption of mobile devices at the place of work should encourage users to maximize the interactivity features that enrich these technologies. Perhaps organizations could benefit through knowledge sharing when employees interact socially through mobile devices.

On the other hand managers should be aware that mobile devices are emerging as a key security risk in companies today, especially in cases where employees use their personal devices for company related work. Sadly, most employees are not aware about the existing policies regarding the use of mobile devices at their work place.

LIMITATIONS AND FUTURE RESEARCH

Limitations of the Study

This paper has several limitations that might affect the outcome of the research findings. First, data collection was done using university students. The homogenous nature of the student sample limits the generalizability of the research findings. Nonetheless, university students were selected because

they represent the demographics that are frequent users of mCMC. Second, respondents were asked to evaluate their usage of mCMC communication services in a given time frame. The assumption here is that respondents could remember how often they used mCMC within a given time frame. It is possible that some respondents did not remember how often they used mCMC. Third, the number of mText users and mIM users were not the same. mText users outnumbered mIM users by a slight margin. It is likely that the imbalance between the two groups may have skewed the research findings. Further studies should be done using sample of the same sizes from the two groups. Fourth, respondents were recruited from one single university. The perception of students may not be as diverse as those collected from a different setting. Therefore, the sample may not be a good representative of the actual population. The best option would have involved random selection of mCMC users from several regions. We recommend that further studies be conducted using samples from different regions.

Future Research

Although a lot of progress has been made in developing measuring instruments for examining the relationship between experience, perception of richness and satisfaction with mCMC, more research work is needed in the area of social interactive design. This study simply provides some insight into this emerging area of social interactive design, by examining the relationship between interactivity and social presence. We challenge IS researchers to develop more theories on social interactive design.

This study borrowed heavily from the advertising literature to explore the relationship between interactivity and social presence in mCMC. The dimensions of interactivity used in this study may not necessarily be the most suited. More work should be done in this area and better scales developed to measure the construct of interactivity.

We believe that other factors may be acting as major players in user satisfaction with mCMC besides perceived richness and perceived social presence. Other possible variables that are likely to influence user satisfaction with mCMC, and which are worth investigating include: mobility, flexibility, convenience and social influence.

CONCLUSION

Prior research on CMC has largely focused on factors relating to richness, user experience, social presence and satisfaction. This study both confirms and expands prior theories by showing that user experience, richness and interactivity are antecedents of social presence. The study also confirms that social presence and richness influence satisfaction with mCMC. Most importantly, this study expands the scope of this literature by examining a key theoretical antecedent of social presence — interactivity — that has so far received very little attention in the IS literature. Interactivity influences social presence and is therefore important in the design of these technologies. Our results suggest that future investigation contiguous to interactivity should explain the diverse ways that interactivity enhances social presence (or mobile presence). Although questions remain, most notably with the construct of interactivity, this work represents an important step towards unraveling the important theoretical linkage between user experience, richness, interactivity and social presence.

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QUESTIONNAIRE

Perceived Social Presence — Short et al [46]
- Using mobile IM/Texting makes me feel closer to the person/ people I communicate with
- Using mobile IM/Texting allows me to express myself when communicating with close friends
- I feel emotionally connected to mobile IM/Texting when communicating with close friends
- I find warmth in mobile IM/Texting when communicating with close friends
- Mobile IM/Texting provides personalized information presentation

Experience with mCMC — Carlson & Zmud [6]
- I am very experienced using mobile IM/Texting
- I find mobile IM/Texting very easy to use
- I feel competent using mobile IM/Texting
- I understand how to use all the features of mobile IM/ Texting
- I feel comfortable using mobile IM/Texting
- I feel I am not experienced using mobile IM/Texting

Experience with Communication Partner —
Carlson & Zmud [6]
- I feel mobile IM/Texting allows me to communicate emotional issues with close friends
- I feel mobile IM/Texting allows me to communicate personal/ private issues with close friends
- I feel mobile IM/Texting allows me to communicate informally with close friends
- Using mobile IM/Texting makes me feel I am not familiar with close friends
- I feel I do not trust my close friends when using mobile IM/ Texting
- Using mobile IM/Texting makes me feel I am familiar with close friends
- I feel that mobile IM/Texting allows me to communicate formally/officially with close friends
- Using mobile IM/Texting makes me feel close to my close friends

Experience with Topic — Carlson & Zmud [6]
- Using mobile IM/Texting makes me feel I am experienced with the topic of discussion when communicating with close friends
- Using mobile IM/Texting makes me feel I am more knowledgeable about topic of discussion when communicating with close friends
- Using mobile IM/Texting makes me feel I am well versed with the concepts of the topic of discussion when communicating to close friends

Engaging — MacMillan & Hwang [32],
Liu [31] Khalifa & Shen [28]
- I feel that I have a great deal of control over mobile IM/ Texting
- I feel that mobile IM/Texting keeps my attention when communicating with close friends
- I feel that mobile IM/Texting is unmanageable
- I feel that mobile IM/Texting doesn't keep my attention when communicating with close friends
- I feel that mobile IM/Texting allows me to respond to messages when convenient

Perceived Channel Richness — Daft & Lengel [11]
- Using mobile IM/Texting allows me and my close friends to receive an mobile IM/Texting immediate response
- Using mobile IM/Texting allows me and my close friends to tailor our messages to our personal requirements
- Using mobile IM/Texting allows me and my close friends to share our feelings or emotions in our messages
- Using mobile IM/Texting allows me and my close friends to communicate a variety of different cues (e.g. emotional tone and attitude) in our messages"
- I feel that mobile IM/Texting has variety of content (signs, symbols, verbal and nonverbal formats)
- I feel that mobile IM/Texting lacks content (signs, symbols, verbal and nonverbal formats)

Nodelay — MacMillan & Hwang [32],
Liu [31] Khalifa & Shen [28]
- I find it easy to input feedback with mobile IM/Texting
- I feel that mobile IM/Texting processes inputs very quickly
- I find it easy to process information with mobile IM/Texting
- I feel that mobile IM/Texting allows me to get information from close friends very fast

Synchronicity — MacMillan & Hwang [32],
Liu [31] Khalifa & Shen [28]
- I feel that mobile IM/Texting allows two way communication
- I feel that mobile IM/Texting allows instantaneous communications
- I feel that mobile IM/Texting is interactive
- I feel that mobile IM/Texting is a one-way communication
- I feel that mobile IM/Texting does not allow instantaneous communications

Channel Satisfaction — Otondo [37]
- The way information is presented in mobile IM/Texting is satisfactory to me
- Overall I feel satisfied with mobile IM/Texting
- In future I am likely to use mobile IM/Texting
- Overall my experience using mobile IM/Texting is positive