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Personality traits and concern for privacy: an empirical study in the context of location-based services

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Abstract
For more than a century, concern for privacy (CFP) has co-evolved with advances in information technology. The CFP refers to the anxious sense of interest that a person has because of various types of threats to the person's state of being free from intrusion. Research studies have validated this concept and identified its consequences. For example, research has shown that the CFP can have a negative influence on the adoption of information technology; but little is known about factors likely to influence such concern. This paper attempts to fill that gap. Because privacy is said to be a part of a more general 'right to one's personality', we consider the so-called 'Big Five' personality traits (agreeableness, extraversion, emotional stability, openness to experience, and conscientiousness) as factors that can influence privacy concerns. Protection motivation theory helps us to explain this influence in the context of an emerging pervasive technology: location-based services. Using a survey-based approach, we find that agreeableness, conscientiousness, and openness to experience each affect the CFP. These results have implications for the adoption, the design, and the marketing of highly personalized new technologies.
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Introduction

One of the more notable trends during the 1990s was an increased organizational use of a new technology: the World Wide Web. As businesses began to use the World Wide Web for sharing and exchanging personal information, the concern for privacy (CFP) began to escalate. CFP refers to the anxious sense of interest that a person has because of various types of threats to the person's state of being free from intrusion (Malhotra *et al*., 2004). Early studies attempted to validate measurements for CFP in an organizational setting (Smith *et al*., 1996; Stewart & Segars, 2002); more recently, researchers have attempted to determine the consequences of CFP. They have found that CFP has a negative effect on adoption and thus is a major threat to e-commerce usage (Malhotra *et al*., 2004; Dinev & Hart, 2006; Van Slyke *et al*., 2006; Dinev *et al*., 2006).

While CFP has been shown to be important, we know little about the factors that influence it. Our study attempts to fill that gap and to inform both practice and theory. From a practical perspective, if we know more about CFP, we can find ways to offset its negative influence on adoption.

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And from a theoretical perspective, if we know the factors that influence CFP, we can determine the boundaries for theories on CFP. For example, we will know if factors that influence CFP are limited to particular characteristics of a technology, its user or both, which in turn will help us to predict the valence of their influence. If we know about the nature of the influence, we then can also suggest other factors that can moderate the relationship between CFP and its antecedents. This would further inform practice – we can suggest ways to reduce CFP when such concern might be exaggerated, or increase it when such concern might be understated.

Smith *et al*. (1996) constructed a measure of CFP which was later refined and re-validated by Stewart & Segars (2002). Even though both studies suggested that CFP is likely to be influenced by consumers' personality traits, neither proposed a theoretical foundation for such a study. Thus, the relationship between personality traits and CFP remains untested. Our research on CFP examines this relationship.

It is well established that CFP co-evolves with technology inventions (Westin, 2003). As information systems become increasingly ubiquitous, pervasive, and personalized (Lyytinen *et al*., 2004), CFP will likely increase. So for the purpose of this study, we conduct our inquiry in the context of a new technology: location-based services (LBS). When a cellular phone is equipped with LBS, it is capable of capturing the geographic whereabouts of its user. As the ability to track a person's whereabouts can be viewed as beneficial in some situations (e.g., in an emergency situation) and as harmful in others, LBS have triggered a wave of privacy concerns (Ackerman, 2004; Bohn *et al*., 2004; Armstrong & Ruggles, 2005). Users feel threatened by such services to varying degrees, and thus will exhibit concerns for privacy to varying degrees.

Our main thesis is that CFP is influenced by an individual's dispositional differences or personality traits. Personality traits are an individual's stable dispositions or tendencies across situations (McCrae & Costa, 1987; Ajzen, 1988). We will use protection motivation theory (PMT) (Rogers, 1975, 1983) as a foundation to explain how these traits influence CFP. We use this theory for two reasons. First, the theory clarifies how individuals appraise threats; second, the theory explains how personality variables play a part in the appraisal of threats. Since CFP is defined in terms of threats, the theory is well suited to explain how personality traits might influence it.

The influence of personality traits on CFP can have some bearing on technology adoption. Traditionally, technology adoption has been explained through constructs that represent *positive* evaluations of technology. For example, evaluations are made about the usefulness, ease of use, or enjoyment of a technology. However, CFP is likely to influence technology adoption through a *negative* evaluation of a technology. Our thesis is that such an evaluation will be rooted in the personality traits of individuals. If the influence of personality traits on CFP is ignored, then there is a risk that adoption models will be mis-specified. In terms of adoption, it is interesting to point out here that past research studies have been based on the assumption that positive attitudes equate to the adoption and use of a technology. Our focus on CFP may open the door for inquiries into the effects of less positive attitudes on adoption. However, it should be noted that we do not examine the link between CFP and adoption in the present study; nor do we claim that personality traits are the only antecedents to CFP. Since no prior study has attempted to examine personality traits the way that our work does, this paper thus can be viewed as an exploratory study that attempts to address one set of antecedents and to stimulate future research on other factors that can influence CFP.

Our work proceeds as follows. First, we describe a brief history of privacy and how it has co-evolved with technology. Then we discuss PMT and how it helps to explain our predictions about CFP. This is followed by a description of our research model, which covers related work in psychology that supports our hypotheses pertaining to personality traits as antecedents of CFP. Next we describe the method we use to evaluate our research model along with our results. Finally, we discuss these results and several important implications that follow from them.

Conceptual background

The co-evolving nature of privacy and technology

For as far back as privacy has been a concern for the individual, it has been associated with technology. The following section illustrates that concerns about privacy seem to have co-evolved with technologies. For that, we review the extant literature in two parts. The first part is about privacy and technology in general; the second part is about the technology of interest to the present study – LBS. Our review should make it clear that privacy and this type of technology seem almost inseparable from each other.

A history of privacy and technology Interest in privacy as a growing concern occurred in North America in the late 19th century. This interest was prompted by the introduction of two technologies, print mass media and photography, to the public domain. As a result of their introduction, there was a push for legislation to create an individual right for privacy (Warren & Brandeis, 1890). During that time, privacy was conceptualized on the principle of an 'inviolate personality' and viewed as part of a more general 'right to one's personality' (Warren & Brandeis, 1890). Since then, discussions about privacy and its associated concerns have extended to social, cultural, and psychological issues. In fact, it is believed that privacy is not an inert concept that exists in a vacuum, but instead is strongly influenced by environmental forces (Kelvin, 1973; Laufer & Wolfe, 1977; Levin & Askin, 1977; Sheehan, 2002). One of the major forces that have had such an influence is new technologies and

their applications by organizations (Westin, 2003; Armstrong & Ruggles, 2005).

Westin (2003) describes how CFP fluctuated with the technologies. He notes that the period after the Second World War (between 1945 and 1960) was described as a 'period of limited information-technology developments' (Westin, 2003, p. 435) and was therefore associated with only little or no interest in CFP. The era from 1961 to 1979, in contrast, was characterized as a 'high-technology age' (Westin, 2003, p. 435) where financial institutions implemented their first database management systems. The ability to collect, store, and process customer information gave rise to a series of legal manifestations, culminating in the Privacy Act of 1974, which was established in order to protect citizens' data from government use and misuse after the Nixon presidency.

The subsequent period between 1980 and 1989 can be described as a period of 'enhanced computer and telecommunications performance but without fundamental changes in information-society relationships bearing on privacy' (Westin, 2003, p. 439), whereas during the period between 1990 and 2002, privacy 'became a first-level social and political issue […] [and] assumed global proportions' (Westin, 2003, p. 441). Advancements in data communications and networks provided the platform for the Internet to flourish. Individuals became capable of accessing the most current information online, conducting instant trades and purchases, and exchanging ideas and opinions with a broad audience. Not surprisingly, it was exactly during that time that privacy and its associated concerns gained tremendous interest among the IS community. In the organizational realm, studies emerged that examined privacy with regard to secondary information use (Culnan, 1993), an individual's willingness to be profiled (Culnan & Armstrong, 1999), or with an exclusive focus on establishing a validated psychometric instrument for assessing information privacy (Pedersen, 1996; Smith *et al*., 1996; Stewart & Segars, 2002). In the e-commerce realm, studies transpired that viewed CFP as the biggest threat perceived by e-commerce users and examined their influence on e-commerce adoption (Culnan & Armstrong, 1999; Eddy *et al*., 1999; Hoffman *et al*., 1999; Culnan, 2000; Sheehan, 2002). Subsequent studies (i.e., after 2002) supported the importance of privacy on adoption decisions (Malhotra *et al*., 2004; Dinev & Hart, 2006; Van Slyke *et al*., 2006; Dinev *et al*., 2006).

The new age of privacy and LBS Since 2002, the latest advancements in technology have again captured the interest of the public as well as enforcement agencies: cellular phones. Mobile penetration rates in Western Europe, such as in the United Kingdom, Sweden, and Italy, have already exceeded 110% (Wallace, 2006), indicating that cellular phones and their associated services have become an integral part of an individual's daily life. Even more so, cellular phones have taken over the role of a personalized information system. They store names and their associated phone numbers, to-do lists, calendar entries and birthday reminders; they are used for accessing the news, weather, stock quotes, and email, and they can function as an individual's credit card.

In addition, and with the advent of so-called LBS, cellular phones are even capable of capturing the geographic whereabouts of individuals, thus, dragging the concept of personalization to its ultimate. While localization systems using Global Positioning System (GPS) have been around for a while, the integration of GPS into a cellular phone is relatively new. In the U.S., the so-called Enhanced 911 service is only gradually available. It allows mobile users when placing a 911 (or emergency call) on their cellular phones to be automatically localized for further services such as ambulance, police, etc. Examples of other LBS include real-time navigation services with zoomable online maps, location-sensitive billing (e.g., paying while passing toll stations on highways), or location-specific store advertisements sent to a consumer's mobile phone when the person is in close proximity. Such services rely on the automated collection of location information through network and service providers.

As the ability to track a person's whereabouts can be viewed as beneficial in some situations (e.g., in an emergency situation) and as harmful in others, LBS have triggered yet another wave of CFP (Ackerman, 2004; Bohn *et al*., 2004; Armstrong & Ruggles, 2005). Boston snowplow drivers, for example, threatened with strike when ordered to carry GPS-enabled cellular phones. Eventually, the drivers agreed under the condition that the phones were not used to calculate their working hours (Fortune Small Business (FSB), 2006). In contrast, some tracking efforts go unbeknownst and without the explicit consent of those observed. For example, a 2005 federal court ruling revealed that the U.S. Department of Justice has routinely and secretly been monitoring the locations of people through their cell phones without probable cause (Electronic Frontier Foundation, 2005).

At present, only one out of four cellular providers in the U.S. is currently capable of providing LBS on their phones. Once the implementation is finalized, the level of localization accuracy within cellular networks will be remarkable. For example, and as mandated by the Federal Communications Commission, location accuracy levels are required to be within 50–100 m for 67% of all calls and within 150–300 m for 95% of calls (Beinat, 2001). Unsurprisingly, and as evidenced by public opinion polls, privacy threats represent *the* major roadblock for LBS adoption among cellular phone users. For most individuals, location information is perceived to be highly personal and private. In 2004, for example, the proportion of surveyed respondents who felt that LBS would threaten their privacy accounted for 35% (Fischer, 2004); in 2006, it increased to 43% (Redknee, 2006); and in 2007, only as little as 10% felt at ease with the idea of sharing their location information with family and friends (Porus & Ellis, 2007).

Up to now, research in the context of privacy issues pertaining to LBS has been predominantly conceptual (Siau & Shen, 2003; Valacich, 2003), or strongly focused on design issues (Gosh & Swaminatha, 2001; Rodden *et al*., 2002; Lederer *et al*., 2004). Only a few studies exist that examine the influence of privacy and its associated concerns on intentions to adopt LBS from an empirical perspective (Xu & Teo, 2004; Xu *et al*., 2005). Up to now and to our knowledge, no study exists that examines antecedents to CFP in the context of LBS.

In summary, our review of the literature about privacy and new technologies should have made two things clear. First, interest in privacy has been sparked mainly by technological advancements. Second, with information systems becoming personal, ubiquitous, and pervasive (Ackerman, 2004), separation between CFP and technology will become increasingly difficult. In these highly personalized technological settings, talking about technology without considering the privacy implications, and vice versa, will be fruitless. Due to this increased amalgamation between technology and privacy, the emanating threat is growing – and so is the urge to protect oneself from this harm.

PMT and threat appraisals

PMT explains and predicts the change in protective attitudes and behaviours made by a person who is confronted with threats (Rogers, 1975, 1983; Weinstein, 1993). According to the theory, there are two cognitive processes of appraisal that an individual uses to cope with threats (Rogers, 1975, 1983). By a process of threat appraisal, a person estimates (1) how vulnerable is a threat, and (2) how serious is the threat. By a process of coping appraisal, a person estimates (1) how effective would a response be to a threat and (2) what competence is required to respond to the threat. These processes result in responses that are either adaptive or not adaptive. When a person performs adaptive responses, a protection motivation is said to exist in that person (Rogers, 1975, 1983). In addition to describing the outcomes of these processes, PMT also describes what triggers them. Two sources of information are said to prompt these processes; one source of information is said to be environmental, and the other one is said to be intra-personal or inherent to the individual.

The source of information that is environmental includes (1) verbal persuasion and (2) knowledge that comes from observations. This source of information has been shown to be more aptly suited for research in the marketing and health disciplines (Pechmann *et al*., 1993; Floyd *et al*., 2000; Zhao & Pechmann, 2007). The source of information that is intra-personal includes (1) personality variables and (2) prior experiences. This latter source of information is the focus of our study. With respect to this source of information, we restrict our attention to personality traits, which are typical personality variables (Jahng *et al*., 2002). Our focus on personality traits to the exclusion of prior experience is reasonable as we believe that the trait openness to experience fully accounts for prior experience.

There are three reasons why we focus on personality variables. One is that these variables are recognized to be important in the decision making and IS literature as they inform our knowledge about people's information processing styles, attitudes, and behaviours (Benbasat & Dexter, 1982; Lu *et al*., 2001; Jahng *et al*., 2002). Another is that as information technologies become more personalized (Ackerman, 2004), personality variables can influence how they are perceived in terms of security (Gonzalez & Sawicka, 2002). The final, and perhaps most important, reason is that personality variables, such as traits, can account for the influence of individual differences in determining the strength of the attitudinal constructs (Maddux & Rogers, 1983; Rogers, 1983). And according to PMT, these traits capture the idea that a person's threat perception – and with it the motivation to be protected from a threat – is an essential part of the person's psychological makeup. Later on, we will describe specific traits that are of interest to our inquiry and we will explain how they might influence CFP.

PMT has been used to explain a variety of health-related issues, each of which is associated with some kind of threat (Weinstein, 1993; Floyd *et al*., 2000; Milne *et al*., 2000). In general, threat is defined as something that is a source of danger that can bring harm (physical or mental) to an individual. We conceive of CFP as the anxious sense of interest that a person has due to various types of threats to the person's state of being free from intrusion. As a result, CFP might be accompanied by feelings of fear and worry.

In terms of a person's private information and CFP, there are four types of threats described in the literature. They are (1) the collection of private information; (2) the unauthorized secondary use of private information; (3) the improper access to private information; and (4) the existence of errors in storing private information (Smith *et al*., 1996). The collection of private information means that large amounts of personal and identifiable data on individuals are gathered (Smith *et al*., 1996, p. 172). The unauthorized secondary use of private information means that personal information is collected for one purpose, but is used for another without proper authorization from the individual. The improper access to private information means that 'data … are readily available to people not properly authorized to view or work with the data' (Smith *et al*., 1996, p. 172). Finally, the existence of errors in storing private information means that stored personal data contain 'deliberate and accidental errors' (Smith *et al*., 1996, p. 172). These threats can be related to a given technology. In the context of LBS, for example, the extent to which providers collect location information about individuals, store that information, use that information for purposes other than the ones intended, and allow others, who are not authorized, to access an individual's location data are

all likely to contribute to the overall level of CFP an individual holds about LBS.

Personality traits and threat appraisals

Personality traits are defined as an individual's dispositions or tendencies that lead to certain attitudinal and behavioural patterns across situations (McCrae & Costa, 1987; Ajzen, 1988). 'They reflect who we are and in aggregate determine our affective, behavioural, and cognitive style' (Mount *et al*., 2005, p. 449). Personality traits are said to be stable. In fact, due to their hereditary origin (Bergeman *et al*., 1993), the malleability of a personality is, particularly beyond adulthood, significantly limited (McCrae *et al*., 2004). In other words, the personality traits are individual dispositional characteristics that have been found to be relatively stable across individuals' adult lifespan (McCrae & Costa, 1991) and even across cultures (Saldago *et al*., 2003).

The exact set of personality traits has been the object of many studies and has led to inconsistent results until the late 1980s when the Big Five framework emerged as a unifying theory for the study of personality, integrating numerous narrow traits that had previously been applied with mixed success as predictors of attitudes across life domains (McCrae & Costa, 1987). The conceptual and psychometric consolidation of the five traits, comprising agreeableness, conscientiousness, emotional stability, extraversion, and openness, represented a breakthrough for personality research. Its validity has been tested in numerous life domains. For instance, they appear to predict well-being (Costa *et al*., 1987; McCrae & Costa, 1991), job attitudes such as job satisfaction (Heller *et al*., 2002; Judge *et al*., 2002), training success and job performance (Barrick & Mount, 1991; Mount *et al*., 1998; Tett & Burnett, 2003), and numerous other behavioural and attitudinal outcomes (e.g., political attitudes, deviant behaviours).

Personality traits have a long and distinguished history in personality and social psychology research as they explain attitudes, or 'the disposition to respond favourably or unfavourably to an object, person, institution, or event' (Ajzen, 1988, p. 4). Even though attitudes as well as traits are viewed as relatively stable dispositions, attitudes are typically noted to be more malleable than personality traits. In this regard, Ajzen (1988, p. 7) has noted that 'Evaluations can change rapidly as events unfold and new information about a person or issue becomes available, but the configuration of personality traits that characterize an individual is much more resistant to transformation'.

What does this all mean with regard to PMT and CFP? Since personality traits are resistant to transformation, it means that concerns about threats are explainable, to at least some extent, by individual's personality traits. Just like there are individuals who like different things, there are individuals who feel threatened to a varying degree by the same things. Even though PMT has been predominantly used in the health-behaviour studies where the severity of threat is directed towards life (e.g., cancer or smoking) (Milne *et al*., 2000), that it applies to an increasingly individualistic technology, whose loss or vulnerability equals that of say a health risk such as stress, seems therefore reasonable. In the case of LBS, for example, the fact that one person knows that another can keep track of him in an unobtrusive manner can be perceived as highly intrusive (Xu & Teo, 2004; Xu *et al*., 2005). As the collection of information about tracking people's routine activities becomes more and more habitual, people will find it increasingly difficult to guard technology against personal privacy intrusions (Armstrong & Ruggles, 2005). As such, they are likely to experience a wide range of emotional distress, such as fear, anxiety, and worry. And, their use of such technology could reasonably be argued to become increasingly stressful.

The idea that personality traits might influence perceptions of privacy is not new. In the field of IS, the influence of personality traits on perceptions of privacy was suggested by Smith *et al*. (1996) just over a decade ago. More recently, Stewart & Segars (2002) also suggested that CFP is likely to be influenced by consumers' personality traits. Both papers defined and validated useful measures for CFP, but the authors did not describe a theoretical foundation for investigating the relationship between personality traits and CFP. To date, this relationship remains untested. Next, we present the theoretical foundation for this relationship as described by our research model shown in Figure 1.

Agreeableness represents an individual's propensity to strive for harmony and low levels of conflict in interpersonal relationships (McCrae & Costa, 1991). Highly agreeable individuals have been found to trust others and to be less suspicious of their environment or other individuals (Costa *et al*., 1991). They are found to be selfless and altruistic and to avoid conflict by deferring to others instead of fighting; they are also said to be humble, generous, warm and loving (McCrae & Costa, 1991). Individuals low on agreeableness, in contrast, are said to be aggressive, arrogant, occupied with themselves, and without an explicit strive for intimacy or harmony in their interpersonal relationships (Costa *et al*., 1991; Judge *et al*., 2002). They are found to cause higher turnover rates

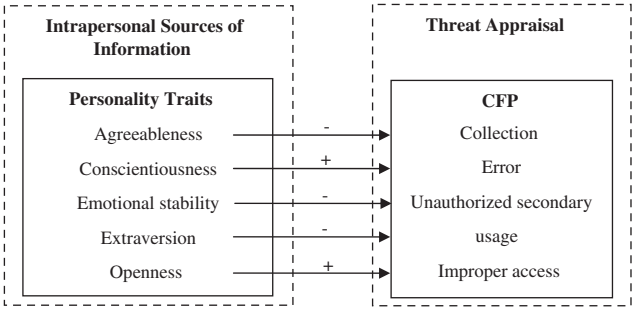

Figure 1 Research model.

and to expose higher rates of deviant behaviour in the workplace, such as disciplinary problems or theft (Saldago, 2002); they are also found to rate behaviours, such as drinking and driving, speeding, or cheating, as riskier than agreeable individuals (Gullone & Moore, 2000).

Thus, and in accordance with PMT, agreeable individuals are therefore less unlikely to appraise others' actions as potentially harmful when faced with privacy threats. Their tendency to trust others and to be less suspicious of their environment should reduce their level of CFP. Moreover, they would expect organizations and others to act in a manner that enhances pleasant and satisfying relationships (Judge *et al*., 2002). In contrast, individuals who have less agreeableness traits – assuming the same level of other traits – are more likely to appraise others' actions as potentially harmful. We conceive CFP to be reflective of the threat that an individual perceives as result of others' actions. This leads us to the following hypothesis.

Hypothesis 1: *The agreeableness of individuals will be negatively associated with their CFP.*

Conscientiousness, or an individual's strive for dependability, attention to detail, and exact effort, is the most widely studied personality trait of the Big Five (Barrick *et al*., 2001). Conscientious individuals are found to be competent, accomplished, logical, and foresighted (Costa *et al*., 1991). They have a tendency to keep things well organized and methodological, as well as a tendency to adhere to standards and principles; they strive for excellence, efficiency, accuracy, and detail, and do so with high levels of self-discipline and deliberation (Costa *et al*., 1991). Individuals who are low on conscientiousness, in contrast, have a tendency to procrastinate, to give up quickly, and to be unorganized.

Based on PMT and because conscientious individuals tend to be foresighted, they are likely to be concerned about others' actions. For example, they will be concerned about what others will do with their personal information. In addition, because such individuals tend to be deliberative, they are more likely to ruminate over things. And, because they tend to give attention to details and to adhere to standards, they are also likely to pay close attention to the actions of others. Less conscientious individuals, in contrast, are less likely to appraise threats as more conscientious individuals do because they have less of the same tendencies. The things that more conscientious individuals are likely to be concerned about are consistent with those things that CFP is all about. This leads us to the following hypothesis.

Hypothesis 2: *The conscientiousness of individuals will be positively associated with their CFP.*

Emotional stability refers to an individual's tendency to stay emotionally balanced across situations. Compared to emotionally stable individuals, individuals who are emotionally unstable, or neurotic, have a tendency to experience more threats and anxieties (Goldberg, 1990), and to view almost all aspects of life as less positive, and for the most part even stressful (Spector *et al*., 2000). Neurotic individuals are also found to be impatient, cynical, and have a paranoid alienation (Bermudez, 1999); they are found to take less risk because of trait-anxiety (Lauriola & Levin, 2001) and to judge behaviours, such as cheating, negatively (Gullone & Moore, 2000). It has also been shown that neurotic teachers are less likely to apply computers in a classroom setting (Katz, 1992). Owing to their worrisome nature and their tendency to focus on negative events and possible losses (Judge *et al*., 2002), we expect neurotic (or emotionally instable) individuals to be worried and concerned about privacy as they evaluate it in accordance with PMT. For example, they will be more likely to appraise the risks rather than the potential benefits of a technology. As a result, neurotic individuals are likely to perceive threats to their privacy as stronger than those who are less neurotic. This leads us to the following hypothesis.

Hypothesis 3: *The emotional stability of individuals will be negatively associated with their CFP.*

Extraverted individuals are predisposed to experience positive life events. They are characterized as energetic, outgoing, and dominant in social situations (Judge *et al*., 2002). They tend to have more friends and seem to draw energy from interactions with others and their environment (Judge *et al*., 2002). Extraverted individuals also tend to display riskier behaviour due to their need for arousal (Gullone & Moore, 2000; Lauriola & Levin, 2001) and to be more competitive, hostile, optimistic, and self-efficacious than their introverted counterpart (Bermudez, 1999). They have also been found to be more likely to make efforts to be actively involved and interested in opportunities to provide and obtain information (McCrae & Costa, 1987, 1999). For example, it has been found that extraverted teachers are more likely to use computers as a tool to find information in a classroom setting (Katz, 1992).

For introverted individuals, in contrast, the general urge to actively interact with their environments is much less pronounced. Introverted individuals have been found to be more anxious, depressed, and cynic (Bermudez, 1999) and generally more vulnerable (Soldz & Vaillant, 1999). Introverts have also been found to perceive higher intrusions of privacy (Stone, 1986) and to have a stronger urge for anonymity (Pedersen, 1987).

In accordance with PMT, extraverted individuals are likely to appraise a situation in terms of their above average overall need for social relationships. Because of this need, extraverted individuals are more likely to be concerned about the actions of others. But such concerns are more likely to be about the well-being of their relationship with that person than with their own

personal information *per se*. As long as their personal information has less bearing on their relationship with others, it is likely to be less of a concern for more extraverted individuals. Since we conceive CFP to be about threats to a person's personal information, it is likely to be affected by the extent to which a person is extraverted. Our hypothesis about this is as follows.

Hypothesis 4: *The extraversion of individuals will be negatively associated with their CFP.*

The personality trait *openness to experience* pertains to an individual's curiosity, intellect, and propensity to try new things and experience new situations. Individuals high on openness to experience have previously been found to be imaginative, aesthetically responsive, empathic, exploring, curious, and unconventional (McCrae & Costa, 1991). They were found to show a high level of scientific and artistic creativity, divergent thinking, liberalism, and only little religiosity (Judge *et al.*, 2002). Open individuals have also been found to perform well in organizational training programmes and to be predisposed to enjoy learning (Barrick *et al.*, 2001) and to choose the experience of a wide variety of new things rather than sticking with behaviours in which they have previously engaged.

Owing to their broad variety of richer life experiences, individuals high on openness have undergone a series of life learning events over time. Therefore, and compared to others, open individuals have developed a broader and deeper sense of awareness. As a result of such awareness, they are more likely to be sensitive to things that are threatening. And in accordance with PMT, they are likely to appraise things as more harmful. Individuals who are low on openness, in contrast, are less aware. As such, they are less likely to evaluate threats. Since CFP is about threats, individuals' openness ought to influence it. Our hypothesis about this effect is as follows.

Hypothesis 5: *The openness of individuals will be positively associated with their CFP.*

Method and results

As we noted in our review of the literature, CFP tends to co-evolve with technology inventions. In other words, efforts directed towards technological personalization necessitates personality variables to be included as determining factors – more so than ever. As such, we focus on one of the latest technological advancements available in the realm of ubiquitous and pervasive technologies: LBS. Some empirical studies have already recognized the importance of CFP in the context of LBS (Fischer, 2004; Redknee, 2006; Porus & Ellis, 2007). We used a survey instrument to assess CFP, which is consistent with the approach used by other researchers, such as Smith *et al*. (1996) and Stewart & Segars (2002). But, in addition, we provided participants in our study with descriptions of how LBS work in general, and for what they can be used in particular. This approach was taken to overcome any lack of familiarity with LBS that might have existed among our participants due to its technological novelty. Participants were presented not only with an online textual description of various application domains (as listed in the Appendix), but also with some online video clips as part of the initial description. This was to make sure that participants had sufficient information to form an opinion about their possible future use of LBS.

Study sample

Because this study is exploratory in nature, we felt that it was reasonable to gather data on a novel set of technologies using a student population. There are two reasons why we made this choice, given our unique focus on LBS and personality traits. One reason is that younger people, such as students, are among the most frequent users of mobile services (e.g., Okazaki, 2006). A recent study on mobile banking has found that people aged 18–29 years old are the heaviest users of text messages and mobile Internet (Senecal, 2008). Indeed, this age group of people is also recognized to be highly educated, either employed or studying, or both (Brown *et al.*, 2003). The other reason is that due to their hereditary origin, personality traits are found to be stable across an individual's lifespan, in particular beyond adulthood (McCrae & Costa, 1991).

Five hundred and fifty undergraduate and graduate business students from a large university participated in our online survey. The gender makeup of our sample was 51% male and 49% female. Students were given course credit for participation. In order to ensure a high level of validity, we limited the total number of usable responses to those that were either entirely complete or contained only one missing data point. Overall, 378 responses were used for subsequent analyses.

Measurements

Based upon a review of the literature, validated survey items were identified for personality traits and CFP. More specifically, we used items developed by Smith *et al*. (1996) for measuring CFP as a four-dimensional second-order construct, comprising collection, error, unauthorized secondary usage, and improper access. Items were modified to fit the context of LBS and were measured on a 7-point Likert scale ranging from 1 (strongly agree) to 7 (strongly disagree). The Big Five personality traits were measured using a 10-item scale developed and validated by Gosling *et al*. (2003). A 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree), was used. Despite the plethora of personality scales, we decided to apply this particular scale for numerous reasons. First, the 10-item scale is advantageous due to its brevity. Other comparable scales use much longer formats (e.g., 240-item NEO-PI-R or the 60-item NEO-FFI (Costa & McCrae, 1992)), which would have resulted in a lengthy

Table 1 Measurement model

Construct	*Item*	*Loadings*	*No. of items*	*Mean*	*Std. Dev.*	*Reliability coefficient*	*AVE*
CFP	Error	0.75	9	6.13	0.96	0.94	0.64
(2nd order construct)	Unauthorized secondary usage	0.94					
	Improper access	0.94					
Error	ERR2	0.96	2	5.61	1.24	0.96	0.92
(1st order construct)	ERR3	0.96					
Unauthorized secondary usage	UN1	0.86	4	6.30	1.04	0.93	0.76
(1st order construct)	UN2	0.89					
	UN3	0.87					
	UN4	0.86					
Improper access	IMP1	0.74	3	6.24	1.03	0.91	0.77
(1st order construct)	IMP2	0.94					
	IMP3	0.94					
Agreeableness	AGR1	0.91	2	2.43	1.00	0.89	0.80
	AGR2	0.89					
Conscientiousness	CONS1	0.84	2	5.03	1.40	0.86	0.76
	CONS2	0.90					
Emotional stability	ES1	0.77	2	5.46	1.04	0.83	0.71
	ES2	0.91					
Extraversion	EX1	0.94	2	4.46	1.44	0.90	0.82
	EX2	0.86					
Openness to experience	OE1	0.89	2	2.39	1.02	0.81	0.69
	OE2	0.77					

questionnaire overall. Minimizing missing data while simultaneously increasing the reliability of obtained data was therefore our primary objective. Second, personality trait instruments in general have 'moved toward shorter, though still psychometrically sound, measures' (Woods and Hampson, p. 373), such as the ones developed by Nagy (2002), Woods & Hampson (2005), Herzberg & Braehler (2006), and Rammstedt (2007). Those measures have shown to be psychometrically valid and to be equivalent proxies for conventional multi-item scales. The most recent validation of the scale used in this paper was conducted by Muck *et al*. (2007). And third, besides scrutinizing CFP in the context of LBS, we also wanted to contribute to the validation of non-proprietary, freely available scales in the realm of personality research. The Appendix provides an overview of all survey items used in this study.

Statistical analyses and model testing were accomplished using structural equation modelling (SEM) techniques due to the fact that our study is concerned with latent independent *and* dependent variables. For analytic purposes, we used PLS Graph 3.0. Compared to other SEM tools, PLS is said to be better suited when exploring and predicting theoretical relationships (Gefen *et al*., 2000). It is also less stringent towards assumptions of normality, considering that most natural phenomena are not normally distributed, and consequently can be used with a smaller sample size (Gefen *et al*., 2000).

Measurement model results

The objective of examining the measurement model is to investigate the adequacy of the measures. It comprises a series of steps, including internal, convergent, and discriminant validity. By examining internal validity of the constructs, as indicated by the loadings on their respective constructs, one ensures that the items are indeed measuring the constructs they were designed for (Chin & Newsted, 1999). Here, standardized loadings should be greater than 0.7. Even though both sets of measurements, that is, personality traits and CFP, had been validated by prior research, measures for CFP were not loading properly. More specifically, the concern for collecting personal information through the usage of LBS displayed a loading of 0.53 only (see also Table A4 in the Appendix for some basic statistics about the excluded elements). Conceptually, this finding makes

sense for a few reasons. First, location data is collected automatically. Individuals are typically not aware that the collection of this kind of data is (or will become) part of their cellular phone service. Even current cellular service (without the explicit availability of LBS) has, in order to provide reliable service, some localization capability already built in. So, for example, in order to provide a 'hand-off' (i.e., transferring a cellular phone call from one cell to the next), the network has to know which towers are involved. Knowing which towers are involved equals knowing, at least roughly, where a cellular phone user is geographically located. Therefore, it seems not surprising that the collection procedure is of no importance for mobile users. Second, it seems possible that the very nature of collecting location data raises less concern than, for example, the unauthorized secondary usage of the same data. In other words, an individual's perceived benefits in collecting this data for providing LBS may supersede personal concerns in this matter. Supplementary survey data, even though not part of this study, support this argument. Approximately 57% of participants found LBS to be slightly useful, useful, or extremely useful (and 25% either useful or extremely useful).

With regard to the concern for error, we also had to delete one item due to its low loading of 0.52. Table 1 shows the descriptive statistics as well as the construct reliabilities of the resulting items. Their values demonstrate adequate convergent and discriminant validity. Besides sufficient loadings, the average variance extracted (AVE) is higher than 0.5 as recommended by Fornell & Larcker (1981). Discriminant validity, on the other hand, is attained if the AVE for each construct is greater than the variance shared between the construct and other constructs in the model (Chin, 1998). In equivalent terms, this is accomplished if the correlations between constructs are lower than the square root of the AVE (see the Appendix, Table A3). The values in Table 1 also indicate that, in terms of reliability, all variables met the criterion for adequate reliability (Nunnally, 1978).

Structural model results

The test of structural model includes estimates of the path coefficients, which indicate the strengths of the relationships between the variables, and the R^2 values, which represent the amount of variance explained. As Figure 1 indicates, we found agreeableness, conscientiousness, and openness to experience to be contributing factors to the formation of CFP; extraversion and emotional stability, in contrast, were found to show no impact (Figure 2).

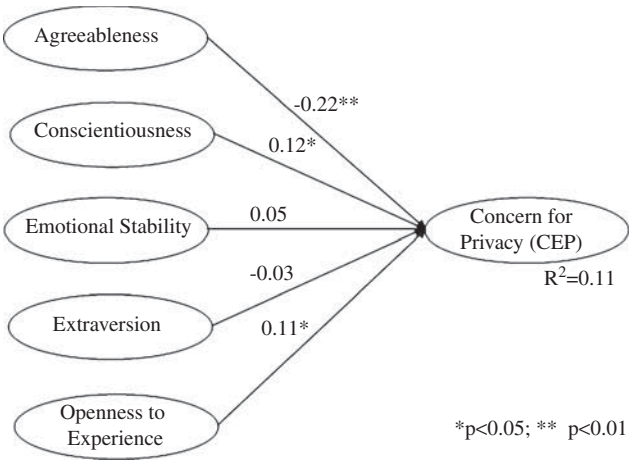

Figure 2 Structural model results showing standardized path coefficients.

Discussion

Recent studies have acknowledged the influence of CFP on technology adoption behaviour (Malhotra *et al*., 2004; Dinev & Hart, 2006; Van Slyke *et al*., 2006; Dinev *et al*., 2006). Despite the importance of CFP, however, no research that we are aware of has examined factors that precede CFP in the IS field. With technology advancing to personalized devices that amalgamate privacy and technology into one, this study represents a first attempt in deciphering antecedents to CFP by basing them on individuals' characteristics.

The characteristics of the individual as an influencing factor in IS adoption have been pointed out as early as the IS field emerged (Mason & Mitroff, 1973; Lucas, 1978; Zmud, 1979). Among other things, studies pointed out the influence of age and gender (e.g., Venkatesh *et al*., 2000), intrinsic motivations (e.g., Agarwal & Karahanna, 2000; Venkatesh, 2000), and cognitive differences (e.g., Alavi & Joachimsthaler, 1992). In addition, recent studies have shown that cognitive style has an impact on purchase behaviour in the context of e-commerce (Jahng *et al*., 2002) and on usage behaviour in the knowledge management realm (Taylor, 2004). Although personality traits are recognized as individual characteristics, past research studies have given them little or no direct focus. It is, however, at a time when technology metamorphes into a personal assistant that personality variables will show their influential weight in determining threats (or the lack thereof) emitted by that technology.

In this paper, and exemplary for the context of LBS, we have shown that personality traits are influential in the formation of CFP. More specifically, out of the Big Five personality traits, three traits were found to be influential. These traits were agreeableness, conscientiousness, and openness to experience; the other two traits, extraversion and emotional stability, were not found to influence CFP. Note that the partial influence of personality traits on a dependent variable is not unusual. Other studies have shown that traits vary in their respective relevance. For example, in the context of job satisfaction, only three traits were found to be influential (Judge *et al*.,

2002); the same finding applies to the context of job performance (Barrick & Mount, 1991).

In our study, highly agreeable individuals, who strive for harmony in their social relationships and thus are more likely to trust their environment, tended to have lower CFP towards LBS than their non-agreeable counterparts who tended to have higher CFP. Similarly, conscientious individuals who are said to be deliberate, organized, and meticulous tended to have higher CFP than non-conscientious individuals who tended to have lower CFP. Finally, individuals who are open to experiencing new things and who have undergone a rich set of life experiences also tended to have higher level of CFP than non-open individuals who tended to have lower concern.

Interestingly, and contrary to our prediction, the personality traits extraversion and emotional stability did not show a significant level of CFP. Upon reflection, however, these findings make sense. In the case of emotional stability, for example, it can be argued that study participants were forced to undergo a cognitive process when thinking about their perceived threats in the context of LBS – a situation that goes against the very nature of emotions. In other words, and from a psychological perspective, emotional stability represents a nuance of a human being that shows its effect in emotional or affective situations only – a principle also referred to as 'trait activation' (Tett & Burnett, 2003). The principle posits that personality traits become expressed only in response to trait-relevant situational cues (Tett & Burnett, 2003). Cognitive situations, in contrast, do not initiate affective or emotional cues, but rather conscientious calculations about the object of interest (Ajzen, 1988). We believe that these reasons might explain why emotional stability did not have a significant influence on CFP.

Similarly, it can be argued that the personality trait of extraversion was also not activated in our study. Extraversion, or an individual's outgoing and social predisposition, is a trait to be most likely activated in social situations. As extraverted individuals are said to draw their energy from the interaction with their surroundings, it is thus not surprising that research views extraversion – compared to agreeableness, conscientiousness, or emotional stability for example – as a trait that is less directed towards the inside of an individual, but rather captures how an individual is perceived from the outside (Mount *et al.*, 2005). The administrative setup of the study required individuals to process the object of interest by themselves and not in interaction with others. It can therefore be argued that extraversion-relevant situational cues might not have been activated in the context of our study. As a result, extraversion failed to show a significant influence on CFP.

In addition to the discussion on our theory, there are also a couple of points to be made about our measurement results. The first point is that the explanatory power of our model, as indicated by an R^2 of 11%, might seem low. But it is to be noted that an F-test with 5 and 372 degrees of freedom results in an F-statistic of 8.18. This value confirms a significant difference at the level of <0.000, indicating that the R^2 value of 11% is significantly different from 0. In general, although a higher R^2 value is usually desirable, it is just not always attainable for every model. For example, R^2 value might be low because of a restriction in the range of responses for the scales that measure a given variable; it might also be low because of the type of variable that we focus on. In fact, in the social science settings, where personality variables are the focus of many studies, an R^2 value in the range 10–20% is said to be quite acceptable (Gaur & Gaur 2006, p. 109).

The second point is that although the significant path coefficients of the traits seem low, this should be of minimal concern. That is because, in reality, these traits all co-exist in a person. And, as such, they combine to influence a person's CFP. In fact, one can assess what will be the influence of all traits together on CFP. When we make such an assessment of a structural model with the combined traits, we get a much greater standardized path coefficient of 0.322 as a link to CFP. And, this is different from 0 at a 0.001 significance level.

Implications for research and practice

In general, a number of interesting implications for theory and practice follow from the present study. First, it is important for IS researchers to understand that technology has become an integral part of an individual's life – and will continue to do so. Cellular phones store our social network in the form of phone numbers, emails, and appointment reminders, etc. The so-called 'social mapping services', such as Boost Loopt (offered by Sprint Nextel), help us to track the whereabouts of our friends (Boost Mobile, 2007). Current technologies capture our life to the extent that we feel fractured when they are missing from it. With technologies advancing to integrated personalized devices, they are also becoming more privacy-intrusive and the perceived threat emanating from them directly attacks the human being. In fact, researchers have called privacy the 'killer threat' to pervasive environments (Ackerman, 2004). Because this study has exclusively relied on examining LBS only, its applicability to other personalized technologies, such as radio frequency identifiers or wearable computers, is still open.

Nevertheless, we think our work provides the foundation for an alternative explanation for technology adoption. Specifically, personality traits might also influence technology adoption, although our work suggests that this influence is mediated by CFP. It will be interesting to determine if there is empirical support for this proposition. If indeed these constructs are related as we have suggested, then we can develop a better understanding of technology adoption. For example,

rather than relying only on criteria that have traditionally been used to explain adoption with a focus on possible benefits, there may be criteria that can explain technology adoption with a focus on individuals' stable disposition towards privacy. In other words, it is possible that future technology adoption decisions will be less determined by usefulness factors and more by concerns that go against human nature or ethics (Myers & Miller, 1996). Comparing which of these factors signifies a greater impact is left to future research. However, we would not be surprised if personality traits have a greater influence in highly personalized technology settings than in less personalized settings, such as a work environment with fixed technologies.

Second, and closely related to the previous, it is important to understand that privacy is and has always been inversely proportional to functionality. Thus, the more personalized a technology is, the more likely it is to rely on individual or personal information to be personalized. But an increased demand for highly personal information is also likely to be linked to an increase in an individual's threat perception and the associated urge to be protected from harm. The motivation to protect is an essential part of human nature, and thus part of the psychological makeup. Some researchers have even claimed that threat perceptions and the drive to protect is biologically motivated (Black, 2006) and can be traced back to human evolution (Buss, 2005).

Third, this study can be used as a first step towards understanding the psychological state of technology consumers and how it influences their concerns for privacy. In analogy to Sheehan (2002), who developed a typology of Internet users and segmented them into fundamentalists, pragmatists, and unconcerned individuals based on their CFP, the findings of this study can be used to segment LBS consumers based on the constellation of particular personality traits. Even though personality traits cannot be changed as they are innate predispositions that are found to be stable over time (McCrae *et al*., 2004), knowing that certain personality traits are influential in the formation of CFP can be used as a leverage point for marketing researchers and technology designers alike.

A fourth implication that follows from our results is that if personality traits are inert to changes, then other non-personality-related factors are most likely to moderate their influence on CFP. An example of such moderating factors could be contextual or situational cues that might interact with some of the traits and that might trigger them to become more salient in certain environments (Tett & Burnett, 2003). What if, for example, technology designers can design LBS that match the peculiarity of a highly conscientious person? Designers would have to make sure that they address an individual's drive for structure and pedantry to the extent that technology is capable of supporting an assurance-based communication and thus mitigating personal concerns. Alternatively, an inverse strategy can be applied when such concerns are understated. For example, highly agreeable individuals can be sensitized to privacy by providing them with technology that alerts them towards immanent privacy threats. Overall, we expect moderators in the relationship between personality traits and CFP to be mostly technology-specific. However, this is left for future researchers to demonstrate empirically.

Limitations and future research

Besides replicating the study in the context of various different pervasive technologies, future research also has the opportunity to do so with actual adoption behaviours in focus. Owing to their novelty, LBS were not commercially available at the time of this study. Consequently, our study was limited to a scenario-based survey approach only and should therefore be viewed as an initial step in deciphering the psychological makeup of pervasive technology users. Even though our results do not generalize to other technologies or services, future studies can nevertheless use them as a basis for examining the ever increasing number of commercially available technologies.

Closely related to the novelty of the technology is also the question of selecting the appropriate sample. With the commercial availability of LBS increasing, future research should also try to broaden the scope of the sample by, for example, differentiating between mandatory and voluntary users. One would expect that voluntary users are less concerned about their privacy than others as they have freely chosen to deploy the technology. Also, future studies might want to consider lengthier personality scales than the ones used, such as the NEO-FFI or an IPIP-based scale. This would allow for a more in-depth examination of the relationship between facets of each personality trait and facets of privacy concerns in order to illuminate further the complex relationship between both.

Another venue for future research is to examine an individual's CFP in less personal and more organizational contexts. As professionals, individuals are already exposed to geographic surveillance techniques as part of their job descriptions. For instance, delivery companies track the whereabouts of their trucks (and implicitly their drivers), car rental companies track their vehicle fleet, and transportation companies track their buses and taxis. Examples are numerous and showcase that an individual's perceived threat can easily result in aversion (or negative acceptance) towards the use of technology that is needed for getting a job done (Eddy *et al*., 1999). Therefore, future studies should not only study usage behaviours, but primarily usage patterns as they are most likely to find deviant behaviours, that is, behaviours that go against the intended use of technology and cause the individual to find workarounds.

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References

ACKERMAN M (2004) Privacy in pervasive environments: next generation labeling protocols. *Personal Ubiquitous Computing* **8,** 430–439.

AGARWAL R and KARAHANNA E (2000) Time flies when you're having fun: cognitive absorption and beliefs about information technology usage. *MIS Quarterly* **24(4),** 665–694.

AJZEN I (1988) *Attitudes, Personality, and Behavior*. Open University Press, Stony Startford.

ALAVI M and JOACHIMSTHALER EA (1992) Revisiting dss implementation research: a meta analysis of the literature and suggestions for researchers. *MIS Quarterly* **16(1),** 95–116.

ARMSTRONG MP and RUGGLES AJ (2005) Geographic information technologies and personal privacy. *Cartographica* **40(4),** 63–73.

BARRICK MR and MOUNT MK (1991) The big five personality dimensions and job performance: a meta-analysis. *Personnel Psychology* **44,** 1–26.

BARRICK MR, MOUNT MK and JUDGE TA (2001) Personality and performance at the beginning of the new millennium: what do we know and where do we go next?. *International Journal of Selection and Assessment* **9,** 9–30.

BEINAT E (2001) Privacy and location-based: stating the policies clearly. *GeoInformatics* **4 (September),** 14–17.

BENBASAT I and DEXTER AS (1982) Individual differences in the use of decision support aids. *Journal of Accounting Research* **20(1),** 1–11.

BERGEMAN CS, CHIPUER HM, PLOMIN R, PEDERSEN NL, MCCLEARN GE, NESSELROADE JR, COSTA PT and MCCRAE RR (1993) Genetic and environmental effects on openness to experience, agreeableness, and conscientiousness: an adoption/twin study. *Journal of Personality* **61(2),** 159–179.

BERMUDEZ J (1999) Personality and health-protective behaviour. *European Journal of Personality* **13,** 83–103.

BLACK P (2006) Thrust to wholeness: the nature of self-protection. *Review of General Psychology* **10(3),** 191–209.

BOHN J, COROAMA V, LANGHEINRICH M, MATTERN F and ROHS M (2004) Living in a world of smart everyday objects – social, economic, and ethical implications. *Journal of Human and Ecological Risk Assessment* **10(5),** 763–786.

BOOST MOBILE MEDIA (2007) Boost mobile and loopt pioneer social mapping for young mobile phone users. Press Release, http://www.loopt.com/loopt/press/boostpressrelease.html (accessed 13 March 2008).

BROWN I, ZAHEEDA C, DAVIES D and STROEBEL S (2003) Cell phone banking: predictors of adoption in south africa – an exploratory study. *International Journal of Information Management* **23,** 381–394.

BUSS DM (Ed.) (2005) *The Handbook of Evolutionary Psychology*. John Wiley & Sons, Hoboken, NJ.

CHIN W (1998) Issues and opinions on structural equation modeling. *MIS Quarterly* **22(1),** vii–xvi.

CHIN W and NEWSTED PR (1999) Structural equation modeling analysis with small samples using partial least squares. In *Statistical Strategies for Small Sample Research* (HOYLE RH, Ed.), pp 307–322, Sage Publications, Thousand Oaks, CA.

COSTA Jr. PT and MCCRAE RR (1992) *Revised Neo Personality Inventory (neo-pi-r) and Neo Five-Factor Inventory (neo-ffi) Professional Manual*. Psychological Assessment Resources, Odessa, FL.

COSTA PT, MCCRAE RR and DYE DA (1991) Facet scales for agreeableness and conscientiousness: a revision of the neo personality inventory. *Personal Individual Differences* **12(9),** 887–898.

COSTA PT, MCCRAE RR and ZONDERMAN AB (1987) Environmental and dispositional influences on well-being: longitudinal follow-up of an american national sample. *British Journal of Psychology* **78,** 299–306.

CULNAN MJ (1993) 'How did they get my name?' An exploratory investigation of consumer attitudes toward secondary information use. *MIS Quarterly* **17(2),** 341–363.

CULNAN MJ (2000) Protecting privacy online: is self-regulation working. *Journal of Public Policy & Marketing* **19(1),** 20–26.

CULNAN MJ and ARMSTRONG PK (1999) Information privacy concerns, procedural fairness, and impersonal trust: an empirical investigation. *Organization Science* **10(1),** 104–115.

DINEV T, BELLOTTO M, HART P, RUSSO V, SERRA I and COLAUTTI C (2006) Privacy calculus model in e-commerce – a study of Italy and the United States. *European Journal of Information Systems* **15(4),** 389–402.

DINEV T and HART P (2006) An extended privacy calculus model for e-commerce transactions. *Information Systems Research* **17(1),** 61–80.

EDDY ER, STONE DL and STONE-ROMERO EF (1999) The effects of information management policies on reactions to human resource information systems: an integration of privacy and procedural justice perspectives. *Personnel Psychology* **52,** 335–358.

ELECTRONIC FRONTIER FOUNDATION (2005) New Case Reveals Routine Abuse of Government Surveillance Powers. Press Release, http://www.eff.org/press/archives/2005/09/26 (accessed 13 March 2008).

FISCHER K (2004) Consumers ready for wireless location-based services; 2005 will be a strong year for carrier deployment, InStat, http://www.instat.com/press.asp?ID=1175&sku=IN0401660MCD (accessed 10 October 2006).

FLOYD DL, PRENTICE-DUNN S and ROGERS RW (2000) A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology* **30(2),** 407–429.

FORNELL C and LARCKER DF (1981) Evaluating structural equations models with unobservable variables and measurement error. *Journal of Marketing Research* **18(1),** 39–50.

GAUR A and GAUR S (2006) *Statistical Methods for Practice and Research: A Guide to Data Analysis Using SPSS*. Sage Publications, New Delhi.

GEFEN D, STRAUB DW and BOUDREAU M-C (2000) Structural equation modeling and regression: guidelines for research practice. *Communications of the Association for Information Systems* **4(7),** 1–80.

GOLDBERG LR (1990) An alternative 'description of personality': the big-five factor structure. *Journal of Personality and Social Psychology* **59,** 1216–1229.

GONZALEZ JJ and SAWICKA A (2002) A framework for human factors in information security. In *Presented at the WSEAS International Conference on Information Security*. Rio de Janeiro, http://ikt.hia.no/josejg/Papers/A%20Framework%20for%20Human%20Factors%20in%20Information%20Security.pdf (accessed 13 March 2008).

GOSH AK and SWAMINATHA TM (2001) Software security and privacy risks in mobile e-commerce. *Communications of the ACM* **44(2),** 51–57.

GOSLING SD, RENTFROW PJ and WILLIAM BS (2003) A very brief measure of the big-five personality domains. *Journal of Research in Personality* **37,** 504–528.

GULLONE E and MOORE S (2000) Adolescent risk-taking and the five-factor model of personality. *Journal of Adolescence* **23,** 393–407.

HELLER D, JUDGE TA and WATSON D (2002) The confounding role of personality and trait affectivity in the relationship between job and life satisfaction. *Journal of Organizational Behavior* **23,** 815–835.

HERZBERG PY and BRAEHLER E (2006) Assessing the big-five personality domains via short forms. *European Journal of Psychological Assessment* **22(3),** 139–148.

HOFFMAN DL, NOVAK TP and PERALTA MA (1999) Information privacy in the marketspace: implications for the commercial uses of anonymity on the web. *The Information Society* **15,** 129–139.

JAHNG JJ, JAIN H and RAMAMURTHY K (2002) Personality traits and effectiveness of presentation of product information in e-business systems. *European Journal of Information Systems* **11,** 181–195.

JUDGE TA, HELLER D and MOUNT MK (2002) Five-factor model of personality and job satisfaction: a meta-analysis. *Journal of Applied Psychology* **87,** 530–541.

KATZ YJ (1992) Toward a personality profile of successful computer-using teacher. *Educational Technology* **32,** 39–40.

KELVIN P (1973) A social-psychological examination of privacy. *British Journal of Social Clinical Psychology* **12,** 248–261.

LAUFER RS and WOLFE M (1977) Privacy as a concept and a social issue: a multidimensional development theory. *Journal of Social Issues* **33(3),** 22–42.

LAURIOLA M and LEVIN IP (2001) Personality traits and risky decision-making in a controlled experimental task: an exploratory study. *Personality and Individual Differences* **31,** 215–226.

LEDERER S, HONG JI, DEY AK and LANDAY JA (2004) Personal privacy through understanding and action: five pitfalls for designers. *Personal Ubiquitous Computing* **8,** 440–454.

LEVIN HA and ASKIN F (1977) Privacy in the courts: law and social reality. *Journal of Social Issues* **33(3),** 138–153.

LU HP, YU HJ and LU SSK (2001) The effects of cognitive style and model type on dss acceptance: an empirical study. *European Journal of Operational Research* **131(3),** 649–663.

LUCAS HC (1978) Empirical evidence for a descriptive model of implementation. *MIS Quarterly* **2(2),** 27–41.

LYYTINEN K, YOO Y, VARSHNEY U, ACKERMAN MS, DAVIS G, AVITAL M, ROBEY D, SAWYER S and SØRENSEN C (2004) Surfing the next wave: design and implementation challenges of ubiquitous computing environments. *Communications of the AIS* **13,** 697–716.

MADDUX JE and ROGERS RW (1983) Protection motivation theory and self-efficacy: a revised theory of fear appeals and attitude change. *Journal of Experimental Social Psychology* **19,** 242–253.

MALHOTRA NK, KIM SS and AGARWAL J (2004) Internet users' information privacy concerns (iuipc): the construct, the scale, and a causal model. *Information Systems Research* **15(4),** 336–355.

MASON RO and MITROFF II (1973) A program for research on management information systems. *Management Science* **19(5),** 475–487.

MCCRAE RR and COSTA P (1999) A five factor theory of personality. In *Handbook of Personality: Theory and Research* (PERVIN L, Ed), pp 139–153, Guilford, New York.

MCCRAE RR and COSTA PT (1987) Validation of the five-factor model of personality across instruments and observers. *Journal of Personality & Social Psychology* **52,** 81–90.

MCCRAE RR and COSTA PT (1991) Adding liebe and arbeit: the full five-factor model and well-being. *Personality and Social Psychology Bulletin* **17(2),** 227–232.

MCCRAE RR, COSTA PT, HREBICKOVA M, URBANEK T, MARTIN TA, ORYOL VE, RUKAVISHNIKOV AA and SENIN IG (2004) Age differences in personality traits across cultures: self-report and observer perspectives. *European Journal of Personality* **18,** 143–157.

MILNE S, SHEERAN P and ORBELL S (2000) Prediction and intervention in health-related behavior: a meta-analytic review of protection motivation theory. *Journal of Applied Social Psychology* **30(1),** 106–143.

MOUNT MK, BARRICK MR, SCULLEN SM and ROUNDS J (2005) Higher-order dimensions of the big five personality traits and the big six vocational interest types. *Personnel Psychology* **58,** 447–478.

MOUNT MK, BARRICK MR and STEWART GL (1998) Five-factor model of personality and performance in jobs involving interpersonal interactions. *Human Performance* **11(2/2),** 145–165.

MUCK PM, HELL B and GOSLING SD (2007) Construct validation of a short five-factor model instrument: a self-peer study on german adaptation of the ten-item personality inventory (tipi-g). *European Journal of Psychological Assessment* **23(3),** 166–175.

MYERS MD and MILLER L (1996) Ethical dilemmas in the use of information technology: an aristotelian perspective. *Ethics & Behavior* **6(2),** 153–160.

NAGY MS (2002) Using a single-item approach to measure facet job satisfaction. *Journal of Occupational and Organizational Psychology* **75,** 77–86.

NUNNALLY J (1978) *Psychometric Theory*. McGraw-Hill, New York.

OKAZAKI S (2006) What do we know about mobile internet adopters? A cluster analysis. *Information & Management* **43,** 127–141.

PECHMANN C, ZHAO G, GOLDBERG ME and REIBLING ET (1993) What to convey in antismoking advertisements for adolescents: the use of protection motivation theory to identify effective message themes. *Journal of Marketing* **67(April),** 1–18.

PEDERSEN DM (1987) Relationship of personality to privacy preferences. *Journal of Social Behavior and Personality* **2(2),** 267–274.

PEDERSEN DM (1996) A factorial comparison of privacy questionnaires. *Social Behavior and Personality* **24(3),** 249–262.

PORUS J and ELLIS M (2007) Location-based services and presence technology: the future of telecommunications is closer than you think. Harris Interactive, The Harris Report, http://www.harrisinteractive.com/news/newsletters/HarrisReport/HI_TheHarrisReport_2007_v02_i01.pdf (accessed 13 March 2008).

RAMMSTEDT B (2007) The 10-item big five inventory: norm values and investigation of sociodemographic effects based in a German population representative sample. *European Journal of Psychological Assessment* **23(3),** 193–201.

REDKNEE (2006) Redknee protects wireless subscribers' privacy concerns with industry first solution: personalization allows users to decide which wireless services, applications and users can access their personal data. Redknee. http://www.redknee.com/news_events/news_releases/archive_2006/156/?PHPSESSID=d99270ce1b41ea4c39b1ec7eab2e6f95 (accessed 10 October 2006).

RODDEN T, FRIDAY A, MULLER H and DIX A (2002) A lightweight approach to managing privacy in location-based services. Technical Report Equator-02-058, University of Nottingham and Lancaster University and University of Bristol.

ROGERS RW (1975) A protection motivation theory of fear appeals and attitude change. *Journal of Psychology* **91,** 93–114.

ROGERS RW (Ed.) (1983) *Cognitive and Physiological Processes in Fear Appeals and Attitude Change: A Revised Theory of Protection Motivation*. Plenum, New York, NY.

SALDAGO JF (2002) The big five personality dimensions and counterproductive behaviors. *International Journal of Selection and Assessment* **10(1/2),** 117–125.

SALDAGO JF, MOSCOSO S and LADO M (2003) Evidence of cross-cultural invariance of the big five personality dimensions in work settings. *European Journal of Personality* **17,** 67–76.

SENECAL D (2008) Demographics matter to mobile banking strategies. CreditUnions.com.

SHEEHAN K (2002) Toward a typology of internet users and online privacy concerns. *The Information Society* **18,** 21–32.

SIAU K and SHEN Z (2003) Building customer trust in mobile commerce. *Communications of the ACM* **46(4),** 91–94.
SMITH HJ, MILBERG SJ and BURKE SJ (1996) Information privacy: measuring individuals' concerns about organizational practices. *MIS Quarterly* **20(2),** 167–196.
SOLDZ S and VAILLANT GE (1999) The big five personality traits and the life course: a 45-year longitudinal study. *Journal of Research in Personality* **33,** 208–232.
SPECTOR PE, ZAPF D, CHEN PY and FRESE M (2000) Why negative affectivity should not be controlled in job stress research: don't throw out the baby with the bath water. *Journal of Organizational Behavior* **21,** 79–95.
STEWART KA and SEGARS AH (2002) An empirical examination of the concern for information privacy instrument. *Information Systems Research* **13(1),** 36–49.
STONE DL (1986) Relationship between introversion/extraversion, values regarding control over information, and perceptions of invasion of privacy. *Perceptual and Motor Skills* **62,** 371–376.
TAYLOR WA (2004) Computer-mediated knowledge sharing and individual user differences: an exploratory study. *European Journal of Information Systems* **13,** 52–64.
TETT RP and BURNETT DD (2003) A personality trait-based interactionist model of job performance. *Journal of Applied Psychology* **88(3),** 500–517.
VALACICH JS (2003) Case Western Workshop on Ubiquitous Computing Environments, October 24–26, 2003, Weatherhead School of Management, Case Western Reserve University, Cleveland, OH, USA, http://weatherhead.case.edu/pervasive/Paper/UBE%202003%20-%20Valacich.pdf (accessed 13 March 2008).
VAN SLYKE C, SHIM JT, JOHNSON R and JIANG J (2006) Concern for information privacy and online consumer purchasing. *Journal of the Association for Information Systems* **7(6),** 415–444.
VENKATESH V (2000) Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research* **11(4),** 342–365.
VENKATESH V, MORRIS MG and ACKERMAN PL (2000) A longitudinal field investigation of gender differences in individual technology adoption decision-making processes. *Organizational Behavior and Human Decision Processes* **83(1),** 33–60.
WALLACE B (2006) 30 countries passed 100% mobile phone penetration in q1. Telecommunications Online, http://www.telecommagazine.com/newsglobe/article.asp?HH_ID=AR_2148 (accessed 20 March 2007).
WARREN S and BRANDEIS L (1890) The right to privacy. *Harvard Law Review* **4(5),** 193.
WAXER C (2006) Satellite Plumbing. Fortune Small Business, http://money.cnn.com/magazines/fsb/fsb_archive/2006/02/01/8368208/index.htm (accessed 13 March 2008).
WEINSTEIN N (1993) Testing four competing theories of health-protective behavior. *Health Psychology* **12(4),** 324–333.
WESTIN A (2003) Social and political dimensions of privacy. *Journal of Social Issues* **59(2),** 431–453.
WOODS SA and HAMPSON SE (2005) Measuring the big five with single item using a bipolar response scale. *European Journal of Personality* **19,** 373–390.
XU H and TEO H-H (2004) Alleviating consumers' privacy concerns in location-based services: a psychological control perspective. In *Proceedings of the 25th International Conference on Information Systems*. Washington, DC, http://www.ais.bepress.com/icis2004/64 (accessed 13 March 2008).
XU H, TEO H-H and TAN BCY (2005) Predicting the adoption of location-based services: the role of trust and perceived privacy risk. In *Proceedings of the 26th International Conference on Information Systems*. Las Vegas, NV, http://www.ais.bepress.com/icis2005/71 (accessed 13 March 2008).
ZHAO G and PECHMANN C (2007) The impact of regulatory focus on adolescents' response to antismoking advertising campaigns. *Journal of Marketing Research* **44(November),** 671–687.
ZMUD RW (1979) Individual differences and MIS success: a review of the empirical literature. *Management Science* **25(10),** 966–979.

Appendix (for reviewing purposes only)

See Tables A1–A4.

Table A1 Scenario description (textual part)

The latest commercially available applications for cellular phones nowadays are location-based services (LBS). LBS are services that take into account the geographic position of a person (or rather your cellular phone).
Take OnStar for example, a navigational system for cars that has been in use for several years already. Even though OnStar is not considered to be a 'true' LBS in the strictest sense (as it is provided to cars and not to cell phones!), it should nevertheless give you a good idea of what LBS are all about.
As LBS come in different shapes and forms, the following list should provide you with a hint of what LBS can and will be used for. For example,

- With LBS provided to your cellular phone, you can use your phone to find the closest ATM, restaurant, gas station, etc., and obtain driving directions, including the best route to a destination, without explicitly specifying where you are presently located. The system will automatically detect your current location and provide you with the necessary services. (Link to demo simulating a location request.)
- With LBS provided to your cellular phone, your cellular phone provider is able to report your location information to the police, ambulance, and other authorities in case of an emergency situation. All you have to do is place a 911 call. Your current location will automatically be detected and passed on.
- With LBS provided to your cellular phone, businesses in your geographic vicinity can send you information about events, entertainment opportunities, or special promotions. For example, you can receive vouchers, discount coupons, and flyers on your cellular phone while passing by.
- With LBS provided to your cellular phone, you will also be able to track other people. For instance, FriendFinder is an application that provides you with a list of your friends who are currently in your vicinity. This should make it easy for you to meet up with them. (Link to Web Site of FriendFinder.)

Based on our brief introduction, we hope that you have gained a basic understanding of what LBS are all about. Again, *LBS are services that utilize the geographic information of your cellular phone, and provide you with services based on that*. Technologically, your cellular phone location is captured by your cellular phone provider who, if necessary, provides this piece of information to third parties.

Table A2 Questionnaire items

Concern for Information Privacy; Source: Smith *et al*. (1996)	
Concern of collection	
PPCOLL1[a]	It bothers me if my cellular phone provider stores my location information
PPCOLL2[a]	It bothers me when my location information is available to my cellular phone provider
PPCOLL3[a]	I'm concerned that my cellular phone provider will collect too much location information about me
PPCOLL4[a]	I'm not comfortable with the idea that my cellular phone provider is able to track me at any time
PPCOLL5[a]	I would rather not provide my location information to my cellular phone provider
Concern of error	
PPERR1[a]	All location information should be double-checked for accuracy – no matter how much it costs
PPERR2	My cellular phone provider should take a lot of steps to make sure that the location information in their databases is accurate
PPERR3	My cellular phone provider should have thorough procedures to correct errors in location information
Concern of unauthorized secondary use	
PPUN1	My cellular phone provider should not disclose location information to unauthorized parties
PPUN2	My cellular phone provider should never share location information without my consent
PPUN3	My cellular phone provider should not use my location information for any purpose unless it has been authorized by me
PPUN4	My cellular phone provider should never sell location information of its customers to other companies
Concern of improper access	
PPIMP1	My cellular phone provider should devote a lot of time and effort to preventing unauthorized access to location information
PPIMP2	Databases that contain location information should be protected from unauthorized access – no matter how much it costs
PPIMP3	My cellular phone provider should take more steps to make sure that unauthorized people cannot access personal LBS information
Agreeableness; Source: Gosling *et al*. (2003)	
AGR1	I see myself as sympathetic/warm
AGR2	I see myself as critical/quarrelsome(R)
Conscientiousness; Source: Gosling *et al*. (2003)	
CONS1	I see myself as dependable/self-disciplined
CONS2	I see myself as disorganized/careless (R)
Emotional stability; Source: Gosling *et al*. (2003)	
ES1	I see myself as calm/emotionally stable
ES2	I see myself as anxious/easily upset (R)
Extraversion; Source: Gosling *et al*. (2003)	
EXTR1	I see myself as extraverted/enthusiastic
EXTR2	I see myself as reserved/quiet (R)
Openness to new experience; Source: Gosling *et al*. (2003)	
OE1	I see myself as open to new experiences/complex
OE2	I see myself as conventional/uncreative (R)

[a]These items were asked, but not used for the analysis.

Table A3 Correlation matrix and AVE

	CFP	*Agreeableness*	*Conscientiousness*	*Emotional stability*	*Extraversion*	*Openness to experience*
CFP	0.80					
Agreeableness	−0.27	0.90				
Conscientiousness	0.16	−0.06	0.87			
Emotional stability	0.14	−0.19	0.19	0.84		
Extraversion	−0.04	0.13	0.07	−0.11	0.90	
Openness to experience	0.19	−0.23	0.13	0.23	0.13	0.83

Correlations within second-order construct	*Error*	*Unauthorized secondary use*	*Improper access*
Error	0.96		
Unauthorized secondary use	0.55	0.87	
Improper access	0.62	0.85	0.88

Note: The squared root of the average variance extracted (AVE) is presented on the diagonal; off-diagonal are correlations

Table A4 Psychometric properties of original CFP measures

Construct	*Item*	*Loadings*	*Mean*	*Std. Dev.*
CFP	Error	0.70	5.28	1.13
	Unauthorized secondary usage	0.91	6.30	1.04
	Improper access	0.91	6.24	1.03
	Collection[a]	0.53[a]	4.71	1.36

[a] These items were asked, but not used for the analysis presented in the Method and results section.