Telecare acceptance as sticky entrapment: A realist review

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M.S. Berge. Telecare acceptance as sticky entrapment: A realist review. Gerontechnology 2016;15(2):98-108; doi:10.4017/gt.2016.15.2.023.00 **Background** Telecare is important in future governmental health and social plans. Telecare acceptance is one of the factors that appears to be vital for uptake and thus important to understand. Different technology acceptance models have been applied but judged to be insufficient in assessing telecare acceptance with older people. The purpose of this paper is to review and evaluate why the existing technology acceptance models fall short when applied to telecare and propose an improved approach for assessing telecare acceptance. **Methods** This is a realist review with iterative searches. Four search engines covering approximately 50 databases in health, social science and technology were used in each of the three stepwise searches. The searches started wide, funnelling down to pursue the interesting results that emerged. According to the realist approach, particular focus has been on context, and transparency is applied by explicitly documenting the reasons for decisions to enable readers to make their own judgments. **Results & Discussion** This literature review provides evidence for the shortcomings of the exciting technology acceptance models when used for assessing telecare acceptance. By applying entanglement theory on issues where technology assessment models have shown inadequate, new perspectives emerge. These perspectives are significant for users' acceptance of telecare, however not highlighted when using technology acceptance models. These perspectives include dealing with imagined situations, fear of not handling technology, the significance of contexts, and users' adjustments of technology to better suit their needs. The identification of these dependences and dependencies appear to be essential for assessing telecare acceptance, and previously not captured by technology acceptance models.

Keywords: telecare acceptance, entanglement theory, actor-network theory, older people

Telecare receives an increasing attention in governmental health and social plans[1], but the uptake of telecare is variable and often low[1]. The results from telecare studies differ substantially as some report that telecare appears to support older people to remain at home[2,3], while others show opposite results[4]. Previous research raises several questions about the slow uptake and identifies users' acceptance of telecare to be a key issue[5-8]. Studies report that various technology acceptance models fall short when used for assessing telecare acceptance[6,9]. This literature review seeks to identify and illuminate perspectives that may improve the understanding of *telecare* acceptance at the individual level.

The aim of this review is twofold; firstly to collect evidence from previous research and reviews about the usefulness of existing models in understanding telecare acceptance; secondly to identify a better approach to understanding telecare acceptance. This paper defines telecare acceptance as when the users experience their needs appropriately met by telecare.

Researching telecare within the social sciences includes being attentive to context, which research indicates to be important in telecare[10]. Context is defined by Pawson[11] to include the characteristics of (i) the individual actors, (ii) their interrelationships, (iii) the institutional location, and (iv) the surrounding infrastructure. This literature review follows the principles of Realist Review (RR)[12], which emphasises how different contexts influence outcomes and thus expects different outcomes as it recognises every situation as being unique despite similarities with others. The realist approach seeks in general to illuminate what works for whom in what context and may therefore give a more distinct answer to what needs attention in for example telecare acceptance.

There is wide disagreement in the literature concerning terms used for technology in health and social care. 'Telecare' is used in substantially different ways which makes it even more challenging to assess telecare acceptance due to ambiguity to what is actually assessed[13-15]. This paper uses the definition of telecare from the Department of Health (UK): "*Personal and environmental sensors in the home that enable people to remain safe and independent in their own home for longer. 24 hour monitoring ensures that, should an event occur, the information is acted upon immediately and the most appropriate response put in train*"[16]. Following this definition,

the technology concerns sensors that respond and summon attention when needed.

Tsai[10] and Chen et al.[7] emphasise that telecare should not be assessed isolated from the context in which it works. Telecare is often discussed in relation to older people, and thus many aspects relate to care in later life. Older people are generally positive about telecare[17] but are anxious they might be stigmatized particularly if it is noticeable to others and thus makes them stand out from their peers[18]. It may make apparent an individual's need for assistance, and appearance of being frail and unable to cope[19,20].

Reluctance appears to be a common reaction to using aids by older people even if they increase mobility and independence[21,22]. Technology is therefore recommended to be used before it is actually needed to avoid stigma[23]. Various reasons may underpin resistance to telecare, such as people not feeling old enough to really need it yet, which is a challenge for promoting preventative use[6]. This indicates that telecare has a social impact on people's lives, which needs addressing when considering acceptance.

The social impact might concern accepting support more generally, not the technology per se. However, using telecare also includes interaction with technology, which should not be ignored, as some adjustments in daily life might be required. Therefore, telecare acceptance might include different issues than technology acceptance. Various technology acceptance models exist. These are mainly focusing on the users' acceptance of information technology[24-26]. This paper proposes that there might be elements that are vital to accepting telecare that are not either present or important concerning technology acceptance.

The focus of this paper is on older people, and the intention is to apply the insights gained from the literature review to some examples to test out the emerging theory.

Methodology

There are different standards in doing literature reviews: Systematic Reviews (SR), Narrative Reviews (NR) and RR. They use different approaches and emphasise different aspects thus their applicability to various situations differs. This review draws on RR that follows the RAMESES[12] (Realist And MEta-narrative Evidence Synthesis: Evolving Standards) publication standard and the rationale for using RR will now be outlined.

The nature of RR is iterative and flexible. Thus, it is not compatible with the standard processes established for SR[27,28] or NR[29] that require answers to specific set questions. In contrast to their aims, RR tries to understand the contextual influences on whether, why and how interventions might work through illuminating issues that might provide explanations. RR's iterative approach entails stepwise literature searches building on the findings from the previous search. Transparency in RR is delivered by explicitly documenting the judgements and inferences made throughout the review to allow readers to interpret the findings and make their own judgements[12]. Implementing telecare in health and care services is a complex intervention, as it produces different outcomes in different contexts[10,30]. When the context changes, the mechanisms (people, things, knowledge etc.) that are active in the intervention are affected and this produces intended and unintended outcomes. Thus, an intervention working well in one context might not succeed in another.

In a realist approach, Context, Mechanisms and Outcome (CMO) are imperative to understand why a complex intervention succeeds or fails. Both the intended and the unintended outcomes are important as they provide useful information about the intervention. Since everyone interacts individually with the technology but not isolated from the context, understanding the context is essential[30,31]. The approach in SR and NR often causes the contexts and mechanisms to be concealed, thus the essential information searched for in a realist approach will be missing[32,33]. In RR different outcomes are equally important as the mechanisms and outcomes provide vital information as to why a programme succeeds or fails[34].

As the intention is to pursue the essential perspectives that are lacking in technology acceptance models when used in assessing telecare acceptance, and, as these perspectives are associated with impact from different social contexts and technology, differences in context are expected to offer essential information. Therefore, RR offers better perspectives for finding answers to the questions raised in this paper.

Literature search

Search strategy

Following the principles of RR, this review is iterative; starting with an initial search based on initial knowledge of previously used approaches in assessing telecare, the Technology Acceptance Model (TAM) and Actor-Network Theory (ANT), and seeking to find other models that are used. TAM was included because it is widely used in assessing telecare acceptance, despite arguments that it is insufficient regarding the complexity in telecare[6]. ANT was included because it deals with both complexity and the social theory of technology[35]. As the aim was to as-

sess the usefulness of these models in relation to telecare acceptance, it was necessary to explore how telecare acceptance differs from technology acceptance. The only limit to all searches was that they were peer-reviewed papers in English.

A second search aimed to expand the initial search, focusing on ANT in relation to older people's possibilities of remaining at home and on possible shortcomings. By exploring ANT further, it was recognised how it too ignored so far overlooked perspectives. Previous knowledge of Entanglement Theory (ET), indicated it having potentials in understanding telecare acceptance. The second search gave no additional inclusions, but led to the third search that aimed to explore ET's suitability further and look for previous experiences regarding telecare acceptance.

Four search engines covering approximately 50 relevant databases were consulted (*Table 1*), Web of Science (WoS), ASSIA, Scopus and Engineering Village (EV). As telecare is at the crossroads of health, social and engineering topics, the databases had to cover these disciplines. Two articles were included using a snowball approach (*Figure 1*). The searches indicated ANT rarely being used in relation to telecare. Weekly alerts to include new publications gave no additional inclusions. WoS and Scopus had very similar hits resulting in a huge quantity of duplicates while EV gave very few hits except where 'technology' was the only search term.

The lack of unified definitions of terms describing technology in health and care services presented challenges[13-15]. Therefore, a variety of key words was necessary to cover relevant literature and the papers were thoroughly checked to identify the relevance of the technology used. This paper defines telecare differently from Huang[36], where telecare is used for technology monitoring remote patients' medical condition at home, and Correa et al.[37], who discuss social alarms. When assessing acceptance of telecare it is important to clarify the term in order to recognize the elements involved (humans, things etc.), and their expected interaction, to understand what actually happens.

Paper selection and appraisal

The initial search resulted in 322 papers, 152 remained after removing duplicates using EndNote. The remaining titles were screened for any indication of the papers addressing ANT and/or technology acceptance related to technology in health and care, not just telecare, due to the inconsistent use of terms. Leaving 48 abstracts to be read and assessed aiming to find ANT, and/or technology acceptance models associated with supporting independent living. Situations that resembled telecare contexts and included ANT or models for technology acceptance were also included.

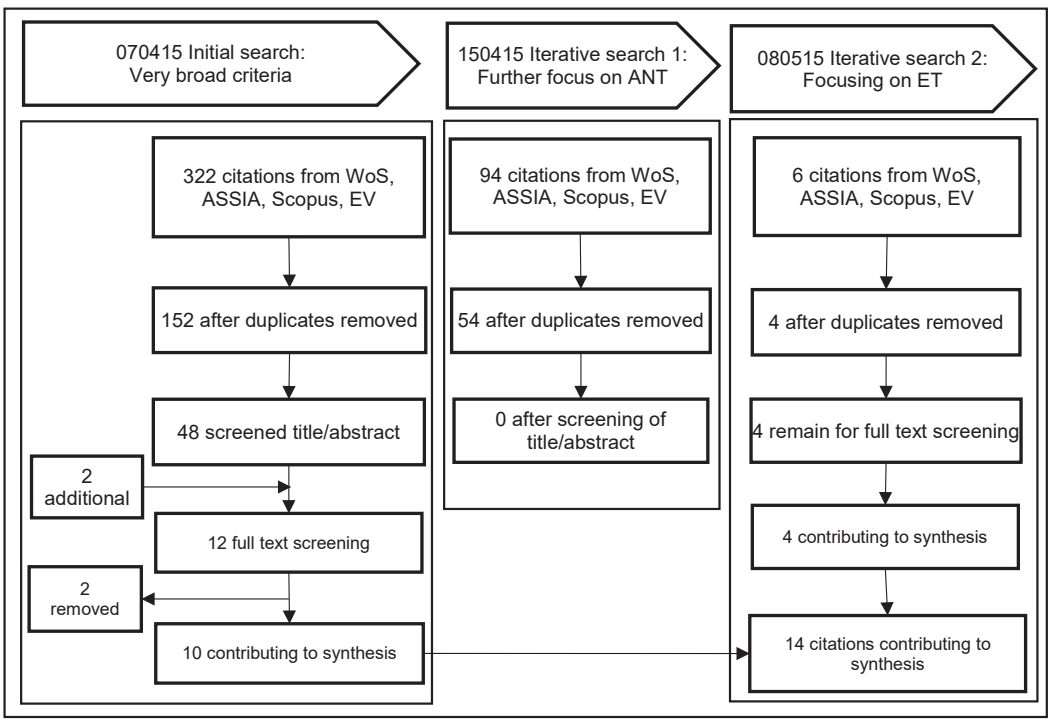

Figure 1. Flow diagram illustrating search process[14]

Table 1. Overview of the searches; ANT=Actor-Network Theory; TAM=Technology Acceptance Model; ET=Entanglement Theory

Search criterion			Searched data base: WoS, All databases	ASSIA, 24 databases	Scopus	Engineering Village
Initial search: April 7, 2015						
ANT AND	telecare		1	1	1	0
	telehealth		0	0	1	0
	(smart house OR smart home)		0	0	1	0
	community care		1	1	2	0
	independent living		0	0	0	0
	assistive technology		1	1	2	0
	technology adoption		10	16	0	0
	user acceptance		1	3	1	0
	TAM		3	6	2	1
	quality of experience		0	0	0	0
Telecare AND	technology adoption		1	5	0	0
	user acceptance		12	24	3	0
	TAM		6	13	8	4
	quality of experience		0	1	0	0
Independent living AND	technology adoption		2	4	0	0
	user acceptance		8	7	10	0
	TAM		0	0	0	0
	quality of experience		0	2	0	0
ANT AND Technology AND care			26	74	36	20
Sums (322 in total)			**72**	**158**	**67**	**25**
Iterative search 1: April 15, 2015						
ANT AND	old person		0	1	0	0
	home		13	51	29	0
Sums (94 in total)			**13**	**52**	**29**	**0**
Iterative search 2: May 8, 2015						
Archeology AND ET			1	3	2	0
ET AND	telecare		0	0	0	0
	technology acceptance		0	0	0	0
Sums (6 in total)			**1**	**3**	**2**	**0**

Special attention was paid to information about context and mechanisms that affected the outcome. The initial search funnelled down to 10 papers being included. One further item was included from a reference list, and another suggested when retrieving a pdf from a web side. After reading the papers in full text, they were categorized in three; (i) 6 papers providing evidence regarding the inadequacies of TAM and Health Technology Assessment (HTA) when applied to telecare; (ii) 4 papers showing necessary aspects to consider when assessing technology acceptance for older people; and (iii) 2 papers excluded due to irrelevance.

To be included, discussion of the inadequacy of TAM and HTA in telecare had to relate to home settings, as the aim was to learn what affects telecare acceptance for older people wanting to remain at home. Literature in category (ii) was included even if it described hospital settings, work situations and administrative technology, if it contained information about mechanisms and/or context that affected the outcome, understanding telecare acceptance.

Results

Perspectives on telecare acceptance

Some existing perspectives on technology acceptance models are presented and their applicability in relation to telecare critiqued. Then a new approach to investigating telecare acceptance is presented. The literature showed that existing research on telecare acceptance includes HTA and the widely used and frequently modified TAM. Both approaches are developed for assessing acceptance of different technology in other surroundings and reveal key limitations when applied to telecare.

Health Technology Assessment

HTA is defined by WHO[26] to be the systematic evaluation of effects of health technology to inform policy decision making. Health technology is defined very broadly as: *"the application of organized knowledge and skills in the form of medicines, medical devices, vaccines, procedures and systems developed to solve a health problem and improve quality of life"*[26].

The definition itself indicates that HTA is not directed towards assessing the acceptance of tel-

ecare. HTA is used for assessing patients' acceptance of technology, however, critiqued because it appears to assume that the different effects of health technology may be studied objectively and context-free[9]. Koivisto et al.[9] argue, on the contrary, that the context is important in assessing user acceptance of more complex technologies. HTA is assessed to be the least relevant model, and will not be discussed further in this paper.

Technology Acceptance Model

TAM is a validated model measuring, amongst other things, perceived usefulness and perceived ease of use, which are demonstrated to be vital for users' acceptance of technology[24]. TAM is developed for measuring acceptance of software applications and computers for people in work-related settings. Acceptance is related to the system being operational and used, so people experience improved job performance when using technology. TAM is developed further (TAM2 and TAM3) to increase usability of various new technology interventions[25]. It is perhaps the most frequently used model in assessing telecare acceptance[7,36]. However, a work-related context with computers is different from a home with telecare installed to support independent living.

TAM is suggested to be insufficient in assessing telecare acceptance and additional variables are suggested, especially when used with older people[7]. Chen et al.[7] have reviewed empirical studies, worldwide, on technology acceptance with older people, using TAM or related models. The studies included a variety of technologies related to domestic matters. The 19 included studies were heterogeneous in methods, sampling of target groups, age (range 18-94 years) and experience in using of technology. They conclude that TAM is useful, however, suggest including biophysical and psychosocial variables to better understand what affects older adult's acceptance of technology as TAM does not cover this. They also critique TAM for excluding contexts.

Tsai[10] supports the need for adding personal, contextual and social factors to TAM when assessing telecare acceptance with older people. This support emerge from his study in Taiwan where TAM was integrated with social capital theory and cognitive theory, focusing on how different interacting factors affected users acceptance. TAM used alone did not reveal the factors that appeared significant for acceptance[10].

Bouwhuis at al.[6] refer to a broad range of evaluations of telecare projects in the Netherlands analysed by using TAM. They emphasise the huge variety of expectations from the heterogeneous users having telecare installed. They define telecare broadly and include a range of technologies. Bouwhuis et al.[8] found that the telecare systems were too complex for using TAM, as telecare had aspects that were difficult to observe and were thus not picked up: for example, users might adjust the systems to fit their needs better, causing reduced effect but improved acceptance. However, if the users did not find the technology helpful, they stopped using it. Bouwhuis at al.[6] consider the way TAM uses 'acceptance' to be ambiguous, as it is mainly observed when a system is installed and operational. They argue that telecare may be installed and operational without the user actually needing to interact with it, which is not picked up when using TAM.

Peek et al.[5] distinguish between the pre- and post-implementation stages in acceptance, which TAM does not differentiate. They argue for more qualitative research on the post-implementation stage to capture the complexity and timeline of telecare acceptance. The paper uses the expression 'technology for ageing in place', which covers a wide range of technologies. Peek et al.[5] illuminate different anxieties that older people have before they have technology installed. They emphasize the complexity of telecare and show how acceptance of telecare includes a variety of perspectives referred to by the older people. However, their study shows that if older people do not perceive the need for technology they most likely will not start using it.

Literature reveals limitations in TAM that include complexity[5,6], context[7,10], interactions between technology and user[6,10], and imagined and actual anxieties concerning technology use[5]. Several authors argue these areas as important for telecare acceptance and therefore necessary to address[5-7,9,10].

Actor-Network Theory

ANT catches the complexity in telecare settings, the different characteristics in users and technology and the impact of the relations between users and contexts. ANT recognises the relations between the different actors, human and non-human, constituting a network and believes the actors shape each other interdependently in the processes[38].

According to ANT, an actor is any element that makes a difference and causes changes that affect the other actors constituting the network[39]. Latour[40] suggests that imagining what would have to be done without the nonhuman actor will identify its role. In ANT it is vital that actors are not reduced by a priori definitions of their capacities as all actors constituting the network shape each other in the network[41]. When a net-

work functions as a unit, it is hard to discover the complicated network of actors: however, if it breaks down, all actors need to be scrutinized to expose the problem[38]. Given this understanding, it appears difficult to identify the actors that constitute a functioning network.

ANT was from its very inception meant to be a very crude method to learn from actors[41] and thus useful in contributing discovery of the unexpected and what is seldom looked for, as argued by Mol[42p262]: "*If ANT is a theory, then a theory helps to tell cases, draw contrasts, articulate silent layers. Turn questions upside down, focus on the unexpected, add to one's sensitivities, propose new terms, and shift stories from one context to another*".

Ballantyne[35] suggests ANT to be useful in analysing the complex processes in human and technology interactions because it is unique in recognizing their complex and entangled relationships: "*From the ANT perspective it is impossible to cleanly separate the influence of the technological from the social – they are entangled, and may be difficult to disentangle*"[35p112]. He found ANT seldom used with technology in health and care despite several studies drawing on aspects of its conceptual framework.

ANT has potential in assessing telecare acceptance. However, its key limitation lies in not addressing the actors acting on different contextual levels that interact, entangle, develop dependencies in each other and play different roles in different contexts. These are covered in ET, as will be demonstrated.

Entanglement Theory

ET is influenced by ANT, but Hodder[43] discusses the relation between humans and nonhumans further. ET was first described in physics in the mid-thirties[44], however, the concept is used differently by the archaeologist Hodder[43] in relation to social science. ET takes the perspective of things and addresses how relations are not as structured as the term 'network' indicates; thus 'entangle' captures that human and things entrap each other by their dependence and dependencies: "*We seem caught: humans and things are stuck to each other. Rather than focusing on the web as a network, we can see it as a sticky entrapment*"[45p25]. Hodder[45] argues that the relation between human and things (nonhumans) is asymmetrical and often leads to entrapments in particular pathways, which restrain both. He defines entanglement as: *"[H]uman depend on things (HT), things depend on other things (TT), things depend on humans (TH), and humans depend on humans (HH). Thus entanglement = (HT)+(TT)+(TH)+(HH). In this definition it is accepted that humans and things are relationally produced. But the focus on dependence rather than on relationality draws attention to the ways in which humans get entrapped in their relation with things. Humans get caught in a double bind, depending on things that depend on humans"*[45pp19-20].

There is an essential distinction between dependence and dependency, which together produces entanglement[43]. The former focuses on how things enable while the latter involves constraint that is often a result of the former. Humans are dependent on things or humans, which enable them, but similarly they develop dependencies that limit them[45]. When humans and things cannot manage without each other, they are entangled and in making effort to untangle, they can end up even more entangled: "*Entanglement as defined here is messy and highly contingent. It is very difficult to predict – because so highly interconnected in so many dimensions and directions, entanglement is also practical and everyday – dealing with real forces as much as imagined ones*"[43p182].

Entanglement concerns reality in specific unintentional ways that happen through complex interactions[46]. ET starts with the smallest things that make up the system, and humans are not at the centre of social change. Things have their own dependencies and interactions and enter into social change, which is especially noticeable when they fall apart. In being dependent on things, humans make much effort to fix them and through this falling apart and finding new solutions, social change moves forward[43].

Discussion

Previous research calls for a dynamic model to disentangle the complexity of telecare and relate it to the contexts in which it appears and affects the user, resulting in either being or not being accepted. The literature critiques TAM and HTA for being insufficient in assessing telecare acceptance, as important aspects are not covered[5-7,9,10]. Perceived ease of use and usefulness of technology are demonstrated to be important for user acceptance and use of *technology*, but not sufficient for understanding *telecare* acceptance[36,47-49]. To a certain extent perceived usefulness of technology does affect telecare acceptance[5,18,19], however, it is not sufficient.

Several studies show improved acceptance of telecare when people did not intend to use it themselves, as they did not identify with the user group[5,18]. Thus, the reliability of studies referring to telecare acceptance among those without

knowledge or experience in telecare or among people who are not in the target group may be questioned. Acceptance of telecare by the actual users is identified to be crucial for them to start using it[5]. Therefore, this paper introduces this definition: "*Telecare acceptance is when the users' experience their needs appropriately met by telecare*". Telecare is suggested to be better accepted when it is a common facility integrated in health and care services, which is also what users themselves have suggested provides a means to avoid standing out from their peers[18].

Considering the above perspectives, telecare acceptance includes more than just accepting the technology, as users indicate the social dimensions to be significant. Regarding telecare acceptance through ET lenses as 'a messy and sticky entanglement' may develop improved understanding. Scrutinizing the relations from the thing's perspective can help understanding how dependences and dependencies work. Hodder[43] emphasizes the difficulties of predicting and disentangling something that functions well.

ET has potential to illuminate significant perspectives in assessing *telecare* acceptance according to reviewed literature, which the *technology* acceptance models lack. To demonstrate this potential ET is applied to particular examples of telecare use.

The Real and the imagined

Steele et al.[3] refer to cases where older people express anxiety about not being in control over activation and deactivation of the technology and fear being a burden to others. Steele et al.[3] refer to different wireless sensor networks (WSN) that include a variety of sensors covering different environmental information. They showed the technological device to potential users, explained its function and asked them to discuss their concerns and likelihood of using it in focus groups consisting of users without any experience of using the technology.

Sensors in a WSN may be movement sensors adjusted to the user's movement pattern by personnel assessing their activity during day and night. The assessment is based upon information from the user, relatives and/or health care staff. The user receives information about how the technology functions and what happens in case of an alert. The person, for example a technician, who installs the movement sensor, configures it to match the user's activity. The described case includes a range of identified things, humans and forces, and there are likely to be some which are only identified if something does not work or if it breaks[43]. Using these sensors will not affect the user's performance in any way and the system is expected to function by alerting when the activity pattern deviates from what is defined as 'the normal' pattern. However, the entanglement is far more complicated as will be demonstrated, using Hodder's[43,45] annotations of interactions.

A small part of this entanglement may be like this: To adjust the movement sensor the staff must fill in the assessment form correctly (TH) based on the information given by the user, relatives and/or prior knowledge about the user (HH). The technician must configure the sensor correctly according to the form (TH). The movement sensor is dependent on the battery to function (TT); on being correctly configured (TH) and on the actual activity pattern (TH). The situation actually requires the user to follow the movement pattern outlined from the assessment (HH). However, the user cannot be expected to live like a pre-set machine, and this will affect the system's raising of alarms (TH) therefore the actual activity pattern is likely to differ occasionally from the reported activity pattern (HH). This is exactly what the users are afraid of (HT), and may cause them to change their activity pattern according to how the sensors are configured (HT). The situation indicated will be that the configuration of the sensor is dependent on the user's expressed activity pattern, which expects the user to follow the pre-set pattern to avoid setting off an alarm. If a sensor causes an alert (TT) because the configured activity pattern (TH) differs from the actual activity pattern (TH), a reconfiguration will be needed (TH). Humans will always seek to repair things which make them even more dependent[45].

The identification of the dependences and dependencies are in this case essential for being able to assess telecare acceptance, and are not previously highlighted by other acceptance models. The users as referred by Steele et al.[3] have not yet used the technology, thus their anxiety may or may not be real, but it still affects their behaviour towards the 'thing'.

Importance of context

The context affects the outcome in different ways as this issue from the RemoDem project will illustrate[50,51]. The Giraff is a mobile two-way video communication system, remotely operated and intended to facilitate communication between persons at a distance. Anyone can operate the Giraff from any computer using free software. The Giraff is on wheels, a camera shows the operator where to navigate the Giraff, and communication happens via broadband. The face of the remote operator is visible on the monitor on the Giraff[51]. Strictly speaking, this technology is not telecare as defined in this paper. However it is

on the borderline, and exemplifies some of the difficulties in using categories, and illustrates the importance of explaining which and why technology is under consideration.

The Giraff received negative publicity from media, claiming that robots would take over the care for people with dementia. This caused anxiety and prejudice which affected the carers and relatives' attitudes toward wanting to use it. However, the people with dementia appeared to like the Giraff as they smiled when they saw a familiar person appear on the monitor[50]. People with dementia responded to the Giraff as if it was the actual person they saw on the screen, not as a technological device[51]. The paid carers were hostile to the Giraff because they were afraid of losing their jobs[50]. However, when they experienced how the people with dementia welcomed the Giraff, they started to see new possibilities for improving care by making additional checks on the users[51]. One family wanted to trial the Giraff in the home of their relative with dementia. Three days later they asked for the Giraff to be removed as it bumped into the furniture[50].

There are different contexts in this issue; the abstract which is affected by opinions and expectations, and the concrete, represented by the home environment. To illustrate a piece of the entanglement: The family carer starts the Giraff (TH), which responds due to the batteries functioning (TT). Because the batteries are charged (TH), the camera provides information about the surroundings (TT) so the operator can navigate the Giraff (HT). The user has furnished the room to meet their requirements. When furniture blocks the way, the Giraff is dependent on a human to clear its way (TH) or it will not respond to the operator's requests (HT). Other unidentified persons might be involved, like a home help lacking information about the Giraff's requirement for space (HH). By using the Giraff for achieving assurance (HT) all elements constituting this possibility must function, resulting in an entanglement of dependences and dependencies.

The journalists reporting on their perceived idea (HH) of what tasks the Giraff is intended to undertake (TH) became part of the entanglement, as they are part of the context. The words journalists used to describe the technology were important, as they influenced people's perception (HH), and what people heard/read caused expectations that affected their attitude towards it (TH). People will hardly want to start using technology that scares them. They need to see its potential, and to be able to withdraw if it does not match their needs. Thus, media may play an important role in telecare acceptance. In these contexts different humans, things, real and imagined forces are entangled and interacting[43].

Adjusting to actual needs

Bouwhuis et al.[6] describe how older people's bathrooms were equipped with movement sensors that controlled the light. Two issues arose; if the person spent too much time on the toilet, the lack of movement switched the light off. The washing machine, often placed in the bathroom, caused the opposite situation when it was operating as its movements made the light switch on. This became a nuisance to people and many solved the problem by physically removing the lights from the bathroom. They put in floor lightning instead, which they could control themselves but this turned out to be a safety hazard.

The purpose of putting automatic lights in the bathroom was to avoid putting an electric switch in the humid room[6], and this is a solution often used to enhance older people's safety by reducing risks of falling due to darkness. Because the technology did not fit the actual needs, the achieved result was not improved safety but the opposite. First, the benefit to the users having the light on while using the bathroom was insufficient, as the timespan for the light to stay on was too short. Instead of a help, it was a drawback. The other drawback was the movements from the washing machine activating the light. Both issues were unintended effects of the technology, which lead to unauthorised changes causing more safety hazards than if authorised personnel had mounted a switch in the bathroom.

The timespan is configured (TH) based on information (HH), which causes the light to be activated by movement (TH)(TT). When the human movement does not occur, the pre-set time limit is exceeded and causes the light to go off (TH) (TT). The washing machine activated the light and turned it on (TT). If this is caused by where the movement sensor is situated (TH) it will be necessary to change its detection angles (TH) based on new information from the users (HH) and from the actual functioning of the sensor (HT). The timespan also needed adjustment (TH) based on updated information about the activity pattern (HH).

The technology was working but not according to the user's needs. It 'forced' them to keep waving while using the toilet, and 'stopped' them from using the washing machine, to work as intended, although these restraints were unintended. Hodder[46] argues that things cannot exist in the way humans want, without human intervention. However, things depend on humans and this dependence appears to shape human forms

of behaviour and adjust human behaviour resulting in turn in things regulating human behaviour. The telecare caused entanglement sticking to the user, as it required new visits from the installer. This would activate a range of interactions between the user and all the things, humans and forces involved in arranging and accomplishing the changes. As this did not accord with what the users' wanted, they sorted things out themselves, apparently perceiving themselves less entrapped in sticky dependencies, however still entrapped, as they had to act upon unintended situations. Neither of the technology acceptance models have dealt with the above, which is significant for telecare acceptance. Technological artefacts like telecare devices are not just technical objects; they have social effects and embody social ideas. The technology is part of a heterogeneous entanglement that relies on its consisting parts to enable some actions and constrain others.

Conclusion

Through this iterative literature review, this paper demonstrates the shortcomings of some technology acceptance models in assessing telecare, before introducing two new potential approaches, ANT and ET. The differences between these do not imply they are contradictory: however, by taking the arguments further, ET enables understanding in the shortcomings of technology acceptance models and why these are significant aspects of telecare acceptance. By applying ET to some situations from the literature, some of the gaps in understanding are demonstrated, and the potential in ET to deal with them.

Older people express that they want to manage themselves and stay independent[2]. They are afraid that using remedies like telecare may give the impression that they are in need of help and assistance[22], especially if they alert others unintentionally. These views affect the users' acceptance, whether they are real or imagined, thus hindering telecare use. ET points directly to how the entanglement is *"practical and everyday – dealing with real forces as much as imagined ones"*[43p182]. Because this is important for the users when they consider using telecare it must be understood by researchers. Neither of the other approaches capture this perspective.

Telecare is complex and the context matters, which few approaches manage to cover sufficiently[6,7,9,10]. Hodder[46] emphasizes how humans and things depend on each other since they are relationally constructed. The Giraff issue illuminates how humans and things play very different parts in making up the context. Humans and things relate to each other in ambiguous ways, and this needs special attention when assessing telecare acceptance. The Giraff issue illustrates how the context might be multi-dimensional, consisting of both abstract and concrete elements (for example opinions and furniture) that both affect telecare acceptance, albeit in different ways. ET is the only approach that illuminates this entanglement.

None of the technology acceptance models discusses how users adapt to technology and/or adjust it to fit their purpose better. This significant element needs highlighting using ET. By using ET, we are able to gain additional insights. Telecare involves unique actors and contexts in every new implementation, thus these are difficult to predict, and their entanglements are likely to be obscure. By retrospectively analysing situations using ET, opportunities might emerge to better understand where and what to focus on when planning telecare. By recognizing the complexity in telecare and acknowledging the variety of entangled human, things and forces, the evaluator may be more sensitive to the unexpected.

Acknowledgements

I am indebted to the Regional Research Centre for Western Norway which funded this telecare project and the Norwegian Nurses Organisation for their financial support. I wish to thank Alison Bowes and Louise McCabe for their comment. I also wish to thank the anonymous reviewers of the earlier version of this paper. The views expressed in this paper are the author's own.

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