Revisiting Social Influence in the Ubiquitous Computing Era

Jay Zeal  
University of Melbourne  
jzeal@unimelb.edu.au

Stephen P. Smith  
Monash University  
stephen.smith@monash.edu

Rens Scheepers  
Deakin University  
rens.scheepers@deakin.edu.au

Abstract

This paper revisits the social influence construct in the era of ubiquitous computing. Despite its rather broad origins in psychology, social influence has to date been operationalized rather narrowly in the information technology adoption literature. We report on a study of mobile technology users in which we studied various social influences on these individuals. We isolate four distinct variants of social influence, operating in both inbound and outbound directions, each with positive and negative impacts. The study integrates three different dimensions of social influence into an analytical framework to facilitate future research.

1. Introduction

"One of the most pervasive determinants of an individual’s behavior is the influence of those around him" - Burnkrant et al. 1975.

Ubiquitous computing is increasingly part of everyday life through portable and persistently connected computing devices such as smart mobile phones, portable entertainment devices, and location-aware applications. Ubiquitous computing encompasses a mix of utilitarian, hedonic and connective applications that have been embedded into work, socialize and play activities [1]. For example, social networking applications such as Facebook and Twitter, accessed via the desktop and mobile computing platforms that people use for most of their waking hours are simultaneously work and play related, and so blur the distinction between social interactions for work and for play [1][2]. The always on, always connected environment that these devices create is a radical departure from the desktop-dominated computing era. In the contextually-bounded computing environments of the pre-ubiquitous era, desktop systems at home and work provided discrete and independent computing environments. These environments are becoming less distinct, however, as portable and persistently connected devices become prevalent, and processing and applications become network-centered rather than device-centered.

The majority of research into technology acceptance to date has focused on a single context of use, and most often has been set in an organizational context. Close examination of the constructs in these models reveals a strong utilitarian focus [3][4][5][6]. This reflects the journey of computerization, which commenced within the organizational context, and only has comparatively recently extended to homes and society as a whole. When the Technology Acceptance Model (TAM) was formulated in 1989, for instance, most computer use occurred in organizational contexts and was geared towards explaining individual acceptance (as workers) of organizationally-related IT such as spreadsheets, word-processing, and computer-aided design packages [3]. TAM and related models have provided valuable insights into these adoption processes. Although recent advances in ubiquitous and mobile computing have caused contextual boundaries to have become blurred (i.e., a single device can simultaneously service social and work needs), social influence as operationalized in the Information Systems discipline still remains largely contextually bound to a particular context (workplace or home).

In a ubiquitous computing era where many individuals typically have inter-connective forms of technologies (e.g., iPads, smartphones, location-based devices and services) with them at most times, context switching occurs sporadically. In this regard, Choi et al. (2007) has suggested that quality of life is a more inclusive dependent variable to explain technology used across multiple contexts [7]. Others conceptualize context in terms of hedonic and utilitarian motivations to adopt and use [8]. These approaches stand in contrast to the contextually-bound, single purpose assumptions that underpin many current technology acceptance models. In a ubiquitous computing context, the individual recognizes value in three separate dimensions: utilitarian, hedonic and social [1]. Hence it remains uncertain whether the existing operationalization of social influence is adequate to capture the nuances of use in multiple contexts and with multiple purposes in the ubiquitous technology era. We thus consider the following research question:

Should the social influence construct, as currently operationalized in IS literature, be broadened to account for technology adoption in today's multi-purpose, multi-contextual, ubiquitous technology era? And if so, how?

The paper is structured as follows. First we present the existing literature and identify deficiencies in the operationalization of the social influence construct. We then develop a more comprehensive framework for the analysis of social influence in ubiquitous computing area. We do so by drawing on the social psychology and wider
literature, isolating four distinct variants as one of the dimensions of social influence. We then identify two additional dimensions of social influence, relating to the direction (inbound or outbound), and impact (positive or negative) of the influence. We incorporate these three dimensions into an analytical framework, which we illustrate empirically. We contend this analytical framework better accommodates the nuances of social influence in the ubiquitous computing era.

2. Literature Review

The review begins with the origins of social influence in social psychology research. We then describe how social influence has been operationalized by Information Systems scholars, emphasizing the lack of consistency and theoretical precision. We examine literature that points to a richer conceptualization of social influence (term the network perspective), that extends simplistic unidirectional influences. The networked perspective acknowledges social influence in terms of both sender and receiver and explores the nature of the influence (positive or negative), in terms of individual adoption and non-adoption.

2.1. Roots of Social Influence in Social Psychology

Social influence is “any change which a person’s relations with other people (individuals, groups, institutions or society) produce on his intellectual activities, emotions or actions” [9]. Deutsch and Gerard (1955) define three distinct forms of social influence: informational, normative and value-expressive influence [10]. These correspond to and operate through the three processes of social influence described by Kelman (1958): internalization, compliance and identification [11].

Informational influence refers to the provision of credible evidence of reality [12]. Presented with the need to make informed decisions, individuals accept the opinions of those who are seen as credible when “proof of reality” is complex, vague or difficult to determine. The lower the individual’s confidence and knowledge in the matter, the greater the tendency to seek the opinion of someone perceived as more knowledgeable [13]. This form of social influence accounts for the persuasive power of mass media and printed literature where the author or media source is perceived as reputable. Informational influence (defined in Kelman’s three processes of social influence as a form of internalization) occurs when a user perceives information obtained via credible sources as enhancing his or her knowledge [11][14]. Referring to the advice of a friend who works as a computer salesman in selecting a laptop for oneself is an example of informative influence in operation.

Value-expressive influence, on the other hand, refers to an individual’s desire to enhance his/her self-image through association with a reference group [15]. This relates to the notion of ‘social status’ and manifests as individuality or ‘need for uniqueness’ by establishing social differentiation [16][17]. Value-expressive influence operates through the Kelman’s process of identification. This occurs when an individual adopts another person’s behaviors because such actions are associated with a satisfying, self-defining, relationship with another person or group [11]. An executive of an organization adopting a high-end smartphone believing his status is better expressed by having the device, would be an instance of value-expressive influence in action.

Normative social influence relates to conformity with the expectations of other persons or groups, to achieve rewards or avoid punishment [13][18]. Within Kelman’s three processes of social influence, normative influence operates through process of compliance where an individual exhibits behavior in accordance with others’ expectations [11]. An employee attending a workplace meeting with his superiors, feeling the weight of expectation by colleagues as to be not interrupted, turning the cellular phone off is a case of normative influence at play.

At an organizational level mandating use of a technology (normative influence) is commonplace. However, at the personal level, where voluntary use is more common, normative influence nevertheless occurs, but assumes more subtle forms. For instance, some telecommunication providers bundle additional services with the operating systems of mobile devices. This could be considered a subtle form of normative social influence that seeks to influence an individual to adopt such additional services. These examples raise the need to revisit existing theoretical perspectives to better capture the richness of social influence in the context of consumer-based ICT adoption and use. In this paper we define technology adoption as accepting a technology with the intent to use.

A fourth variant of social influence, termed Relationship-centered influence emanates from the human need to form and maintain strong, stable interpersonal relationships that bring in a sense of belonging and satisfaction [19]. This need is revealed in social networks where individuals seeking to strengthen relationships perform behaviors intended solely for the benefit of other group members.
(families and networks of close friends are typical settings for this type of behavior). Social capital scholars refer to the strength of such ties within a social group as 'bonding capital' [20]. Actions to strengthen within-group bonds typically take the form of gestures of generosity and kindness. This variant of social influence is unique in that the beneficiary of the behavior is not oneself (See Table 1). A husband may download a novel that he believes his wife would enjoy reading into his iPad solely for her benefit. There is no obvious provision of knowledge (informative influence), social status gain (value-expressive influence) or conformance to another's expectation (normative influence). The motivation is instead likely to be concerned with connectedness and bonding.

Whilst each abovementioned variant of social influence is conceptually distinct, when observed in practice each may occur in isolation or in combination, and to differing degrees. For instance, a person may purchase an expensive watch as a result of peer pressure from colleagues who use the watch as a token of group membership (normative influence). Simultaneously, the watch may also act, to a lesser extent, as a symbol of social class and status (value-expressive influence). This illustrates the potentially conflated nature of the social influence construct, and the need to disaggregate and distinguish different variants when operationalizing the construct.

### Table 1: Distinct variants of social influence

<table>
<thead>
<tr>
<th>Variant of Social Influence</th>
<th>Brief Description</th>
<th>Motivation</th>
<th>Primary Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informative</td>
<td>Influence of knowledgeable individual(s)</td>
<td>Knowledge, information</td>
<td>Self</td>
</tr>
<tr>
<td>Value-expressive</td>
<td>Influence concerning a person’s self-concept (Status, social image, uniqueness)</td>
<td>Social status, image, identity</td>
<td>Self</td>
</tr>
<tr>
<td>Normative</td>
<td>Conforming to others’ expectations</td>
<td>Authority</td>
<td>Self</td>
</tr>
<tr>
<td>Relationship-centered</td>
<td>Accommodating others via favors and benefits</td>
<td>Connectedness, Bonding</td>
<td>Others</td>
</tr>
</tbody>
</table>

Next we examine social influence construct as operationalized in the field of Information Systems.

### 2.2. Social influence in Information Systems

In the Social Psychology and Marketing literatures, social influence is considered a theoretically mature concept [21]. The use of this construct in IS technology adoption research is, however, problematic [22][23] due to inconsistency in the classification of the type of social influence employed, and inconsistency in findings about the role and significance of social influence in technology acceptance [24]. (A summary of leading IS research that incorporate social influence appears in Table 2).

With regard to inconsistencies in classification of social influence it seems that there is little consensus in IS. This might be due to the lack of any overarching theoretical models that seek to account for all forms of social influence. For instance, the Model of Adoption of Technology in Households (MATH) classifies informational influence (influence of news media and experts) as normative influence whereas value-expressive influence (social status gain) is classified not as a social influence construct, but as an attitudinal belief [25]. TAM2 implies value-expressive influence is a sub-type of normative influence by attempting to capture the effects of the former via the latter [5]. Some models incorporate ‘social influence’ when it seems to refer to normative influence only [6]. A more unified classification of the different variants of social influence is therefore necessary.

<table>
<thead>
<tr>
<th>Source</th>
<th>Acceptance Model</th>
<th>Variant of Social Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis 1989</td>
<td>TAM</td>
<td>Unspecified (subsumed in External Variables)</td>
</tr>
<tr>
<td>Thompson et al. 1991</td>
<td>MPCU</td>
<td>Normative</td>
</tr>
<tr>
<td>Rogers 1995</td>
<td>DT</td>
<td>Informative</td>
</tr>
<tr>
<td>Taylor et al. 1995</td>
<td>TAM-TPB</td>
<td>Normative</td>
</tr>
<tr>
<td>Venkatesh et al. 2000</td>
<td>TAM 2</td>
<td>Normative/Value-expressive</td>
</tr>
<tr>
<td>Venkatesh et al. 2003</td>
<td>UTAUT</td>
<td>Normative</td>
</tr>
<tr>
<td>van der Heijden 2004</td>
<td>Hedonic</td>
<td>Unspecified (similar to TAM)</td>
</tr>
<tr>
<td>Brown et al. 2005</td>
<td>MATH-HLC</td>
<td>Normative/Value-expressive</td>
</tr>
<tr>
<td>Brown et al. 2006</td>
<td>MATH</td>
<td>Normative/Value-expressive</td>
</tr>
<tr>
<td>Eckhardt et al. 2008</td>
<td>Multi-layered Referent Model</td>
<td>Normative</td>
</tr>
<tr>
<td>Venkatesh et al. 2008</td>
<td>TAM 3</td>
<td>Normative/Value-expressive</td>
</tr>
<tr>
<td>Eckhardt et al. 2009</td>
<td>Workplace Referent Model</td>
<td>Normative</td>
</tr>
<tr>
<td>Kim et al. 2009</td>
<td>MDS Value Perspective</td>
<td>Normative / Informative / Value-expressive</td>
</tr>
</tbody>
</table>

Table 2: Leading IS research that incorporate social influence in models of technology acceptance and use.

With regard to inconsistencies in findings concerning the role and significance of social influence let us start by analyzing social influence in the most frequently cited model for technology adoption, the Technology Acceptance Model (TAM) [3]. "Subjective norm" in the Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB) representing normative influence was found to be not significant in TAM and was eliminated from the model [3][24]. Later versions of TAM, e.g. TAM2, reintroduced social influence constructs back into the model [5]. Over the years some researchers have chosen to leave it out, others found its effects insignificant [26][27] while some incorporated only
certain forms of social influence, mostly normative variant, into their models of technology adoption [4][28]. Despite each study using theoretical arguments in support of the particular type of social influence used in its model, overall there has been no framework governing the use of social influence constructs in the information systems discipline. As a result, the inclusion of social influence construct in its many forms into models of technology acceptance appears a bit haphazard. This observation is echoed by Eckhardt et al. (2008): “There is still a distinct lack of knowledge for the concrete effect of social influence in individual technology adoption” [21]. Recent research in the field also suggests that “a single cumulative subjective norm measure might be too naïve” [4]. Similarly, Srite and Karahanna (2006) recommend that different social norms be conceptualized more distinctly to describe more accurately the nuances of the social environment [29].

Due to the abovementioned inconsistencies in classification of the variants of social influence and the inconsistencies in findings within the IS research we resort to the original definition of social influence from social psychology in developing a more comprehensive framework of social influence (Table 1). We contend that the diversity in the terminology used to describe different variants of social influence encountered in IS technology adoption and use literature (as summarized Table 2), can readily be accommodated in the classification in Table 1. However, the different variants of social influence denote only one dimension of this complex construct. We now consider other dimensions of social influence in the literature.

2.3. Network perspective: The direction of influence as an additional dimension

Since the inception of sociology in the 19th century, society has been considered as a complex web of interactions between individuals. Sociologist Karl Marx (1857) remarks: "society is not merely an aggregate of individuals; it is the sum of the relations in which these individuals stand to one another” [30]. Hence social influence by definition is a network effect [30][31] where influence flows from highly influential actors within the network (also known as opinion leaders) towards the targets of such influence [32]. Within the IS acceptance literature, social influence is usually modeled as a unidirectional construct [4], and rarely formulated as a multidirectional network effect where the influence flows inbound as well as outbound. In social psychology it has been established that opinion leaders (those who regularly influence others) are themselves affected by the changed behavior of the ones being influenced in an influence cycle [33]. By focusing only on inbound social influence, such nuances of network related effects can easily be overlooked.

In contrast to the individual technology acceptance literature, frameworks in related areas of research accommodate both the inbound and outbound nature of social influence. For instance, in the literature on the diffusion of innovations, some theoretical models incorporate both inbound and outbound influence to consider the supply side (outbound push) and the demand side (inbound pull) of diffusion [34]. Successful innovation most often occurs when a need (inbound pull) and the means to resolve it (outbound push) emerge simultaneously [35][36]. There are clear parallels between innovation diffusion and social influence in that both use social networks for transfer of information and influence. This suggests that social influence should also be modeled as a multidirectional construct in technology acceptance work.

2.4. Positive/negative nature of influence as another dimension: The impact on adoption/non-adoption

Lastly, an aspect of social influence that is widely recognized as needing further investigation is its effect on non-adoption [33][37]. Eckhardt suggests that “research in the field of IT non-adoption is still somewhat immature” [4]. Studies that distinctly observed non-adoption have identified that non-adopters are affected by fear of obsolesce [25] and resistance to change [38]. However, the role of social influence in this regard, remains to be determined. We therefore contend that a proposed framework for social influence should be applicable to explain both adoption and non-adoption.

Non-adoption related to social influence falls into two related categories. Firstly, the case of non-adoption due to insufficient social influence, resulting in a lack of impetus for technology adoption and use to manifest, is the perspective that most research have examined. Hagerstrand, in the area of innovation diffusion, posits that it is through a hierarchy of social networks (informational influence) that an innovation filters from a few innovators to the general population and the lack of such networks results in unawareness and non-adoption [39]. Within the technology adoption literature there are many instances where the model hints at a lack of social influence contributing to the non-formation of behavioral intention to adopt (non-adoption) [5][6]. Second, non-adoption could be the result of inhibitors
(factors that specifically deter individual adoption) [40]. For example, perceptions of inadequate security could influence an individual not to engage in an online financial transaction.

While the aspect of non-adoption related to the lack of social influence is somewhat established it must be emphasized that the lack of social influence here refers to the absence of positive social influence supportive of adoption decisions. In many technology adoption models in IS there is an underpinning assumption that social influence considered is of positive nature and that social influence construct only indicates (regardless of the terms used "social norm", "social status" etc) the presence of conducive social influence (positive) or the lack thereof. However the original definition of social influence in TRA (subjective norm) clearly suggests presence of positive as well as negative influence: "The person's perception that most people who are important to him think he should or should not perform the behavior in question" [41]. In IS models of adoption however the negative variant is noticeably absent or worded to imply that only the positive form is considered. An example is Moore et al, in which social influence refers only to positive effects of 'social image' [42]. Similarly, the social influence component of TAM 2 (normative and value-expressive influence) is a "users' perception of usefulness increasing in response to persuasive social information" [5]. As such, we suggest the impact of social influence (positive or negative) should be accommodated in a more comprehensive analytical framework, especially to explain non-adoption.

2.5. Social influence in 3D

As evident from the literature examined, normative social influence, despite having much prominence, lies within a single dimension of a complex phenomenon. To analyze social influence more comprehensively, we therefore contend that the constructs should accommodate at least the three distinct dimensions summarized in Table 3.

<table>
<thead>
<tr>
<th>Dimension 1</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variants of social influence</td>
<td>(refer Table 1)</td>
</tr>
<tr>
<td>Dimension 2</td>
<td>Direction of influence within the social network between sender and receiver</td>
</tr>
<tr>
<td>Dimension 3</td>
<td>Impact of influence (positive/negative nature leading to adoption/non-adoption)</td>
</tr>
</tbody>
</table>

Table 3: The Dimensions of Social Influence

3. Research Method

3.1. Field study

We conducted a field study to investigate how social influence shapes mobile device usage in today's ubicomp environment. A brief overview of the choice of technology and the user group is provided to highlight their significance with regard to the social influence and the framework. Research method and data analysis follows.

3.2. Focus of the study

This research focuses on the use of multi-purpose mobile information appliances such as smartphones and tablet devices (e.g. iPads). The rich feature set and tailorability of these devices enables appropriation through the addition of new applications and add-on hardware. For example, Apple's online Appstore allows owners to extend the functionality of an iPad or iPhone on an ongoing basis. The key is that it allows a user to customize the device according to anticipated multi-contextual use. The study will focus specifically on those applications that involve social interaction and attempt to gauge the effects of social influence on adoption, use and appropriation behaviors.

3.3. Target technology

Device mobility has indeed enabled social mobility, a concept that Lyyinen and Yoo (2002) define as individuals being able to move between social contexts (office, meetings, home) and social roles (manager, colleague, parent) with ease, while remaining connected [43]. Mobile technology was chosen due to its portability enabling users to work, play and socialize while allowing multiple contexts to readily manifest. Personal mobile devices in this category involved smart-phones and iPad-like portable tablet computers (but not laptop computers). Where a user possessed multiple devices that they carried with them on a regular basis then the research focused on all devices involved. The emphasis was not on the device per se but rather on the individual's ubiquitous use of technology. Being able to carry the device with relative ease was considered a critical enabler of such use.

3.4. Target user group

To understand the subtleties of social influence in both work-related and non-work related settings the target users consisted of two groups mirroring the respective environments. The motivation for selecting two groups stemmed from the fact that any variants of social influence, likely to be acutely
visible within a particular context, would be captured readily by having two distinct groups.

The first of such groups, 'organizational group', came about due to a scheme made available to staff at an educational institution (Department of Accounting at Monash University, Australia) where iPads were provided for those who were interested in using them to help with their work activities at no cost to the adopters. Hence this was a group to which organizational influence to adopt a technology was exerted, similar to pre-ubiquitous era, where the technology was provided to assist in work-related activities. Despite the institution offering training to help users get accustomed to use the device for work purposes there was no explicit mention discouraging its use for non-work related tasks. Due to the ubiquitous nature of the device lending itself equally to work-related as well as non-work related contexts it provided a unique opportunity to study contextual switching between utilitarian, hedonic and social contexts sporadically in predominantly a work-related setting. The users were provided with the devices 6 months prior to the study which gave them ample time to get accustomed to the usage of the device and usage to settle into predictable regular use patterns (as opposed to initial exploratory oriented use which may only represent a learning curve rather than a goal oriented purposeful use). The typical age was 40 with participants ranging from 30-60.

The second group, 'general group,' was chosen where the push for adoption and use was free from organizational influence. This group represented a typical individual with a Smartphone sourced from researcher's personal network.

3.5. Research method and data collection

This research is qualitative in nature and exploratory in approach. Qualitative research was most suitable for capturing the contextual richness and complexities of the investigated systems [44]. An exploratory approach was appropriate to increase the understanding of a new phenomenon, test the feasibility of a more extensive study and develop the methods to be employed in a subsequent study [45]. The methodology was based on in-depth interviews [44] of semi-structured nature, which is a common approach in interviewing for qualitative research [46]. This type of interview involved the implementation of a number of predetermined questions. That allowed the respondents to determine the direction and content of the interview within a broader framework provided by the interviewer. We tailored open-ended questions that were organized into an initial questionnaire using theoretical constructs from the framework described in the previous section. We conducted a pilot study to assess the clarity and wording of the open ended questions contained in interview guideline during November 2010. Based on the experiences from the pilot study the initial questionnaire was refined to improve understandability and comprehension. The refined questionnaire was used for the main data gathering conducted during March-April 2011.

We interviewed users from organizational group in an organizational setting (at Monash University) and general group mostly in their home or social environment. As there was a ready supply of users particularly in the latter category we continued the interviews until it was perceived that the empirical returns became marginal (See Table 4).

<table>
<thead>
<tr>
<th>Group</th>
<th>Subjects</th>
<th>Tablets</th>
<th>Smart Phones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational group</td>
<td>8</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>General group</td>
<td>14</td>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 4: Groups, participants and mobile device used

3.6. Research process and data analysis

Interviews took approximately 40 minutes each, which allowed a thorough examination of participant's device usage, preferences and types of external influences at play. Interviews also covered demographical details and level of confidence in using the device.

All interviews were audio-recorded and notes were taken during the interview. The interviews were transcribed by one of the authors. Each interview comprised a workload of 3 hours. The transcripts were shared with interviewees to confirm that it accurately reflected their responses. These interviews provide rich accounts of underlying social influence acting upon individuals' technology adoption and appropriation behavior. What follows is a summary of the results of the qualitative study that uses quotes as appropriate to illustrate findings.

4. Results and Discussion

4.1. Dimension 1: The variants of influence

While evidence to support informative, value-expressive and normative variants were rife amongst the interview participants particular attention was given to rarely studied variant, relationship-centered influence.
4.1.1. Empirical validation of relationship-centered influence. Relationship-centered influence involves providing benefits to another member of the social group with whom the individual desires to strengthen social ties. There is an element of generosity or affection in the action that results in strengthening the relationship in the process. The existence of this distinctive variant was confirmed during the study. This typically involved an individual voluntarily downloading an app to his device solely for the benefit of others. For example:

"Those (apps) usually just sit in my phone; they keep the kids amused during long driving trips."

"I don't use that one (an interactive game app 'Pets Live'). I installed it so that Bella (a friend) gets extra points by having me as part of a larger group when she's fighting against others."

It is worth noting that informational influence at times could fall under the category of relationship-centered influence. However due to the closeness of the relationship the actions involving relationship-centered influence often go far beyond mere provision of information to manifest into more substantial benefits. Provision of benefits and favors to one another among friends and family members should come as no surprise as it is practiced within social circles from a young age. While it hasn't always been feasible to replicate such behavior within the technology domain in the pre-ubiquitous era, increased level of connectedness enabled by advances in mobile computing has fast tracked the transition of such behavior into the ubiquitous computing era.

Next we observe the direction of transfer of social influence within the social network through the lens of inbound and outbound influence.

4.2. Dimension 2: The direction of influence

A social network could be visualized as a complex cluster of differing variants of social influence flowing between pathways formed between two actors where one assuming the role of the (outbound) sender while the other acts as the (inbound) receiver of influence according to each others' needs at that particular moment in time. The roles of actors engaging in outbound push or the inbound pull could switch sporadically between interactions at different points in time creating a complex web of influence transfers that we collectively refer to as social influence. Evidence was found consistent with the above view that each variant of social influence in the framework is indeed dualistic in nature (See Table 5).

The informational influence in the outbound direction disseminates information to others backed by one's expertise in the subject with respect to the considered others. The following comments from a participant in the organizational group indicate informational influence in the outbound direction:

"I understand cloud based technology... (so) I am usually the one to keep tabs on anything worthwhile (Apps) and let my colleagues know"

Inbound informational influence acts to source information from a reliable source as evidence of reality. Informational influence in the inbound direction is revealed by a member of the general group:

"I check the ratings and read comments on Appstore (Apple's online mobile app shop) and only download stuff with 4 or 5 stars (rating)."

<table>
<thead>
<tr>
<th>Variant of social influence</th>
<th>Direction of influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informative</td>
<td>Outbound</td>
</tr>
<tr>
<td>&quot;I understand cloud based technology... (so) I am usually the one to keep tabs on anything worthwhile (Apps) and let my colleagues know&quot;</td>
<td></td>
</tr>
<tr>
<td>Value-expressive</td>
<td>Inbound</td>
</tr>
</tbody>
</table>
| "I was the first to have it (iPad); everybody thought that was cool and wanted to play with it."
| "If they have the same apps (on iPad) then I would think they are like me and perhaps easier to strike a conversation with."
| Normative                  | Outbound               |
| (No Evidence found in the present study.) |
| Relationship-centered      | Inbound                |
| "Those (apps) usually just sit in my phone; they keep the kids amused during long driving trips"
| "By doing that (partner downloading a music composition app) I felt he was thinking about me even when we weren’t together; that was sweet." |

Table 5: Examples of evidence from the field study categorized according to the proposed analytical framework

The outbound value-expressive influence translates into conveying one's social status or uniqueness to others. Within the constraints of the study it meant expressing ones social standing by the type of mobile device or the applications running on it. A member from the general group summarized:

"I was the first to have it (iPad); everybody thought that was cool and wanted to play with it"

Similarly the inbound value-expressive influence meant being perceptive to the others' social status or expressed uniqueness. Within the boundaries of the
study the perception of such values used technology as a means to communicate the perceived values. An organizational group member remarked:

"If they have the same apps (on iPad) then I would think they are similar to me and perhaps easier to strike a conversation with."

The outbound normative influence would cause others to conform to one's expectations. Within the confines of the study this meant exerting some control over others' actions related to the use of the device. This may be facilitated by having the person exerting the influence in a position of power.

Conversely, inbound normative influence pressures oneself to conform to others' expectations. As a member of the organizational group experienced:

"It (iPad) was pretty high tech and you could do a lot with it. But I felt it was supposed to help us with stuff related to our work. I'm still looking for an app of that sort."

Outbound relationship-centered influence causes one to provide benefits or favors to another with close social ties. Using mobile devices this could manifest as a favor provided via the use of mobile technology. A general user group member observed:

"Those (apps) usually just sit in my phone; they keep the kids amused during long driving trips."

Inbound Relationship-centered influence involves receiving a benefit from another with strong social ties. Interview participants from general group indicated that they felt a sense of closeness or gratitude and strengthened their relationship as a result. User from the general group summarized:

"By doing that (partner downloading a music composition app for her) I felt he was thinking about me even when we weren't together, that was sweet."

We next examine how social influence can lead to non-adoptions and non-appropriation.

4.3. Dimension 3: The impact of social influence (positive/negative nature)

The lack of informational influence can indeed contribute to non-adoptions due to the lack of awareness by the user. A member of organizational group stated:

".. I don't have one (hand writing recognition app) on here (iPad). There are probably ones out there but I am usually the last to find out..."

Whilst non-adoptions due to lack of social influence is implied by many technology adoption models, having social influence is assumed to be a positive factor. This may be due to the tendency for technology adoption studies to only identify factors conducive to adoption. However, some evidence suggests that having social influence can cause non-

<table>
<thead>
<tr>
<th>Variant of social influence</th>
<th>Direction of influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informative</td>
<td>Outbound</td>
</tr>
<tr>
<td>(No Evidence found in the present study.)</td>
<td>&quot;If I'm going to pay money for it then I already know there's something good about it. So I only read bad reviews. It's like buying something on eBay from an unknown seller. You want to know all the bad stuff before the good stuff.&quot;</td>
</tr>
<tr>
<td>Value expressive</td>
<td>Inbound</td>
</tr>
<tr>
<td>(No Evidence found in the present study.)</td>
<td>&quot;I try to stay clear of them (games); I don't want my students thinking that I play those silly games.&quot;</td>
</tr>
<tr>
<td>Normative</td>
<td>Outbound</td>
</tr>
<tr>
<td>(No Evidence found in the present study.)</td>
<td>&quot;I didn't want to get it (Galaxy pad) from Telstra (phone company) because they sneak in so many apps that you can't get rid of it.&quot;</td>
</tr>
<tr>
<td>Relationship-centered</td>
<td>Inbound</td>
</tr>
</tbody>
</table>
| (No Evidence found in the present study.) | "I decided not to download it (Facebook app) to the iPhone because if my friends later found out I had the app but didn't reply to their wall posts quickly then I'd feel bad."

Table 6: Examples of negative social influence from the field study categorized according to the proposed framework

Non-adoptions when caused by normative influence is an attempt to avoid normative pressure or undue influence that the user feels is unreasonable or unwelcome. A member of general group explains:

"I'm sure it (GPS tracking app) would come in handy if the phone got stolen... but the app wanted to read my
location all the time. I didn't want anyone tracking my whereabouts over the internet.”

More subtle forms of normative influence were evident where the use subject to undue influence.

“(I) didn't want to get it (Galaxy pad) from Telstra (Phone company) because they sneak in so many apps that you can't get rid of (delete).”

“Yes its (scrabble app) free but it's got an annoying add banner. I tend not to use it anymore.”

Relationship-centered influence, on the other hand, causes non-adoption in situations where adoption may damage social ties with those who are close to oneself.

“I decided not to download it (Facebook app) to the iPhone because if my friends later found out I had the app but didn't reply to their wall posts quickly then I'd feel bad.”

Despite demonstrating all variants of social influence actively swaying users towards non-adoption and non-appropriation, only inbound influence was observed in the data collected during the study (Table 5). This should not be taken to imply that outbound influence is non-existent as each inbound influence flow must be accompanied by a corresponding outbound influence. In fact, one could imagine a scenario for outbound influence where an individual greatly dissatisfied with an app purchased posts a negative review online that actively discourages other users from purchasing the app in question (negative outbound informational influence). Similar scenarios can be thought of that involve other negative variants of social influence operating in the outbound direction. We presume that a study with a larger sample size would produce evidence to confirm that outbound negative influence encourages non-adoption. We intend to carry out such an extension to this study in the future.

Next we observe how the proposed framework ties in with the ubiquitous computing environment.

4.4. Social influence in the ubiquitous computing era

Although the organizational group members were more inclined to utilize the ubicomp devices for work related activities and the general group tended to lean towards social and hedonic purposes, both groups admittedly used the devices to engage in utilitarian, hedonic and social contexts (via apps on the device) intermittently throughout the day. Despite being grouped into organizational and general groups there were no discernable differences in how the two groups used the technology with respect to context switching and the broader theme of social influence.

Of the 22 interviews conducted, only one member of the organizational group was found to not employ context switching (due to difficulties with using the device). We therefore conclude that ubiquitous computing blurs the line between work, social, and play activities [1], and that traditional contextually bound models of technology acceptance do not capture these nuances of social influence in a ubiquitous environment.

With contemporary platforms, such as Facebook and Twitter, enabling social connectedness via ubiquitous technology throughout the day social networks are ever more accessible, the interaction immediate and the social influence abundant. Individuals admittedly engage in trading in financial markets while at social gatherings and have Facebook conversations while at work via the mobile computing devices they carry with them during all waking hours. However socializing, for instance, is not a novel activity; what is new here is engaging in social activities while at work and sporadically switching between different contexts. Increasing number of social activities that traditionally belonged to non-technological domains (E.g. gifting a book) enabled by ubiquitous technology are now being migrated into the technology domain (buy an e-book then email) making the role of social influence ever more significant within the technology domain. Then it is fitting that the models of technology acceptance that gauge individual behavior within the ephemeral nature of a context switched ubiomp environment also make the leap to account for the ubiquitous social phenomena.

5. Conclusion

Based on the present study, we conclude that social influence is indeed a significantly richer construct than currently operationalized in much of the technology acceptance literature. We found empirical support for informative, value-expressive, normative, and relationship-centered variants of social influence. We also found empirical evidence to support the notion that social influence can be both inbound and outbound. Finally, we determined that social influence has both positive and negative impact on individual adoption. Specifically, this puts into perspective non-adoption; we argue it can be understood as the impact of negative social influence emanating from of any of the variants identified in the framework.

Furthermore the inclusivity of the analytical framework that caters for utilitarian, hedonic and social use of technology was confirmed in that it enabled us to consider the rich nature of social influence and enabled analyses according to the three identified dimensions.
6. Limitations

Four limitations warrant discussion. First, the organizational group members did not purchase tablet computers, but instead were given to them by their employer. According to the diffusion of innovations literature, purchase price is a significant driver of value assessment [47]. Therefore the two groups may not be completely comparable.

Secondly, members of the organizational group, having been given the tablet devices for work, may have been reluctant to discuss non work-related use.

Thirdly, at the time of conducting the interviews the only personal tablet computers in widespread use were the Apple's iPads. Despite a mix of phone brands being included in the study overall there were a disproportionate number of Apple devices. This may have affected the frequency and the types of sporadically context switching behavior observed as the device manufacturer had direct control over the way such actions were implemented on the device.

Finally, the relatively small sample size may have consequences for broader applicability of the findings.

7. References


