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Location tracking: views from the older adult population

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Abstract

Background: there has been a rise in the use of social media applications that allow people to see where friends, family and nearby services are located. Yet while uptake has been high for younger people, adoption by older adults is relatively slow, despite the potential health and social benefits. In this paper, we explore the barriers to acceptance of location-based services (LBS) in a community of older adults.
Objective: to understand attitudes to LBS technologies in older adults.
Methods: eighty-six older adults used LBS for 1-week and completed pre- and post-use questionnaires. Twenty available volunteers from the first study also completed in-depth interviews after their experience using the LBS technology.
Results: the pre-use questionnaire identified perceptions of usefulness, individual privacy and visibility as predictive of intentions to use a location-tracking service. Post-use, perceived risk was the only factor to predict intention to use LBS. Interviews with participants revealed that LBS was primarily seen as an assistive technology and that issues of trust and privacy were important.
Conclusion: the findings from this study suggest older adults struggle to see the benefits of LBS and have a number of privacy concerns likely to inhibit future uptake of location-tracking services and devices.

Keywords: *location-based services, ageing, privacy, older adults, older people*

Introduction

The use of location-based services (LBS) is now common-place and particularly prevalent among young people [1]. Applications such as Yelp, Twitter, Facebook, Foursquare and AroundMe share location information and can be accessed with a mobile phone. Such applications could bring significant social, health and safety benefits to older people; however, they are rarely marketed for this group and even in beneficial settings, uptake is poor [2, 3]. In this paper, we try to understand the potential benefits and barriers to uptake of LBS in an older population.

To date, the LBS work with older adults has been grounded in a disability framework. In other words, researchers have focused on the benefits of LBS for older adults with dementia or with other cognitive or mobility deficits [4]. This can lead to a stigmatised conception of LBS as simply another assistive aid [5] and we know that older adults can be embarrassed about their reliance on various assistive devices, sometimes reducing their desire to socialise [6]. This

contrasts markedly with the use of LBS as a 'cool' social facilitator in younger people. Yet popular LBS services such as 'Placeme', which automatically records place visits and calculates the duration of each visit, could certainly prove useful to an older adult group as a relatively simple means of recording and sharing activities and experiences with their peers and family.

One possible barrier to the uptake of LBS in any population is the threat to privacy [7] as LBS services typically generate and share a historical account of places visited in any one day [8]. Concerns over profiling, unauthorised use and disclosure of real-time information may inhibit the acceptability of location-tracking in any population, but it may be particularly acute in a population of older adults who may feel vulnerable about using new technologies. In the *general population*, adoption of LBS is predicted by perceived service availability [9], cost, user personality [10] user concerns about privacy and security [11], concerns about who is sharing information and why [12] and concerns about how much

control can be exerted over the information disclosed as well as trust in the service provider [13]. However, in the *older population*, there has been no explicit exploration of attitudes and intentions to use LBS until now.

We asked a community of older adults to adopt LBS for a week in order to understand how their attitudes to LBS were coloured by that experience and to explore the psychological barriers to LBS uptake in older adults. In our field trial, state-of-the-art location-tracking technologies were introduced to eighty-six healthy, cognitively intact older adults in order to show them the kind of monitoring made possible with these technologies and to better understand the kinds of technology concerns they may have. The accepted convention of at least 10 participants per predictor variable for a regression was observed, as per [14]. Attitudes towards the technology were measured both before and after exposure, using an existing technology attitude questionnaire developed by [15]. Subsequent in-depth qualitative interviews with a selection of trial participants were also conducted. All procedures followed ethics approval.

Method

Quantitative study

Participants

Invitations were sent to 150 surviving participants from a 29-year longitudinal study of ageing in healthy, community-resident older adults (for cohort details of the original study, see [16]). From these, eighty-six older adults (m = 23, f = 63) aged between 72 and 91 years agreed to take part.

Materials

Each participant wore an i-locate LBS monitor provided by TrackaPhone Services (see Appendix S1 (Supplementary data are available in *Age and Ageing* online)) for a period of 7 days. A researcher visited each participant at home, in order to explain how to wear and use the tracking device and battery charging procedures. The location information gathered could be viewed online by researchers (see Figure 1).

All the participants were given pre- and post-LBS use questionnaires 1 month before, and 1 month after the trial (81 questionnaires were returned). The questionnaires included seven constructs: *complexity* (Is the system easy to use?); *autonomy* (Do you or others control access to your information?); *visibility* (willingness to share location); *individual privacy* (a measure of personal privacy concerns); *personal risk* (perceived risks associated with using LBS); *perceived usefulness* (towards the use of LBS); *security* (of the location data); *trust* (in the LBS provider) and finally, the outcome variable *intention to use LBS*. The constructs and their associated questionnaire items are depicted in Appendix S2 (Supplementary data are available in *Age and Ageing* online), along with the correlation coefficients for each category, which show the degree to which questions converge into subscales (the full questionnaire can be found in Appendix S3 (Supplementary data are available in *Age and Ageing* online)).
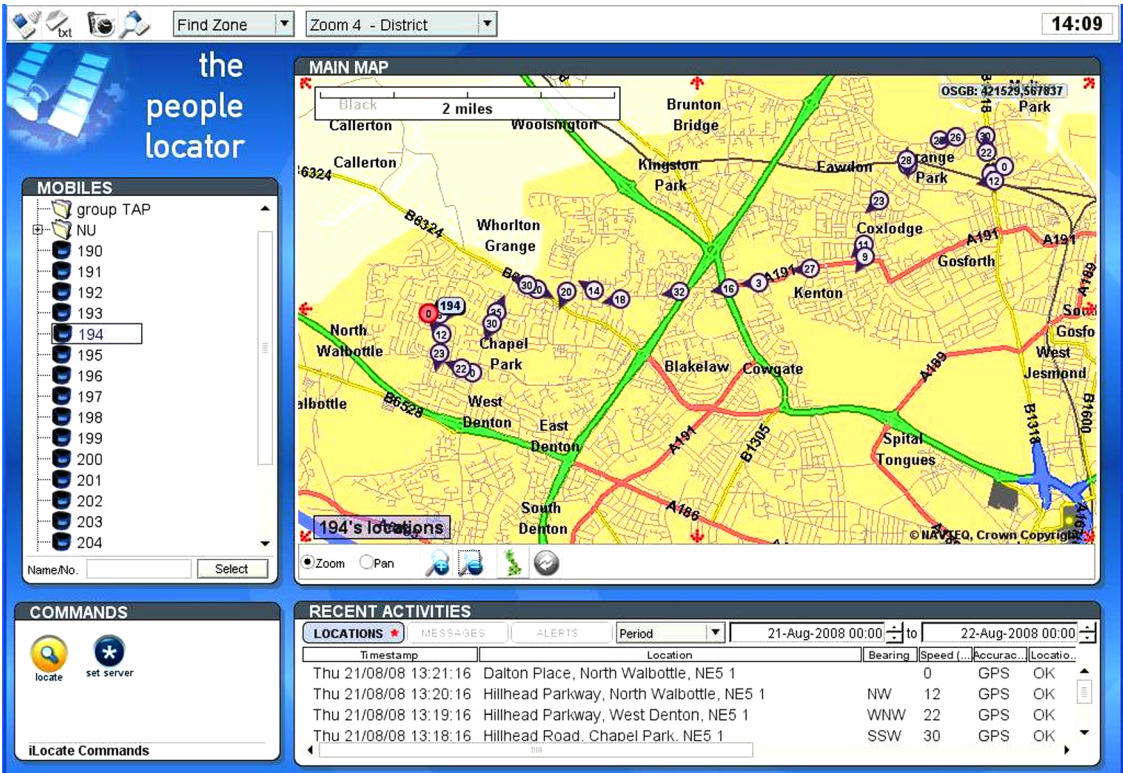
Figure 1. Front-end interface of the LBS

Procedures for analysis

Stepwise linear regression using forwards selection and backwards elimination was applied to the questionnaire data. All predictors and the criterion variable were treated as continuous.

Qualitative study

Participants

All participants were invited to take part in a follow-up study. Twenty of the original sample volunteered (16 females, 4 males) and were interviewed in their homes.

Procedures for analysis

Interviews were transcribed and a sentence-by-sentence thematic analysis was employed using the NVivo qualitative software. Constant comparison between data allowed for the generation of initial codes, a search for overall themes, review of the themes and final definitions. Three other research team members read the transcripts and considered the codes. Any discrepancies between coders were resolved through discussion.

The analysis was guided by a technology acceptance framework identified by [15]. The framework was used as a guide, but the analysis procedure was open to new emerging themes. However, it became apparent that while subtleties between participants varied, the overall themes were a good fit to the framework.

Results

Analysis of the questionnaire data was undertaken using a stepwise regression in order to predict *intention to use LBS* pre- and post-trial (see Table 1). Data from the pre-use questionnaire yielded three variables that predicted intention to use LBS: *perceived usefulness*, *individual privacy* and *visibility*.

Thus, older adults may be reluctant to use LBS *before they have ever experienced it* is because (i) they do not think LBS is likely to be useful; (ii) they value their privacy highly and are

Table 1. Stepwise regression analyses for pre and post-use of LBS

	B	SE B	*P*-value	R^2
Intention to use (pre)				
Constant	−0.690	1.751		0.203**
Attitude/perceived usefulness	0.575	0.196	0.005	
Individual privacy	−0.586	0.196	0.004	
Visibility	0.603	0.297	0.046	
Intention to use (post)				
Constant	2.964	0.737		0.070*
Personal risk	0.299	0.144	0.042	

*$P < 0.05$, **$P < 0.005$.

concerned about others gaining access to their location data and (iii) they would feel as if they were being followed. In marked contrast, stepwise regression data from the post-use questionnaire showed that only one significant predictor variable for intention to use LBS—*personal risk*. In other words, the more they believed LBS would render them vulnerable, the less likely they were to want to use it.

Qualitative analysis of the interviews revealed that four of the five themes identified by [15] were relevant here. Specifically, participants expressed concerns around the usability of the device, as well as concerns around who would have control and sight of the location data and who would ultimately benefit from the data. These are discussed in more detail below.

Is it usable?

Although the device required no explicit control to trigger LBS monitoring, a number of participants confessed that they sometimes forgot to turn on the device, and on occasion forgot to strap it on or take it with them when they left the house:

> I think in a way I was quite relieved when it was over, but mainly because I was having to remember to put one on whenever I went out … and it was quite cumbersome at time—but apart from that it didn't bother me at all

The design implication here is that locating devices might best be integrated with existing objects that the person is attached to—for example, a bracelet or item of clothing they always wear—or offered on their mobile phone. Note, however, that while LBS technology often comes as standard on smart-phones, to date, relatively few older adults have either access to such LBS apps [1], or the motivation to use them [17].

Who controls the data?

Participants expressed concern about where their information would eventually go, who would see it, and whether they could be trusted:

> I don't like that at all, because they sell information on and the next thing you're getting a load of letters. Companies, if they were trustworthy … you just need one person and they can use that information in all sorts of ways can't they?

Data security was of great concern to participants. They felt a sense of resignation, believing a lot of their personal details were already in the public domain, being bought and sold by different organisations. Some participants expressed concern that the introduction of LBS would interfere with their rights:

> I am a bit concerned about civil liberties, over the last few years, and I do think this idea of Big Brother is a little bit frightening,

I would like it to always be voluntary. I don't really like the idea of everybody having to do it.

Who sees the data?

In comparison to the reported habits of younger users, our older participants were relatively conservative about who should be allowed access to their location information, with partners, family, friends, police, carers, doctors and caretakers deemed most acceptable. They were unhappy about strangers having access to location information:

If he had no positive reason to have it, you know, if he wasn't emergency services or if it was just a gossip shop, no. Take a walk, a long walk.

Participants were also aware that location tracking may leave them vulnerable to crime. They worried that if they left their house, people might use the opportunity to break in:

If it's somebody who has a regular life, doing the same things every day, then you've got a pattern. That's it, you're vulnerable straight away.

Note, however, that this concern wasn't universal and some participants 'couldn't see the harm' in divulging location data. One added:

I'd be flattered if anyone wanted to know where I was, to be honest.

Many participants felt that they were past the age when they might have been engaged in activities they needed to keep secret—and, rather ironically—expressed the view that younger people were more likely to suffer privacy violations with LBS:

At my age I'm not conducting any illicit relationship. I'm not likely to be going to the STD clinic! I live a plain life, I can't think of anything I would do at my age. If I were young it might be a different matter altogether.

Who benefits?

There was general agreement that the system could be useful for vulnerable individuals, but that it would not be embraced by the healthy older adult community to which they themselves belonged. This is perhaps the most significant of our findings in trying to explain the low uptake of LBS in older users: the perception of LBS as an *assistive* device designed to overcome disability rather than as a social tool. Our participants had control of their own lives, could make their own decisions, and therefore did not see the necessity of LBS, although they did acknowledge that the tracking device could provide reassurance. Participants did, however, express an interest in the system for more dependent individuals, such as those with dementia, where the technology was again seen as something used 'on' rather than 'by' people:

It depends on the situation, doesn't it? For people that are starting to lose their mind and start wandering, I imagine it would be very helpful if they had a tracking device so somebody knows exactly where they are and can go and collect them. But I don't think it should be used on old people generally.

The older adults could see a wide range of activities that could be enhanced by the use of LBS, for example, as a diary if the user had a failing memory, to assist in dangerous activities such as rock-climbing, or even used as an alibi. Despite these uses, participants generally failed to see how the system offered any useful functionality beyond that offered by a mobile phone:

I could imagine- say I moved to Manchester where my daughters live- and I went out. I could see it being useful to communicate with her to say 'I am at Piccadilly, what bus do I catch?' But mind you, a mobile phone might do just as well.

And as one participant explained, having such a system would not add anything to their current situation:

The way we're bonded we're always in touch and everyone seems to know where everyone is and what they've done. It's because we're so much in touch with each other. That's why telephones are so great

In summary, then, our participants did not anticipate the social benefits currently offered by LBS systems and typically enjoyed by younger users. In short, healthy older adults do not perceive themselves as likely customers and while they might be able to anticipate the health benefits for vulnerable individuals, they simply could not see the benefits for healthy individuals like themselves.

Discussion

Our findings suggest that factors such as risk and trust playing key roles in both pre- and post-use of an LBS and that older adults are concerned with the leakage of private information. The pre-use questionnaire showed that perceived usefulness, individual privacy and visibility (i.e. who sees) were predictors of attitude towards use of a location-tracking service, but some of these factors became less salient once participants gain experience of LBS.

This work highlights the importance of field trials—as the experience of a technology *in situ* can markedly change attitudes towards it. Certainly, those older adults who were interviewed following a week's LBS trial were very willing to trust their location data to certain family members, health professionals or authority figures. However, our data suggest service providers would need to deliver a reliable service in order to maintain trust and to minimise the risk of losing the older client. The interview findings also suggest that an element of personalisation might be key—so that systems could be customised to reflect the privacy and trust profiles of individuals.

However, our most significant qualitative findings simply concern the perceived benefits of LBS. For younger people,

locating friends or services have become commonplace and are simply an additional convenience in facilitating social encounters or sharing information about their day. Our older participants, however, saw LBS very much as an assistive health tool that could provide benefits to others rather than themselves. This may, in part, be related to the ways in which we have presented the device to our older population—in a simple, strap-on form as opposed to a more flexible, attractive, interactive smart-phone app. But there was definitely a sense with our older group that LBS may somehow be associated with dependence and a loss of dignity. One solution to this problem may lie in reciprocity. In our trial, the older adults were themselves 'monitored' but did not undertake any monitoring of their own; while we took pains to show our participants what kinds of information could be revealed about themselves and others, we offered them no opportunities to follow family or friends through the trial period.

Conclusion

We were interested in the views of older adults regarding their LBS experience, and what issues might impact the uptake of such systems for that age group. We found that older adults considered their location information to be sensitive and they were concerned with the potential misuse of their personal information. They expressed privacy concerns, although these were ameliorated following experience with an LBS system. More strikingly, however, older people were not able to see any real benefits of LBS for a healthy, active individual, but feared that adoption of such systems may lead to a portrayal of them as 'unhealthy'. We conclude that one of the biggest challenges for LBS adoption within the older adult population lies with the conception of LBS as an assistive rather than as a social technology.

Key points

- To date, the adoption of LBS by older adults has been slow.
- Relatively few studies have tried to understand the attitudes of older adults towards LBS.
- This work uses both qualitative and quantitative methodologies in order to understand attitudes to LBS use.
- Privacy concerns are likely to inhibit uptake of LBS, yet this could potentially be offset by promoting perceived benefits.

Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

Conflicts of interest

None declared.

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