Does Your Boss Know Where You Are?
Predicting Adoption of LBS in the Workplace

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To date there has been no tested model to predict uptake of LBS services in a real world setting. The leading theoretical contribution to our understanding of attitudes and behaviour towards LBS comes from Junglas & Spitzmüller (2005). They hypothesised that intentions to use LBS would be influenced by technology characteristics, task characteristics, personality type, perceived privacy, perceived usefulness, trust and perceived risk. We developed a questionnaire to test and refine their model with a UK employed population.

Location-Based Services (LBS), technology adoption, questionnaire development

1. INTRODUCTION

Location-Based Services (LBS) have been simply defined as 'services that take into account the geographic position of an entity' (Junglas, 2007). Such applications typically utilise GPS, Bluetooth, wireless networks and cell phone towers to pinpoint the location of a mobile phone (Porus & Ellis, 2007).

Early applications had a strong focus on safety and security: for example in enhancing emergency service responses (Minch, 2004), or in aspects of child security – as with the 'Safe and Sound' system (Marmasse & Schmandt, 2003), in which children were given mobile phones to carry, and both parents and children were notified with an alarm warning once the child strayed out of a predetermined area. Perhaps the ultimate security measure has been adopted in Australia, where police now have the power to fit people suspected of terrorist activities with tracking devices (Perusco & Michael, 2007). Recent news reports suggest that law enforcement in the US has been exploiting an unknown location tracking capability of iPads and iPhones to aid in criminal investigations (McCullagh, 2011).

LBS has also had a social focus. In 2002, the US company AT&T Wireless launched a 'Find Friends' service which allowed users to locate consenting friends and family members using a Global Positioning System (GPS) on their mobile phones (Lawson, 2002). Numerous social networking sites now offer people the chance to locate their friends using platforms such as Facebook Places and Foursquare.

Finally, LBS have had a workplace focus. Research has already shown that employees have different disclosure preferences for work colleagues (Olson, Grudin, & Horvitz, 2005). In terms of LBS, one system developed to monitor employee interaction with colleagues suggested that even with privacy principles adhered to, acceptance of monitoring was limited (Zweig & Webster, 2003). In a study of 387 employees in the US, UK and India, attitudes towards workplace monitoring were also found to be unfavourable (Workman, 2009). However, those who had greater perceptions of vulnerability, more self-efficacy and greater levels of trust 'were more amenable to monitoring' (p.229). It is clear that attitudes towards workplace monitoring are varied, and exploration of LBS in the workplace is lacking.

As the context for location-based services has grown, so has the need to develop a privacy model that establishes the impact of privacy on use and intention to use such services. We do know that there are clear differences in disclosure preferences when faced with revealing location information to friends, family, or colleagues (Consolvo, et al., 2005) and we also know some of the predictors of LBS use within a family setting (Thomas, Briggs, & Little, 2010), but as yet, relatively little is known about LBS use within the

workplace. In this paper, then, we build upon existing work in order to ask whether we can reasonably predict employee's intentions to use LBS.

Location-based services can be accessed in a variety of ways, however in this research the main focus has been LBS use within mobile phones. This research is in collaboration with North-East based company TrackaPhone, who provide various LBS tracking systems to customers. One example of their products is the Alert Client system (Figure 1). Alert Client enables panic buttons and escalation procedures to be used via the TrackaPhone platform.
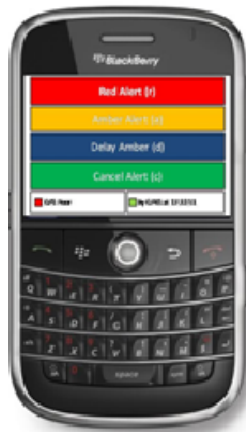

Figure 1: Alert Client view on the Blackberry™ 8800

2. DEVELOPING THE MODEL

To date there has been no tested model to predict uptake of LBS services in a real world setting. The leading theoretical contribution to our understanding of attitudes and behaviour towards LBS comes from Junglas & Spitzmüller (2005). They hypothesised that intentions to use LBS would be influenced by technology characteristics, task characteristics, personality type, perceived privacy, perceived usefulness, trust and perceived risk (Figure 2).
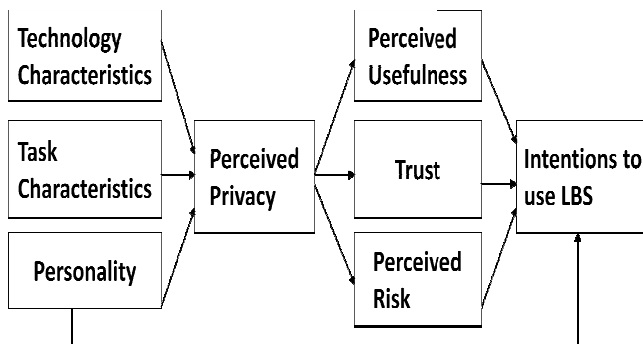

Figure 2: The Research Model (Junglas & Spitzmüller, 2005)

We developed a questionnaire to refine and test the model. Questions for each component were either taken directly from suggestions made by Junglas & Spitzmüller, or if no previously tested items existed, they were created independently during our research. The aim of this research is to test the suggested model using the specially designed questionnaire, which can then be refined and tested further. Each factor from the model will be briefly discussed.

2.1 Task Characteristics

Task characteristics may affect the way individuals perceive a tracking system. If employees are in an unfamiliar environment, for example, they may be more receptive to an LBS system than if they were at home. Questions relating to task characteristics included 'LBS would help if I was working in a dangerous area', or 'I would find location tracking acceptable if I was working in an unknown area'.

2.2 Personality

The Big Five personality traits (agreeableness, conscientiousness, emotional stability, extraversion and openness) have previously been tested as mediators of the intention to use LBS (Junglas, Johnson, & Spitzmüller, 2008). It is hypothesized that more conscientious individuals will form intentions to use LBS, individuals scoring highly on neuroticism may be more likely to distrust LBS, and individuals more open to experiences are likely to have fewer LBS concerns (Junglas & Spitzmüller, 2005). In accordance with the model, we measured conscientiousness and openness to experience (Gosling, Rentfrow, & Swann, 2003), neuroticism (IPIP, 2009), and locus of control (Humphreys, 1993) with previously tested items.

2.3 Perceived Privacy

Four privacy items have been identified that relate to information exchange: collection of personal information, unauthorized secondary use of personal information, errors in personal information, and improper access to personal information (Smith, Milberg, & Burke, 1996). Each factor is considered important to measure privacy concerns. The four privacy items were incorporated using previously defined questionnaire statements (Junglas, et al., 2008). The items were modified slightly to fit the LBS context, for example 'It bothers me if my employer stores my location information'.

In recent work, Concern for Information Privacy (CFIP) has been investigated using Structural Equation Modelling (Zhou, 2010), the hypothesis being that CFIP would positively affect perceived risk and negatively affect trust. Zhou also hypothesised that trust negatively affects risk and

positively affects LBS usage intention. Results showed that concern about collection of information, errors in information, and unauthorised secondary use affected perceived risk and trust, which in turn determined usage of LBS.

2.4 Perceived Usefulness

Junglas (2007) hypothesised that perceptions of usefulness and ease of use would increase after initial usage of LBS. Participants showed that irrespective of the type of LBS task, they perceived a significant increase in usefulness. Items for perceived usefulness came from existing scales (Davis, Bagozzi, & Warshaw, 1989), and were modified for our questionnaire so they related to LBS, for example 'Using LBS would improve my job performance'.

2.5 Trust

Research into trust items has divided the concept into three categories: Benevolence, Ability and Integrity (Mayer, Davis, & Schoorman, 1995). Benevolence reflects the service provider's positive image as viewed from a consumer's perspective. Ability refers to perceived competence. Integrity refers to an organizations' adherence to rules. The trust items (Pavlou & Gefen, 2004), were phrased in line with LBS, for example 'I feel that my employer is reliable'.

2.6 Perceived Risk

Risk has been proposed as 'inseparably intertwined' with trust issues, and is therefore hypothesized to be a direct antecedent of intentions to use LBS (Junglas & Spitzmüller, 2005). For example, trust and perceived risk were found to be key mediators to predict intentions to use the online store Amazon (Pavlou, 2001). Perceived risk items came solely from Pavlou.

2.7 Intentions to Use LBS

Intention items were not prescribed by Junglas & Spitzmüller, so other items from similar research were consulted (Vijayasarathy, 2004; Wang, Lin, & Luarn, 2006). Items were created specifically for this questionnaire, such as 'I intend to use a device which would allow people to locate me during working hours'.

3. METHOD

Pilot study feedback suggested that wording of a number of statements were problematic for participants. These were amended, and the questionnaire was printed. This was then sent to 1,500 named individuals, using addresses from a market research company.

All participants were in some form of employment in the UK at the time of posting. Each questionnaire was sent out with a cover letter, consent form and pre-paid return envelope. We received 106 completed questionnaires back.

4. RESULTS

All data was entered into SPSS v.18 and screened for normality prior to analysis.

4.1 Factor Analysis

The analysis was run applying the principal-axis factoring method with Varimax rotation. Interpreting the output, 21 factors were identified. The questions relating to 'locus of control' were removed, as they did not fit well with the identified factors. Running a second factor analysis, 14 factors were identified. Looking at these results, it became clear that there were 11 main factors present in the data, so a further analysis with 11 factors as a cut-off was run. From this analysis, we identified the following 10 factors: Intentions to use LBS, Disclosure to employer, Neuroticism, Employer responsibility, Perceived Usefulness, Out of work tracking, Trust of the employer, Trust of the LBS provider, Perceived Risk, and Conscientiousness.

4.2 Regression

We then conducted a step-wise logistical regression to understand which of the 10 factors would predict intentions to use LBS. We wanted to understand which of the factors would predict intentions to use LBS in the workplace, so removed the 'out of work tracking factor'. This regression would then tell us what predicted LBS use *within working hours.* Model 3 shows that three factors emerged as predicting intentions to use LBS: perceived usefulness (R^2 =.207), trust of LBS provider (R^2 = .280), and disclosure to employer (R^2 = .331). Coefficients can be seen in Table 1.

	B	SE B	β
Model 1			
Constant	*.440*	*.502*	
Perceived usefulness	*.502*	*.098*	*.455***
Model 2			
Constant	*-.512*	*.566*	
Perceived usefulness	*.450*	*.095*	*.408***
Trust of LBS provider	*.362*	*.113*	*.275**
Model 3			
Constant	*.873*	*.747*	
Perceived usefulness	*.397*	*.094*	*.360***
Trust of LBS provider	*.340*	*.110*	*.258**
Disclosure to employer	*-.236*	*.086*	*-.231**

Table 1: *Coefficients following stepwise multiple regression*

**p < .001, *p < .05
$R^2 = .207$ *for Model 1 (p<.001),* $\Delta R^2 = .073$ *for Model 2 (p<.05),* $\Delta R^2 = .050$ *for Model 3 (p<.05).*

4.3 Structural Equation Modelling

From the regression analysis, we then tested this revised model using Structural Equation Modelling. The factors of Perceived Usefulness, Trust of LBS provider, and Disclosure to employer were drawn as predictors of Intention to Use LBS (Figure 3). The model was drawn in Amos Graphics v.18, and the data from the questionnaire was applied.
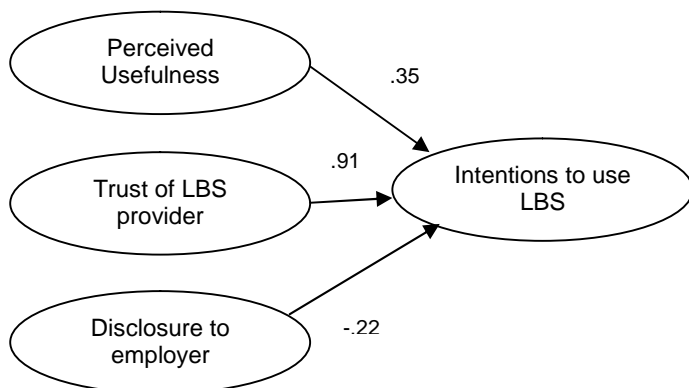

Figure 3. *SEM analysis including three factors from regression*

The model suggested by principal components analysis yielded fit indices of .85 (CFI and IFI), indicating a fairly good fit. However, the χ² value for the model, with 133 degrees of freedom, was 344.3 (*p*=.000), and the RMSEA was .123, suggesting a poor fit. These contradictory SEM findings suggest that our model could be improved, but also that the use of SEM may not be appropriate for this particular phase of our research. It has been highlighted that SEM analysis assumes the sample size is large, but in psychology in general, numbers may not reach more than a few hundred (Werner & Schermelleh-Engel, 2009; Westland, 2010).

5. FUTURE WORK

Taking this into consideration, we plan to refer to the regression output to determine any other factors which correlate highly with intentions to use LBS. For example, when we ran a regression with all items entered as independent variables, 'trust of employer' also emerged as being a factor in the model. The factors identified as predictive of LBS adoption will be included in a revised questionnaire. The issue of sample size will be rectified using a much larger scale (1000+ participants) for the second questionnaire, sent online to employees in the UK and US.

6. RESEARCH CONTRIBUTION

Despite this research only being part one of a two phased investigation the analysis already suggests that the model suggested by Junglas & Spitzmüller (2005) does not predict intentions to use LBS in a work context. We aimed to create a questionnaire to fit the model exactly, yet when looking at factor analysis and regression results, concepts such as personality type do not seem to be important when thinking about LBS adoption. This phase of the research suggests that perceived usefulness of the LBS system, trust of service providers, and the expectations of the employer determine if employees would be willing to use LBS.

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