The Human Element: Social Leveraging of User Engagement with Assisted Living Technology

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Abstract

Research into user engagement with assisted living technology (ALT) has investigated design issues including usability, functionality and aesthetics; looked at user attitude and acceptance research; and examined social factors including the need to create ALT which appropriately supports the relationship between users and service providers. Based on an empirical case study of older persons' independent living services offered by a large UK housing provider, we propose that there is a further, key dimension of ALT user engagement: *social leveraging*. We show how user engagement with key ALT including personal pendant alarms, pull cords and intercoms is shaped and supported in important ways by the ongoing social interaction of residents and skilled staff at independent living schemes. We discuss implications of social leveraging for reconsidering the importance of human resource as part of independent living services, during a time of transition to new technological models, and in light of current funding and organisational priorities.

Introduction

Across the developed nations, institutional models of living for older people are decreasing in popularity, and independent living has gained traction as an alternative. Broadly, independent living refers to accommodation for the 'active elderly', owned or rented, often in dedicated housing developments, with associated services which provide support as and when required. However, living independently is not solely a matter of older people's preference: the world's population is both ageing and living longer, and it is also being strongly driven by the need to reduce pressures on the care sector.

Against this background, technology offers the potential to change the nature of older independent living services, realise cost efficiencies, and reframe the need for, and roles of, staff. There is a wide range of technology (see e.g. Daniel *et al*, 2009) variously called telehealth, telecare, or assistive technology. All three refer to computer-mediated, remote, at-a-distance provision of care and support to users. Telehealth concerns relationships between users and health services, while the focus of both telecare and assistive technology is on the activities of everyday life; the latter can include non-ICT support such as modifications to accommodation, or mobility aids. However, the terms may not be precisely defined, and can be inconsistently used (Clark and McGee-Lennon, 2011). Throughout this paper, we use the term 'assisted living technology' (ALT) to refer to computing infrastructures consisting of sensors, devices and communications which facilitate the delivery of independent living services. Sensors can be for occupancy, motion, and pressure; and to measure environmental and biomedical parameters. Devices include alarms for smoke and flood, as well as neck- or wrist-worn pendants and pull cords fitted to homes: the latter are used to signal personal events such as falls, and are linked to communications channels via phones and intercoms. ALT may also refer to new technologies, including smart monitoring which has the ability to work out patterns of resident activity.

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The availability of ALT has led to new technological models of independent living being implemented, with a greater or lesser amount of ALT now familiar in independent living settings. As part of this, the technology-staff relationship is being rebalanced. However, staff still have a key role to play: as well as the technology, there is a need for the human contribution to the services which are organised around it. This is particularly important to investigate at a time when there is limited research on the quality of independent living services (Pannell and Blood, 2012), together with an absence, in some nations, of central government policy, with providers needing to take a lead.

Thus, this paper considers independent living services holistically, looking at how people and technology complement each other in their delivery. Our specific focus is on how older people interact with the ALT basics which continue to predominate: pendants and pull cords which are activated by residents when assistance is needed. Despite its simplicity, this form of ALT is not 'plug-and-play' (Procter *et al*, 2014). Unlike a smoke alarm (for example) it cannot be fitted and forgotten: it requires users to have an active relationship with it, in order for associated services to be delivered effectively. If a pendant is not worn, a fall could happen which is not reported because the person cannot access it. This means the service is not alerted, there is no awareness of the event and the response cannot be provided. If cords are tied up or tucked out of the way, they may be similarly hard to access. These issues are quite apart from reticence to use the technology for fear of 'being a bother', minimizing situations through embarrassment, or feeling that technology use is a stigmatizing badge of age (Parette and Sherer, 2004): older people need to accept the technology, know how to use it, and be willing to do so when it is needed.

While there is no normative definition of what 'user engagement' with ALT should entail, for the purposes of this paper we intend it to mean that ALT is used by older people in ways that result in the effective and appropriate delivery of associated services when needed. It is multidimensional: user engagement with ALT has been seen by researchers as concerning design / aesthetics (including not just looks, but also desirability and connotations); as a user characteristics issue; as an issue of needing to take account of the lived experience of users; and as a question of appropriate design of technology for supporting the relationship between users and service providers.

This paper offers research based on work with a large UK provider of older persons' independent living services, Horizon Independent Living (a pseudonym). The findings suggest that there is a further key issue: *social leveraging*. Based on qualitative and quantitative data derived from a number of sources, including interviews and observations with residents, managers and staff of several older persons' independent living schemes (each of around 25 - 50 dwellings) over a period of two years, we show that it is not just that ALT should be designed to support the relationship between residents and providers; the relationship itself can leverage user engagement with the technology, through appropriately skilled staff who continuously and sensitively encourage, teach, remind, or even cajole. The implication of this is that the human element in independent living services, at least for current technology, is not replaceable: it is substantive for securing and maintaining user engagement.

We draw out the implications for independent living services and strategy, arguing that investment in new ALT infrastructure and devices needs to be balanced by preservation of the important social roles and functions of the human element – scheme managers and other staff – as an essential part of

successful services. The paper thus offers a case study resurfacing issues of sociotechnical systems design (Mumford, 2000): even for apparently simple technologies, both the social and the technical need to be accounted for when considering design and successful deployment. While this approach is familiar in other domains, it is has been largely ignored in the area of independent living, and needs to be acknowledged as a key level of analysis when evaluating and designing independent living services.

Background

Worldwide, accommodation and support services for older people are gaining importance as an urgent issue to be addressed. A major reason is statistical: there is an increasing number of older people. By 2050, it has been estimated that 32% of people in the developed countries will be over 60 (UN, 2013). This is up from 23% in 2013, and 12% in 1950. Against a background of funding and affordability pressures, and while circumstances and policies differ slightly between countries, there is consensus that independent living is the solution and that technology has a key role to play. In the EU, the European Commission has emphasized the need to prioritize long-term care in a context of shrinking resources, and is seeking solutions (EU, 2015): its innovation strategy is reflected in for example in the Ambient Assisted Living and other programmes (Ortner et al, 2013). The US has similar concerns: 'ageing in place' implies older people continuing to live in their own homes, with associated services, and again technological innovation is seen as a key part of the solution. The challenge is affordability (Joint Centre for Housing Studies of Harvard University, 2014). In Japan and China, there are analogous concerns about the affordability of provision for a rapidly expanding older population (Hu and Yang, 2012).

In what follows, we focus on independent living services in the UK, where the research was carried out. While there are some differences between nations, the arrangement we report on can be found globally: it consists of purpose built accommodation, presence of support staff, and assisted living technology.

ALT is the object of much current research. A recent Special Issue of *Interacting With Computers* was dedicated to Ambient Assisted Living (AAL, Bravo *et al*, 2014). It looked at 'lifestyle assurance systems' or 'third generation' ALT including video interaction, 'virtual neighbourhoods', and fixed sensing and monitoring technologies capable of identifying standard patterns of behaviour of occupants and then alerting relevant services when there are departures from this (Brownsell and Bradley, 2003; Conci and Leonardi, 2013). A major concern is acquisition and reasoning about environmental information to support intelligent response. Other approaches to AAL include participatory and wearable sensing, whereby large datasets can be acquired from users, shared, and analysed (Jara *et al*, 2015). Remote sensing technology could remove the need for human carers onsite, as well as the requirement for older people to actively engage with ALT: since the technology is fixed into the environment, there is no need for the resident to wear or interact with any device directly. However, crucially, these systems are not yet market-ready, and are likely to be expensive (Brownsell, Blackburn and Hawley, 2008). Additionally, there are issues with potential loss of autonomy and the need for users to agree to data collection (Stowe and Harding, 2010). For mainstream deployments, AAL is potential rather than existing technology, which remains the object of ongoing research. The ALT which continues to predominate is more basic, consisting of alarms and sensors, without video interaction or the ability to detect a standard lifestyle.

Some sensing, including flood and fire, is automated. However, personal alarms such as pendants and pull cords require active user engagement. When necessary, users need to press or pull these devices, and deal with the responses, speaking through linked intercoms to remote staff who can advise and if necessary provide assistance. Clark and Goodwin (2010) estimate that of 1.7m ALT installations in the UK, for example, 1.4m include pendant alarms. Thus, successful ALT deployments imply user acceptance, willingness and ability to use the technology.

ALT is one element of independent living services, which, according to Elderly Accommodation Counsel (EAC), a UK older people's charity, are designed for those who are still active and relatively independent (EAC, 2012). The National Institute for Health and Care Excellence (NICE), a government-sponsored UK agency providing guidance on health and social care, describes independent living as developments of purpose-built, self-contained flats, houses or bungalows for the over-60s, with a warden onsite, 'there to help arrange suitable support for residents […] and help out in emergencies' (NICE, 2013: web). There is also 'access to 24-hour emergency care assistance via an alarm system linked to a monitoring centre, which will contact a family member, GP or emergency service if needed' (NICE, 2013: web). Similarly, The Joseph Rowntree Foundation, a UK social research charity, describes support as including 'some form of regular on-site 'warden' or scheme manager' (similar to a warden but with reduced presence; Pannell and Blood, 2012: 14). The Age UK (2012) description resembles the others. This major older people's charity notes that developments or 'schemes' have 20-40 dwellings with 24-hour emergency assistance provided by means of an alarm system, 'some' with a scheme manager. Pannell and Blood (2012) estimate that independent living schemes account for around 5% of all older persons' housing in the UK; Age UK (2012) estimate that 533,000 older people are residents. 75% of UK independent living is for social rent: funded by welfare payments (Age UK, 2012).

Independent living services are in transition. The scaling of ALT, together with call centre response and reductions in onsite staffing, raises important questions about the readiness of residents to interact with ALT as its importance increases, its forms change, and there is potentially a higher requirement for its use. Because ALT is likely to play an increasingly key role in the lives of older people, it is important to understand and address issues of user engagement, in order to inform the design of independent living services.

User engagement with ALT is a complex issue, and there is a range of literature from different disciplines and sources. We examine work on user attitudes; research into design and use, including aesthetics and desirability; impacts of user characteristics; and perspectives which consider the relationship of technology to the everyday lives of users, as well as the support it provides for client-provider relationships.

Independent Living Services are largely organised in the UK by local government bodies known as councils, who have carried out much of the research on ALT acceptance. The indications are that this is high. Aberdeenshire Council (2008) found that 63% of survey respondents agreed with the statement, 'I feel more independent because of my telecare'. In a telecare deployment by North Yorkshire County Council (2010), 95% of respondents said that telecare products give peace of mind; and 87% said it enabled independence. A similar initiative by Cheshire County Council (2008) polled 49 clients and found high satisfaction with telecare.

However, while positive attitudes are important, it does not necessarily follow that the technology is being used where there is a need. Taylor and Agamanolis (2012) investigated the major current ALT device, the pendant, using a phone survey. Only 1 in 5 were wearing the pendant at the time of the (unforewarned) call. Reasons given were the risk of accidental activation, the lack of perceived need (one third had never used it), its unattractiveness, and stigma. In a study of council residents' pendants, Davies and Mulley (1993) found that none of the residents wore them. 65% disliked the idea of wearing a pendant, and 34% had never used one. Residents complained of oversensitivity (the pendant can be activated unintentionally) and unattractiveness. Thus, while older people may value what ALT represents, they may be reluctant to use it.

Aesthetics have been recognised as an issue for user engagement. It has been claimed that older users of pendants have not been sufficiently involved in design, which can enhance ownership. However, this approach has produced ambiguous results. Lindsay *et al* (2012) show how older people can be engaged in participatory design, but Taylor and Agamanolis (2012) report that in co-design sessions around ALT, users had few ideas about redesign and many emphatically wanted no change. This seems to imply that aesthetic changes may not be a solution to user engagement issues. Taylor *et al (*2012) show how improvements to functionality, particularly reduced risk of accidental activation, could improve engagement. However, issues of the appeal of ALT are not limited to the visual. Bright and Coventry (2013) suggest that emotional and psychological costs are also highly important, including self-consciousness, pride, embarrassment, fear of stigma, and difficulty of admitting need. Hence, researchers such as Angelini *et al* (2013) have attempted to align aesthetic design with desirability.

Such work implies that personal characteristics and responses of users have an impact on user engagement over and above issues of technology design. In a study of perceptions of personal alarms, 'effective' and 'ineffective' alarm users were identified amongst a set of participants all of whom had experienced falls (Johnson *et al* 2012). 'Ineffective users' are sceptical, or may not recognise need, suggesting that traits of users may trump design. Courtney *et al (*2007) identify dimensions of 'obtrusiveness' of ALT including privacy, and self-concept. Not wanting to be monitored, and having a self-image which is not consistent with the presence of telecare, can also affect engagement.

As well as research on personal characteristics, there is a body of ethnographically-informed research in ALT which elucidates the social dimension in ALT use. This work considers the link between social relationships and routine by observing users' everyday lives and experiences with technology to derive design requirements. User engagement is related to everyday practices and relationships that already exist (Procter *et al*, 2014). Technology which is inconsistent with these may not be successful. Examples include pill dispenser designs which embody assumptions from professionals of what users are capable of (Palen and Aalokke, 2006) in terms of managing drug regimes; and the BMJ Healthspace system, which involves users keeping their own medical records, both an activity and format unfamiliar to them (Greenhalgh *et al*, 2010). While the focus of this work is on telehealth rather than ALT, the conclusion – that technologies must be adapted to older people's existing experiences of relationships, and the routines these relationships imply – seems equally likely to apply. In particular, users have to remember to wear a pendant; make decisions about where to put it when they are sleeping; and be ready, if used, to

speak through an intercom, potentially to an unknown third party at a call centre.

Such research highlights that ALT is about the configuration of a social relationship between residents and people responsible for their care. The roles and presence of onsite wardens or 'scheme managers' are being altered and reduced, being complemented or replaced by 'floating support' or call centres. The ALT presence becomes more significant, requiring residents to signal issues rather than those issues being monitored and noticed by wardens and scheme managers. Thus, engagement requires new practices which, in turn, require understanding of new routines and reconfigured relationships. These challenges to users go beyond usability, aesthetics, or personal characteristics: new technology-supported models of independent living ask users to live in new ways.

Thus, ALT design needs to be seen not just as a technological challenge, but as a sociotechnical issue. Sociotechnical systems involve technologies and social interaction, each depending on the other. Somerville and Dewsbury (2007) propose that technology design needs to assure the social interaction it is designed to support. Relatedly, Blythe *et al* (2005) discuss 'socially dependable design' which supports the relationships it needs to support through taking account of the lived experience of its users. Procter *et al* (2014) show how technology can be 'hacked' by older people working with informal carers, for example labelling devices or taping over unused / distracting buttons: technology solutions are also solutions for care relationships.

This review has shown that user engagement with ALT can be conceived as a design / aesthetics issue, or an issue about traits of individuals. Equally, there are impacts from the lived routines of users, which may not match technology requirements well. Finally, social relationships are an important part of ALT user engagement. ALT needs to support a relationship between user and provider through which an independent living service can be delivered.

This paper offers a complementary social perspective, focussing, like others, on ALT considered as a sociotechnical system, and taking an ethnographically-informed approach. Where the work discussed shows how ALT needs to support social relationships in independent living, we demonstrate the converse: how the social relationships surrounding ALT can themselves support ALT user engagement. We show how *social leveraging* works as a means to steward and maintain user engagement in individually sensitive ways, and argue for its importance as a resource which needs to be acknowledged in the design of independent living services. In particular, because it is substantive for user engagement, it implies that the presence of key staff needs to be preserved, in particular scheme managers.

The Setting: Horizon Independent Living

Horizon Independent Living (HIL) is a social landlord. This means that it provides accommodation to people on low incomes, many of whom are in receipt of welfare benefits. It has approximately 100,000 residents living in 36,000 homes across the UK, centring on the UK Midlands. The provider, and its demographic, are highly representative of current UK independent living services. The challenges facing HIL are reflected both in the UK and internationally: how to develop and provide effective services in a context of higher demand, reduced funding, and technological change.

HIL offers purpose-built developments of around 25 to 50 units with a central, staffed office. They can be under one roof ('non-dispersed'), an arrangement similar to a block of flats, with offices and social areas; or physically separate ('dispersed'), for example a development of bungalows. Each dwelling in a HIL housing scheme has a basic assisted living technology suite: pendants and pull cords with intercoms.

Developments are differentiated by scheme type: 'sheltered', and 'extra care'. Sheltered schemes offer accommodation with technology and a scheme manager, onsite for 19 hours per week. When the scheme manager is offsite, response is provided through a call centre. Extra care schemes offer a higher level of care as part of the package. There are onsite subcontracted carers responsible for personal care (helping, for example, with showering and getting dressed), in addition to scheme managers.

HIL's main concern, and a motivator for this research, is the need to shape new independent living services that effectively address current funding cuts. The questions are not solely about technology: there is also a need for HIL to understand the role and value of its human resource in the delivery of assistive technology services. This is a central issue for the design of independent living services both in the UK and internationally.

The Research

To investigate these issues, we carried out research consisting of three linked studies over 2 years, at a range of schemes (shown in Table 1; scheme names have been changed, as have names of all staff and residents throughout the paper: due to issues of scheme manager and resident consent it was not generally possible to carry out every study at each scheme). The studies formed a sequence, beginning with (1) a resident survey. This was followed by (2) a 'call logging' study, in which scheme managers kept records of ALT events over 21 days. Finally, (3) observational work was carried out onsite at a range of schemes. This included interviews and shadowing of scheme managers as well as a study of pendant use by clients, also with associated observation and interview. The latter studies were put in place to address questions raised by their predecessors: while all the studies were motivated by the need to understand ALT user engagement, the nature and importance of social leveraging was not an immediate or obvious focus, but emerged out of the research as it unfolded.

|	Resident survey	Call-logging	Observational and interview work
Thornton Way	✓		
Willow Court	✓	✓	✓
Cheam Lodge		✓	
Shakespeare Croft			✓
Godiva Court		✓	✓
Allen Way	✓		
Fratton View		✓	✓

Table 1: Multi-method study and schemes

Resident Survey: I approve of it, but I don't necessarily use it

An important part of user engagement is user acceptance of ALT. To investigate this, we carried out a survey, designed around five issues: how far residents feel they need ALT; how much they like it; whether residents know how to use ALT (that is, activate it); how easy it is to use; and how often it is used. Many questions used Likert scales, but we also left it to residents to tell us (using free fields) the reason they like or do not like ALT; and why they feel it is easy or not easy to use.

The survey was carried out face-to-face at three different schemes: two sheltered and one extra care. The findings are summarised in Figure 1.
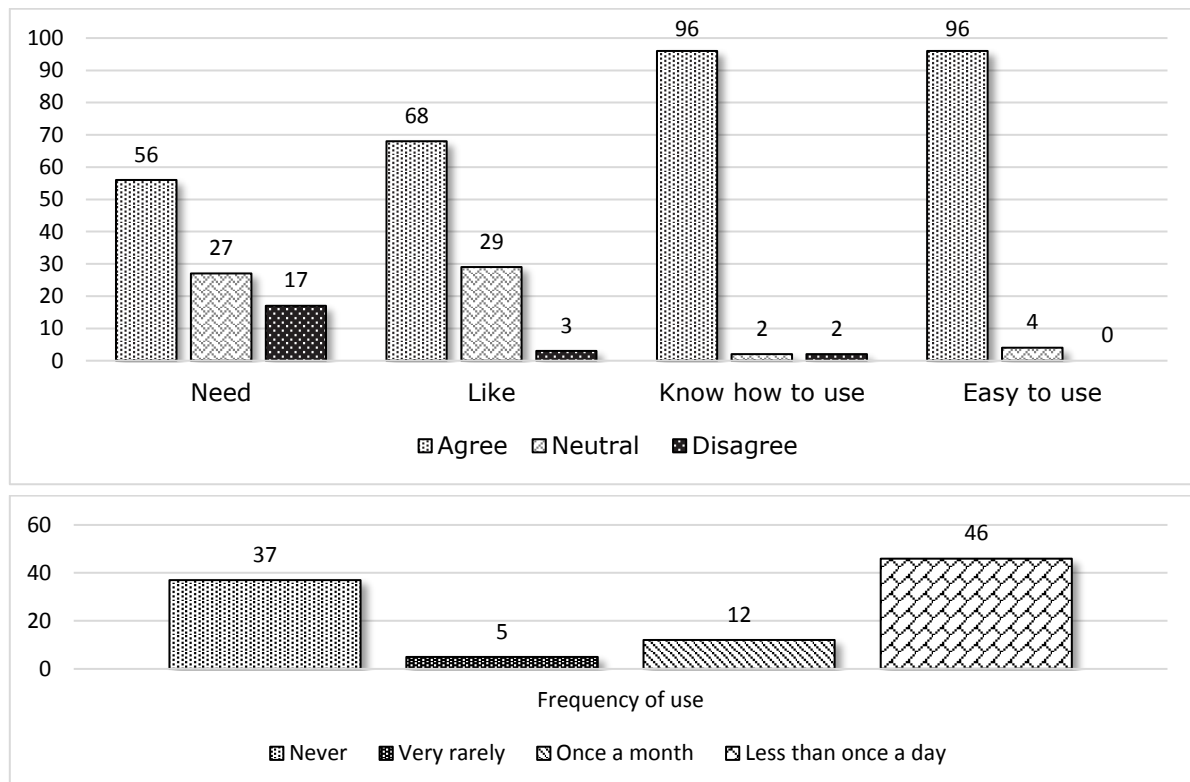
Figure 1: Responses to resident survey, as percentages

96% of respondents agreed that they knew how to use ALT. The same percentage agreed ALT is easy to use. We asked why ALT was usable. The responses indicate a perception of simplicity and obviousness: 'You don't have to be clever to pull a string press a button or listen to somebody speaking'; 'You'd have to be daft if you couldn't use it'. Others drew attention to simple functionality: 'Several installations one simple action'; 'Pulling is easy'; 'Just press it'.

Taking the three schemes as a whole, over two thirds of respondents (68%) agreed that they liked ALT. The reasons for this centred on peace of mind ('good to know it's there'; 'they give peace of mind'), utility ('quick response'; 'handy'; 'good for emergency'), and importance ('they are essential items'; 'they are lifesavers'). Reasons for disliking ALT included preference for a personal service ('feel forced to use them. I would prefer to just go and find someone'), obtrusiveness, or antipathy ('waste of time').

The results show some disconnect between the responses on usability, and the declared frequency of use. While nearly all the respondents agreed that they

knew how to use ALT, and that it is easy to use, over a third (37%) said they had never used it. This means that there is a group of residents whose attitudes to usability do not appear to be based in experience of use, implying acceptance of ALT in theory, but a rejection in practice. Thus our study, as with others, raises the question of whether there is resistance to use where it is needed. However, there are two circumstances in which non-use is not a concern. First, the configuration of an independent living service impacts ALT user engagement. At extra care schemes, more is done face-to-face, reducing the need to use ALT. This is reflected by the contrast in the figures for the two scheme types. Over half (57%) of extra care scheme residents said they never used ALT, against a quarter (28%) for sheltered scheme residents. Mirroring this, less than half (44%) the extra care scheme residents felt they needed it, against a much higher 67% of residents in sheltered schemes. Second, regardless of scheme type, there is a set of residents who, in the words of one scheme manager, 'don't need it yet' (as residents themselves declared). These are 'active elderly' who have anticipated future needs and made arrangements early. This suggests there is an 'ALT-inactive' set of nominal 'users' – and that this is to be expected.

While the survey provided data on attitudes and use, it did not reveal (1) how specifically ALT is being used (only its frequency); (2) whether, and in what circumstances, it is not being used but ought to be; or (3) what social processes might be implicated in the results, which contrast with literature suggesting that numbers using ALT are a fraction of those expressing positive attitudes. Thus we needed to look further at how ALT is used and what are the ways that use is established.

Investigating patterns of ALT use: call logging

The second study was designed to investigate user engagement by focussing on use. Scheme managers across 4 non-dispersed schemes (3 sheltered; 1 extra care) kept records of all the ALT events – or 'calls' - that occurred when they were onsite over a 21-day period.

Time	Location	Call In, or Call Out?	Activation Type	Reason	Urgency	Action
		CI (Client originates call) **CIN** (non-client originates call, e.g. visitor / tradesman) **CO** (You originate call, e.g. test)	**P** Pendant **C** Cord **S** Smoke alarm **O** Other (please specify)	**T** Test **COM** Communication (please specify) **PC** Personal care **U** Unwell **E** Emergency (please specify)	**E** Emergency **S** Serious non-emergency **R** Routine non-emergency **N** No urgency	**NFA** No Further Action (Call only) **FA** Further action non-3rd party (onsite staff deal) **FA3** Further action involving 3rd party (offsite e.g. paramedic)

Table 2: Call logging options

The study was designed together with scheme and upper HIL managers to create a format for call logging which could eventually, in principle, become digital and be used to generate statistics about ALT usage and support

resourcing. There were seven fields: (1) Time; (2) Location; (3) Call In or Call Out (explained below); (4) Activation Type (which device was activated); (5) Reason; (6) Urgency; and (7) Action required. Under relevant fields we provided options, drawn from managers' current practice and thinking. The complete logging scheme is shown in Table 2. 21 formatted paper sheets including the logging scheme were handed to each scheme manager (one for each day), and the study was explained to them.

	Scheme type / size	Reported days/ total number of calls	Calls (average / STD)
Willow Court	Extra care / 24 flats	6 / 20	3.4 / 2.2
Cheam Lodge	Sheltered / 28 flats	23 / 109	5.9 / 2.5
Godiva Court	Sheltered / 34 flats; 1 bungalow	25 / 101	4 / 1.6
Fratton View	Sheltered / 34 flats	17 / 86	5.5 / 7.6

Table 3: Basic call logging data

The results show that across all schemes there were between 3 and 6 calls per day during the time managers were onsite (See Table 3). The breakdown on activity is 52% calls in, and 48% calls out (see Table 4). A 'call in' means a call received onto the system. These fall into two types. Resident calls in, due to activation of pendant or pull cord, or door entry requests when returning from a trip out, compose 21% of all system use. All other calls in, 31% of all ALT activations, are visitor entry requests (family members, health professionals, bought-in carers, tradesman, and others). A 'call out' is originated by the scheme manager, using a handset, and / or the linked control array. Examples include making a general announcement to the scheme (including all flats), known as all-calls; contacting an individual flat; or opening the front door. Thus, resident calls in compose less than a third of all ALT activations and the amount of resident use is lower than that of scheme managers.

Table 4 shows the reasons for resident calls in. These include communications (including enquiries and notifications), requests for personal care, entry requests, and tests. Tests are reactive: the scheme manager calls the resident by handset to ask them to test pendant and pull cord, resulting in activation. Less than 2% of the resident-originated calls were logged as emergency or serious non-emergency (the remainder being routine or non-urgent). Unsurprisingly, action reflected urgency with around 1% requiring third-party involvement, and the majority requiring no further action.

Table 4 also shows reasons for calls out. At Fratton View, tests account for around half of these. Moira, the scheme manager, also used the system to 'check in' with residents (calling first thing in the morning to check how they are), discuss issues with other HIL staff, and let people in. There is a similar set of reasons for calls out at Cheam Lodge: tests, checking in, calls to other offices, calls to individual flats, and all-calls. At Godiva Court, the calls out logged by the scheme manager, David, are checking in, and unwell calls. Test calls involved the same process as at Fratton View, but these were logged as calls in. At Willow Court, there were no calls out, and fewer calls in than at other schemes. This difference is due to the scheme type: at extra care schemes much more of the work is done face-to-face.

The distribution of calls in and calls out revealed by the call logging study indicates a social process whereby the responsibility for ALT use is shared. This is not 'one-way', initiated by residents with staff in a reactive role. Rather,

resident ALT engagement is cooperatively supported: both parties use the system to accomplish the requirements of resident care. This can be seen, for example, in test regimes initiated by scheme managers and responded to by residents; and also through checking in, used by scheme managers to give residents opportunities to self-report on health.

	Scheme			
	Willow Court (n=20)	Fratton View (n=86)	Godiva Court (n=101)	Cheam Lodge (n=109)
Calls in (165)	20	15	56	74
Reasons for calls in	Resident communications (10) Requests for personal care (5) Non-resident (4) Test (1)	Non-resident (13) Resident communications (2)	Non-resident (34) Test (13) Door entry (8) Unwell (1)	Non-resident (47) Test (15) Requests for personal care (5) Unwell (5) Emergency (2)
Calls out (151)	0	71	45	35
Reasons for calls out	NA	Test (46) Other HIL (12) Checking in (10) Door entry (3)	Unwell (30) Checking in (15)	Checking in (20) Individual communications (6) Test (5) All-calls (2) Other HIL (2)

Table 4: Calls in and calls out by reason, across 4 schemes

However, the study reveals variations in patterns of use of the ALT system across the schemes, which suggest that this process is not uniform. There are differences in types of calls logged, and how they were logged. Both test calls and unwell calls were dealt with differently by different managers, sometimes treated as a call in, and sometimes as a call out. The same kind of call can be seen as originating either with the resident or the scheme manager, and this possibly reflects assumptions about responsibilities: David appeared to feel that it was part of his duties to call residents if he felt they were unwell, reducing their need to call in to report this; but that tests are something the resident carries out when reminded. Other managers – both Moira at Fratton View, and Eileen at Cheam Lodge - saw this in reverse: residents needed to report when they are unwell; but tests were something scheme managers initiate.

Regardless of these differences, the call logging study suggests that ALT user engagement goes beyond many of the dimensions acknowledged in the literature – usability, aesthetics, user characteristics, design – to social construction: how far and in what ways a user is required to engage with the ALT system is relative to a relationship with the scheme manager where each party has different roles in the delivery of the service, depending on the scheme and its manager's decisions on responsibilities. The implication is that ALT user engagement takes place within the context of a social relationship which supports it: it is socially leveraged. To explore this further, we ran a third,

ethnographically-informed qualitative study dedicated to observation and interviews with both scheme managers and residents.

On the ground: observations at schemes

Observational work was carried out at four schemes over a number of days at each. This consisted of three activities: (1) shadowing of scheme managers to find out more about their daily activities; (2) interviews with scheme managers about their work; and (3) a study of the use of ALT by residents, focussing on pendants. This involved observing where the pendant was during a visit to a resident, particularly whether it was being worn; and (where permitted by the scheme manager and consented to by the resident) a short structured interview on residents' understanding and use of this key piece of ALT. Table 5 gives scheme details and shows the activities carried out at each.

	SCHEME DETAILS		STUDIES CARRIED OUT			
	Scheme type	Properties	Shadowing scheme manager	Interviewing scheme manager	Pendant study	
					Observing residents	Interviewing residents
Fratton View	Sheltered, non-dispersed	34 flats	✓	✓	✓	
Godiva Court	Sheltered, non-dispersed	34 flats; 1 bungalow	✓	✓	✓	✓
Shakespeare Croft	Sheltered, dispersed	48 bungalows; 1 house	✓	✓	✓	
Willow Court	Extra-care, non-dispersed	24 flats	✓	✓	✓	✓

Table 5: Observational Study: schemes and activities

The data gathered were audio recordings (covering the entirety of all visits), still photographs, and some concurrent notes. All audio recordings were transcribed. Thematic analysis was carried out on the resulting materials, involving multiple iterations to identify key events, issues and interactions and categorise them. The following analysis is organised around the themes identified, which are used to present social leveraging as a set of skilled social practices. We compare and contrast across the different schemes around each theme.

Managing independent living services during a time of transition

Independent living services are in transition. At HIL, face-to-face contact and twenty-four hour staff presence, known as the 'warden model', is being reduced, to be replaced by phone- or intercom-based interactions and a lower scheme manager presence (of 19 hours per week). This is complemented by remote, call-centre-based services when a scheme manager is not onsite. ALT infrastructure is a key part of this change. However, ALT requires the engagement of residents. A concern for all scheme managers was how this transition should be managed, since direct, problem free engagement with ALT could not be assumed.

Resident readiness to use ALT

Three of the four scheme managers we interviewed and observed told us about serious events which had occurred at their schemes. Moira, at Fratton View, made a clear link between reluctance by residents to engage with the remote service, and the need for onsite staff:

> M People would become more vulnerable if there wasn't more staff onsite even though there's a 24-hour call. We had a situation last week, where a lady collapsed in the bathroom at night, she hadn't got her pendant on, she'd got a pull cord in her bathroom and the hall, and she crawled past both of them and dragged herself in the living room and lay on the floor there from 2 O'clock until I came in the following morning, because she knew I was coming, because she didn't want to get anybody up in the middle of the night or you know, worry anybody.

At Shakespeare Croft, the scheme manager, Jane, gave examples of residents experiencing difficulties or having needs during times when she was not onsite and 'waiting for me', in particular a resident who collapsed, and although wearing and able to activate his pendant, waited for Jane to come onsite and open up a communication channel through his intercom as part of her daily scheduled contact with residents.

An important recent event at Godiva Court had been a death. The scheme manager, David, explained:

> D Ellen had a fall, and I think one of the contributing factors to her dying was the fact that she was on the floor for quite a while. She'd gone to the toilet in the middle of the night, and she hadn't worn her pendant.

Jane explained that many residents had expectations of her that they formerly had of wardens; that she was someone to 'sort things out', regardless of ALT. Jane's comments suggest a culture, which persists, of personal relationships and dependencies, and a resistance to impersonal agencies represented by call centres. However, such expectations are not restricted to residents who are used to the warden model. They can also apply to new people joining the scheme. Moira said:

> M Yeah it's a business and it's got to be run efficiently, but people come in here [choose to live at the scheme] because they think that there's going to be someone around for them to have a word with, you know someone they can go to if they've got a problem.

These comments suggest that residents may not always be ready for the demands placed upon them by new models of independent living service, which reduce immediately available, personal human presence, and complement or replace this with ALT and associated remote services. Despite putative uses of ALT these cannot be assumed: there is virtually no resident reporting of being unwell and, crucially, emergency notifications may not be made.

ALT user engagement, then, is a basic issue for HIL, and the object of ongoing work by scheme managers. Our observations show that engagement emerges out of social relationships between scheme managers and residents, founded in skilled social practices that scheme managers bring to bear. This process, social leveraging, has two phases. The first involves shaping a framework of interactions to contextualize and scaffold ALT engagement. The second consists of ongoing interactions with individuals within this framework to address their specific engagement issues. These include addressing resistance, reminding and

reinforcing, making judgments on resident autonomy, and responding selectively to residents depending on needs.

Social leveraging: shaping frameworks for interaction

HIL upper management places a range of duties on its scheme managers, including checking in with residents each day; being available in the scheme office in person and by phone; periodically testing residents' ALT; and carrying out support reviews at intervals (structured interviews to identify whether resident needs have changed). This means that scheme managers are in regular contact with residents for a range of purposes; and that contact is often ALT-mediated, as well as face-to-face. However, while these duties are prescribed, scheme managers exercise their own discretion on how far they are sufficient, in terms both of frequency and content. Scheme managers may organise additional contact, change the mode (for example from ALT-mediated to face-to-face), or expand the scope in terms of the topic. This happens particularly when scheme managers have concerns about residents' health or other risk factors; or about their engagement with ALT.

Checking in is one example of how scheme managers make judgments on what should be the extent and character of the framework for interaction. Checking in involves contacting residents each day depending on their preference: intercom, physical visit, or no contact / opt-outs (marked on a daily 'visiting sheet' scheme managers produce to support the process). The scheme manager greets the resident, and asks how they are and whether there is anything else they want to raise.

At Shakespeare Croft, there was a high percentage of opt-outs (around half, as opposed to a quarter or less at other observed schemes). Nearly all the remaining residents requested intercom contact. Jane was not concerned about the opt-out rate, pointing out that her demographic included many younger residents felt not to be at risk. Equally, she was concerned to implement checking in as a largely ALT-mediated process, on the basis that residents need to 'get used to' new models of assisted living service. This reflects a desire, shared and promoted by HIL upper management, to establish familiar, routine ALT use. This socially leverages ALT engagement in three ways. First, it defines how ALT is to be used by residents (checking in is for greeting and health reporting, while testing is for communicating and activating on request): this means residents do not have to decide its uses for themselves. Second, the activities offload resident responsibility for initiating contact; while they are required to use the equipment, they only need to respond. An effect of offloading may be to reduce the engagement need to manageable and acceptable levels. Third, ALT-mediated activities including checking in support habituation to the technology. Maureen, an upper manager (formerly a scheme manager), told us that this helped with 'preparatory engagement', promoting familiarity with the technology for times when incidents might occur.

Jane's implementation of checking-in at Shakespeare Croft depended on key judgments, in particular that residents opting out of checking in, reducing their only regular ALT engagement requirement to testing, was acceptable; and that those who did use ALT more broadly, including for checking in, were engaging sufficiently. While Jane was generally satisfied on both these issues, our observational work at Shakespeare Croft included sitting in on support plan reviews which expanded on pre-defined questions to address issues of health and ALT engagement (reported on in detail in the next section). Thus, the

shaping of contact around ALT is a matter of skilled scheme manager judgment over and above the generic implementation of HIL-imposed duties.

However, at other schemes with older residents, higher health risks and a more urgent potential need to use ALT, the decisions seen at Shakespeare Croft could not so confidently be made. At Fratton View and Godiva Court, there were different decisions on the framework for interaction, made in order to increase the amount of contact and maximise opportunities for social leveraging of ALT engagement.

The call logging study showed a much higher incidence of unwell calls at Godiva Court than at other schemes. David confirmed that these were checking in calls, but felt that the 'unwell' descriptor was most appropriate: he regarded many of his clients as having ongoing health issues. In contrast, the call logging study showed that there were no unwell calls at Fratton View. This did not mean, however, that people were not unwell at the scheme. Moira said:

> M There are some, some of the very elderly ones, or if they're not very well, then I do tend to go in there every day, just to make sure they're OK.

In contrast to Jane at Shakespeare Croft, Moira felt that ALT-mediated checking-in was not necessarily sufficient in terms of 'looking after' residents:

> M There are some that I feel I need to keep an eye on more closely […]. I can understand that my role has to be that the system is the main thing here […], but I also feel still that my main role is to look after the residents, if I have concerns about them.

Moira therefore supplemented ALT-based checking-in with personal visiting. David went further, making personal visits to some residents who had opted out of contact, saying 'they'll usually see me'. Checking in at both Fratton View and Godiva Court, therefore, tended to be seen as one point of contact on health, where others were also needed in view of greater resident risk and potential urgency.

Social leveraging: individuated interaction

The first phase of social leveraging puts in place a framework for interaction between scheme managers and residents, including ALT-mediated contact which promotes use through routinisation, offloading and habituation. The character and extent of this framework depends on scheme manager judgment. Within the framework, scheme managers then respond to residents' specific ALT engagement needs in tailored, individuated ways: the second phase of social leveraging.

Addressing resistance

One ALT engagement issue of frequent concern for scheme managers is residents not wearing their pendants, since this can lead to emergencies which are not notified. This can be due to resident resistance. Personal visiting was a means of both checking on pendant wearing (which cannot be seen through ALT-mediated checking-in or testing), and working with residents to attempt to address resistance.

Ian, a resident at Godiva Court, kept his pendant in a bowl on a coffee table near his armchair (see Figure 2, Cell 8). He said this was because he could set it off accidentally by hitting the door frame if worn on his wrist. David explained to Ian that this was not a concern for HIL's service, and that he would be happier for Ian to wear it. While David had been unable to change Ian's behaviour, he

was concerned to address it by raising the need to wear the pendant whenever he saw Ian, including provide reassurance on 'false alarms'.

Figure 2: Residents and pendants at time of visit

Rebecca, also at Godiva Court, kept her pendant on the curtain tieback hook, again near her armchair. Before the photograph (Figure 2, Cell 10) was taken, Rebecca had to search for the pendant, which was beneath the other items shown and not readily accessible. Rebecca said: 'It shouldn't be there I know. But I know where it is', realising that her pendant was not where it 'should' be. Unlike Ian, she did not offer a justification. Rebecca had a skin condition resulting in baldness; she wore hats and seemed uncomfortable to see the two visitors (the researcher and the scheme manager). David explained that she was self-conscious and this tended to keep her in the flat; if someone responded to a pendant call it could mean revealing her appearance. David said:

> D It upsets her that I've seen her bald […]. I am going to start pressing her, to be a bit more conscious. I mean, it's just a waste of money... to have it on your wrist, it makes it so easy.

Both Ian and Rebecca were able to explain how to use the pendant, but chose not to wear it. David persisted with visits to communicate the importance of this, adapting his treatment of each according to his perception of the source of resistance.

However, it cannot necessarily be concluded that because someone *is* wearing a pendant, they are engaging as the provider might wish. Sheila, a resident at Godiva Court, had muscular dystrophy and used a walking frame and a scooter. She was determined to walk for periods during the day, despite pain, and had had frequent falls, some serious. Sheila was wearing her pendant at the time of our visit (see Figure 2, Cell 6), and could explain what it was for and how to use it, but played down the seriousness of her falls. There was a contrast between Sheila's own account of these, and David's experience. David said:

> D You see Sheila is massively reliant on that pendant. She may not be using it but she's cut her head open, she's gone down here, you know, she goes down quite regularly. I've seen her go down quite a few times, where I've thought this is it, this is the ambulance boys now.

Despite this, when asked if she had ever had to use the pendant, Sheila said that she hadn't. This was responded to by David who reminded her of various occasions. Sheila then explained that while she sometimes falls, this is not necessarily serious:

> S Yes, I have fallen and hurt myself but mostly what I tend to do is slither down to the ground [...]. I wouldn't use [the pendant] unless I hurt myself or I couldn't stand myself up […]. I mean, I have been helped to recover from falls but I do tend to be determined, don't I David?
>
> D I'm afraid you do, Yeah.

Sheila's desire for independence and control had led to a preference for self-help rather than activation of the pendant. There appeared to be some minimizing of the seriousness and extent of falls. This suggests that while Sheila was wearing the pendant, she may have been underusing it.

Reminding and reinforcing

While many residents do not resist ALT use, an ongoing activity for scheme managers is reminding residents to use it, and reinforcing this. As we saw earlier, at the time of our observational work there had been a death at Godiva Court. David called a scheme-wide meeting to discuss this, and to communicate the importance of wearing the pendant. He commented:

> D I'm saying to them, if you go to the loo, then you need to remember to take it with you… Doing the maximum you can to reinforce the pendant wearing if you can.

This meeting had clearly had an effect, as the following vignette shows (R = Researcher [the author]; B = Beatrice, a Godiva Court resident; see Figure 2, Cell 9):

> R Do you always wear it on your wrist?
>
> B I always have mine on. There's a lady here, she didn't have hers on, and she was taken ill. Lay on the floor, this is just in the last few weeks, isn't it? If she'd had it on she could have pressed it; she could have had some assistance, couldn't she. I never take mine off, unless it's to wash.

R Do you wear it in bed?

B Yes, I wear it in bed as well.

This example shows the importance of David's reinforcing the need to use ALT. Despite not being able to recall how long she had had the pendant, or whether she had used it, Beatrice wore it, understood its importance, and was able to explain how to use it. Edna and Bridie (see Figure 2, Cells 4 and 7) were two other residents at Godiva Court who were also aware of these key issues despite some confusion; neither could remember whether they had used it, but Edna said that 'everything is explained to me'. These three examples are of residents who appeared to have accepted pendants and are ready to use them, but need reminding and reinforcement on an ongoing basis, particularly to mitigate forgetfulness.

During a face-to-face check-in with Sian at Fratton View, Moira checked how she was feeling after a recent fall and a hospital visit, noting that she looked better. Sian was wearing her pendant around her neck (see Figure 2, Cell 3). After leaving Sian's flat, Moira said:

M She does tend to fall quite regularly. Sometimes she has the pendant on and sometimes she hasn't. It's to do with her memory issues.

Moira later carried out a support plan review with Sian who, during the visit, was again wearing her pendant. The formal review questions on ALT are limited to whether tests are regularly carried out, but Moira was keen to use the occasion to reinforce the use of the pendant, as well as pull cords:

M And if you felt poorly you'd press that wouldn't you?

S Yes usually, I get told off by Angela [Sian's daughter] because I don't -

M Well yeah, because if you don't -

S I don't like to bother people -

M Yes but -

S But if I think I can get over it, I think well why bother anybody if I can get over it. If I'm really ill fair enough, I would press it, you know.

Moira discounted Sian's objection that she does not want to bother people:

M Yeah but we have had an incident didn't we, where you fell over.

S That's right. Yes I did.

M Right by your pull cord and you didn't pull it.

S No, I know [makes 'Cuh' sound of disbelief].

M You won't do that again will you?

S No I won't, No, No.

At the end of the review, Moira asked for a commitment as part of the signed support review:

M I've just written on there Sian that you have had a couple of falls recently but you are going to make sure you wear your pendant or pull your cord if you've got any problems.

S Oh Yes, Yes I will.

This example shows how scheme managers exercise judgment not only in terms of how much contact with residents is necessary, but how specific contact is shaped in terms of their priorities in response to resident needs.

At Godiva Court, Barbara was wearing her pendant (see Figure 2, Cell 5), and showed good understanding of what it was for, but this appeared to have been

the result of David's cajoling, and even challenging, her. At the time of the research, Barbara had been a resident for 7 months, and appeared to have high awareness of the use and value of the pendant, as well as of alternative sources of assistance (R = researcher):

> B Well, I haven't needed it yet. Well I always wear it on my wrist, or at night-time I take it to bed, er, you know, I take it off and put it on the bedside, so I can reach it, as near as possible.
>
> R If something did happen, what would you do?
>
> B The first thing I'd think of is to go for this, to press it you know, if I couldn't get out of bed, it's all recording what happens, or if you fall, or fall out of bed, you might not be able to get up. so I should think, either try and crawl to this, well it's right at the bedside, and er, try and get it as quick as possible, otherwise there's the help outside, isn't there, in the passage in the hall.

David suggested that Barbara's engagement with the pendant was at least partly due to his efforts:

> D Barbara's started wearing it. Because I said to her, we're coming up to the Christmas period, I've noticed that you're just sticking that anywhere. She said Well I take it round with me; I said Yes I know Barbara but forgive me you're not a strong person, you're not physically strong; I think you should get into the habit, when you get out of bed, put it on.

Allowing autonomy

Residents' not wearing their pendants led to efforts by scheme managers to change the behaviour. However, there were cases which raised questions for scheme managers about whether it was acceptable for residents *not* to be wearing pendants and, relatedly, how much independence should be permitted.

Like Moira, Jane, the scheme manager at Shakespeare Croft, spent part of the two days of our observations doing support plan reviews. Polly and Hugh were a couple in their 80s. Hugh had had a stroke and had multiple health issues including high blood pressure and angina, and Polly was his carer, who helped administer her husband's drug regime and looked after his personal hygiene including showering. Jane established that Hugh was 'giddy', and had fallen in the bathroom, as well as the living room. While she was aware of the latter (which had resulted in a paramedic visit) the former was not known to her. This prompted Jane to ask about ALT: no pendant could be seen at the time of the visit. Jane asked Polly whether she remembered to wear the pendant, to which Polly responded 'No, we don't need to, we never go out'. This response is difficult to interpret, but it may be that Polly was confusing the pendant with a mobile phone. Jane advised that the pendant needed to be worn to notify of any problem including further falls; she also recommended that Hugh and Polly 'have someone in to shower', i.e. a bought-in carer. Polly's response was that she wished to continue without additional care 'as long as I am able'.

This visit shows that the promotion of support, including ALT, needs to be balanced with older people's wish to remain independent and manage their own lives. A frequent challenge for scheme managers is to make a judgment on the question of how much independence, and what type, independent living services should entail. Despite memory and health issues, Polly was able to engage in complex health arrangements and regimes which were largely self-managed. While Jane's approach and demeanour reflected her respect for this, she said, 'I wish you'd access some help, there is so much out there'. As with other scheme managers, Jane brought skilled judgments to bear, relating her advice on ALT to

Polly and Hugh's immediate needs and risks, and shaping contact beyond the predefined in response to her priorities.

Bob and Charlotte were a couple who shared a flat at Willow Court, with a single pendant between them. Charlotte, like Polly at Shakespeare Croft, was her husband's carer; and like Polly and Hugh, this couple were concerned to manage the arrangement independently. Neither was wearing the pendant at the time of the visit; it was placed in a key safe near their front door (see Figure 2, Cell 12). The discussion focussed on Bob and the implication was that Charlotte felt that she did not need the pendant. The value of the device (which had never been used for any emergency purpose) was the security it gave her regarding Bob, rather than herself:

C I think the pendant gives me security if Bob's not well; and I've got to go out, I know he's got it there [B: Yeah] if he needs it. Like I would be more on edge if there was nothing like that, if I had to go out.

Bob told us that when Charlotte went out, he put the pendant on a table which was easily accessible:

B I'm sitting right by the table, to get the light, so if anything happens I just bang it.

This interview suggested a carefully thought out arrangement of pendant use which whilst not being worn works in terms of Bob and Charlotte's needs and living arrangements. The scheme manager, Julie, had no comment to make regarding pendant use by either client. In particular, whilst the review revealed Charlotte's own health issues the implication was that she did not personally see a need for, or necessarily use, the pendant; but that this was a matter for themselves.

Selective response

Scheme managers treat residents in individuated ways depending on the type of resident, and the scheme manager's judgment of their needs. We have seen examples of dealing with resistance, reminding and reinforcing, and allowing autonomy: each type of response depends on a judgment about what the issue is in terms of ALT engagement. However, in many cases it was not necessary for scheme managers to do any of these things, as residents were already engaging with ALT.

Thus, while Moira used one support plan review to get a commitment from Sian on wearing of her pendant (reported above), at two other reviews ALT engagement was not a focus. During Moira's visit to Doreen, it was noted she was wearing the pendant (see Figure 2, Cell 2), and Moira's only question was the standard one from the review concerning whether the resident tests of pendant and pull cord were taking place. Otherwise, ALT was not mentioned. When asked why she had not focussed on ALT, Moira explained:

M Well, I don't need to necessarily, I mean I do with the younger ones suggest that they wear it but they don't like it, and some of the older ones that have got memory problems, you have to keep reminding them obviously.

Thus, Moira made decisions about who needed reminding and who could be left alone. During the other review, it was not immediately obvious where Aileen's pendant was and Moira asked, 'where's your pendant?'. Aileen then showed her wrist, where it was being worn (see Figure 2, Cell 1). The researcher (the author) asked if she always wore it on her wrist. Aileen said, 'Yes, I even sleep with it'. In response to the question, 'Have you ever had to use it?', Aileen said:

> M   Yes, I did. I tripped over the telephone wire. It was about 11 O'clock at night I think it was and the young man came out. They said something about an ambulance, I said 'I don't want an ambulance, I just want a strong man to lift me up', and I got one!

Moira confirmed that Aileen had had two hip replacements and was not currently prone to falls.

One important reason why scheme managers may feel there is no need to raise ALT engagement with residents is that residents have realized their need. Aileen was an example of someone who had accepted ALT use such that Moira did not need to reinforce it; and of someone who was also ready for remote services, having contacted the call centre outside scheme manager hours.

Hilda was wearing her pendant at the time of a support plan review at Willow Court (see Figure 2, Cell 11). She had a clear insight into its value for her own life, indicating that it was essential for her as she was prone to falls. Like Sheila at Godiva Court, she used both a walking frame and a scooter. Hilda said:

> H   Well, if I have a fall or I don't feel well I use it then, but when I came out of [hospital], before these [indicates drugs], I used to fall every day. The thing is I try and get somewhere, but I can't put any pressure on that arm. That's what does it. If I could, I'd get up myself.

This contrasts with Sheila: Hilda simply reported that she had falls without minimization. As with Moira's visit to Doreen, Julie, the scheme manager, did not feel it necessary to discuss ALT, judging that there was no need. These examples give scheme managers confidence that ALT engagement is in place and there is a reduced need to promote it.

Discussion and Conclusion

Engagement with ALT has been seen as an issue of design, including aesthetics; as a user characteristics issue; as an issue of needing to take account of the lived experience of users; and as a question of appropriate design of technology for supporting the relationship between users and service providers. Our work, building on existing research from ethnographically-informed and sociotechnical perspectives, shows that while social relationships between users and providers need to be supported in particular ways by ALT, the importance of the relationship goes further: it is itself a means of bringing about user engagement. Thus, in addition to other acknowledged dimensions of user engagement, *social leveraging* is key. We now discuss the implications of social leveraging for the design of independent living services, particularly in terms of human resourcing, and for the design of ALT.

The scheme manager role has been recognised as valuable for reasons of personal presence and human contact which can enhance quality of life (see e.g. Help The Aged, 2009). However, our research shows that its importance goes further: it is substantive for securing ALT engagement. This depends on a number of characteristics, many of which are personal: the ability to get to know people, respect them, make skilled judgments, and engage in skilled social practices, are all crucial. However other characteristics are to do with how the role is organised and structured within the service. In particular, presence needs not only to be personal, but also persistent (i.e., the scheme manager is the same person over time). The *persistent personal presence* of scheme managers is essential for social leveraging of ALT engagement, for two reasons: (1) it generates the scheme manager knowledge of residents on which judgments

about sufficient contact and individuated interaction depends; and (2) it provides residents with a *known agent.*

The fact that an agent representing the independent living service is known to the resident over time is important for ALT user engagement in and of itself. Our findings show that impersonal agencies are less likely to be engaged with: there are two examples from this research of residents who lay in distress at night rather than using their pendants or pulling a pull cord. It could be objected that they did so because they were expecting the scheme manager to attend in person or call; without this expectation, perhaps these residents would have used their pendants. However, it seems unlikely that the events occurred due to practices related to social leveraging. The frequently-given reason for non-use, 'not wanting to be a bother', was only ever expressed in relation to the remote service. This suggests reluctance to use ALT when scheme managers are offsite is not necessarily due to inability or resistance, but to having to deal with someone the resident does not know. Moira at Fratton View said:

> M My main problem is trying to make the residents understand that if they've got a problem, they can pull the cord, because these people are just waiting for their call. The thing I get said to me is 'Well I didn't feel well during the night but I didn't pull the cord because I don't want to bother anybody'. And I say 'Don't worry about it, that's what they're there for'. That seems to be that generation I think, they just don't like to bother people.

Thus, social leveraging depends not only on a range of scheme manager skills, but also on their familiarity to residents. Because they are known, residents have fewer qualms about 'bothering' them.

This discussion of scheme manager characteristics has implications both for the design of independent living services, and for how people other than scheme managers could socially leverage ALT user engagement: informal carers, including partners and family, and remote agents at call centres. Earlier in this paper, we saw how two partners supported their husbands. Charlotte had agreed the arrangement of pendant use with Bob, making judgments about his needs. Polly told us that since his stroke, she had encouraged Hugh to use bottles and trays to remove the need to walk to the bathroom, risking falls. These both show awareness of the context of ALT use, although neither appeared to promote use of ALT in as active a way as scheme managers such as David. This implies that it is important for informal carers to understand the value of ALT, as well as how it works, sufficiently well to promote it. Scheme managers know informal carers (who may live at schemes) and may be able to provide direction on this.

Indirect social leveraging (scheme managers supporting informal caregivers to do this) is an example of an implication for the organisation of independent living services once the value and significance of the scheme manager role is seen. The major implication is that since the presence of scheme managers is substantive for social leveraging, independent living services need to be organised in order to preserve the role. However, the pressure is to reduce staffing, and, currently, the role is part-time, complemented by the remote, call-centre based service. A further potential model being discussed by HIL at the time of the research was 'floating support' whereby one scheme manager covers several schemes in rotation. The implication of our work is that whatever the form of service – onsite, floating, or remote – social processes need to be recognised and social leveraging supported. As we have seen, a known agent is important for securing resident ALT engagement. Floating support needs to provide sufficient time for personal relationships to be built so that social

leveraging can take place. The implications for remote services are more extensive. Rather than call-centre hot-desking, operatives could be matched to residents, since the familiarity of an agent may help secure engagement when scheme managers are offsite. In support of this, checking in and testing could be carried out by remote services. While these services, of their nature, cannot function as proactively as scheme managers in terms of social leveraging, the disjunct between the two models could be reduced.

While providers including HIL seek oversight on the uses and value of ALT for their services, our research suggests that there needs to be parallel oversight into social practices which support ALT engagement. There were differences in scheme managers' approaches to running schemes of the same type. Thus, an important issue for the design of independent living services may be to attempt to identify what capacities and practices should be looked for in scheme managers, and to consider whether and how these could be put in place in consistent ways. This could help providers to develop models of best practice, and enhance training; and also to reconsider the roles of remote staff and informal carers.

However, keeping scheme managers in place, making changes to the organisation and staffing of remote services, and putting in place oversight, all represent costs at a time when the sector needs to realize efficiencies. It can also be argued that it is not merited: there is only a need for social leveraging given ALT which requires active user engagement. More advanced future ALT featuring intelligent sensing and lifestyle assurance would remove the need for users to interact directly with or control the technology, making social leveraging unnecessary. At the same time, even if ALT persists in its current form, issues with engagement could be seen as generational, and therefore temporary: future generations who have grown up with advanced computing technologies might accept ALT more readily.

However, our findings show that many sources of resistance are not to do with familiarity with technology, but with admission of need, consistency with self-image, and decisions on autonomy. These issues are independent of technology design. While advanced sensing solutions may do away with the need for direct interaction and user control, they will continue to require the acceptance of users, as well as consent to continuous monitoring and data collection; and the independent living services organised around them will continue to involve a duty of care in terms of advising and supporting appropriately. Thus, generational and technology maturity issues do not obviate the need for social leveraging, although they may attenuate it and change its specific form. This implies that the costing of independent living services needs to take into account an ongoing need for human resource.

The sociotechnical perspective has been important for technology integration and adaptation elsewhere in HCI, including domains where older people are stakeholders: it has been brought to bear in the design of technology for older people in domains including health, communication, and work. In each of these domains the approach has helped to elucidate how social processes should inform design. As we have seen, healthcare technologies such as pill dispensers and medical records need to be designed around older people's current understandings and expectations concerning the social relationships these technologies are intended to support (see e.g. Palen and Aalokke, 2006; Greenhalgh et al, 2010). For the design of communications, lack of familiarity with computing technology as well as problems of social isolation have both been

acknowledged as issues not only for usability and the design of interface metaphors but also how such technology needs be designed around close understandings of social isolation in order to mitigate it (see e.g. Bagnall *et al*, 2006; Waycott *et al*, 2013). Other sociotechnical design research focussing on the older workforce has shown how the design of new technologies needs to be considered alongside job design and work organization in light of the needs and characteristics of the demographic (see e.g. Hussain *et al*, 2014).

Thus, sociotechnical research has been valuable for informing the design of a range of technology for older adults. However, there is an outstanding need for this perspective to be applied to ALT. Our research shows that even the simplest, most basic ALT, such as pendants and pull cords, is surrounded by complex yet mundane social processes which influence user engagement. The design of ALT needs to be considered relative to an ongoing need for social leveraging to embed it in the lives of users and secure engagement by establishing its meaning and value. Future ALT promises complexity, but it needs to be sufficiently comprehensible to enable providers, informal carers, and others, to promote engagement by addressing user concerns around how it works, what it is for, why it should be valued, who is 'behind' the technology providing the services it mediates, and further potential issues including privacy and uses of data. This will apply not only to the types of schemes we have reported on, with greater or lesser presence of staff; but to 'ageing-in-place' settings where existing homes are adapted, services are bought in, and informal carers play an important role.

Our research shows that in addition to the acknowledged dimensions of ALT user engagement, there is another: *social leveraging*. This implies that there is an ongoing, substantive requirement for skilled human resource within independent living services and more broadly to steward and help ensure appropriate ALT user engagement, which, in its absence, may be much more difficult to secure.

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