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By capturing the imagination, creating a conversation, exploring landscapes of possibility design acts as a vehicle for talking about future possibilities that can accommodate different disciplines and outlooks. Informed by social scientific enquiry, design has the ability to engage with the visions of technologists to create ambient assisted living schemes that are not merely technically feasible, but also culturally desirable.

SIMON ROBERTS

Technology for the Future, Design for the Present? Reflections on the Ambient Assisted Living Technology Industry

This essay examines the emergence of a 'proto-industry' that is researching, designing, and building technology with a specific futures in mind. That future is one of a rapidly aging world in which technology plays a key role in supporting the needs and experiences of older people. This category of technologies is referred to as ambient assisted living technology,

and it often takes form of ubiquitous computing, or Ubicomp, created for a particular type of older 'user'. Despite the fact that this demographic aging is already a reality, and much of the technology required already exists, this industry typically frames its efforts in terms of a 'proximate future' (Bell and Dourish 2006). Such a future is always just around the corner or coming into view over the horizon. In this brave new world, new technological capabilities and interaction models will allow older people to achieve their goals through seamless, ubiquitous computing experiences. I suggest that this frame of a proximate future creates a focus on technology development and overshadows the importance of social and cultural practice in the development of appropriate technological interventions.

More importantly, given the significant investments made by national governments, commercial organizations, and EU bodies in such research and development activity, the 'proximate future' frame has arguably postponed the development of large-scale implementation of such technologies. While some technology has been deployed to support older people to live in their own homes, the gap between the projected size of the market (or the audacity of the vision) and current reality is very significant. This is a market, like the technologies themselves, whose future is always 'just around the corner'.

This chapter engages with the practices of a broad industry. It explores the technology-saturated vision of the 'ambient assisted living' sector and examines its current practical focus and rhetorical framing. It explores how design thinking and practice might be used to understand the current limitations of the approach being adopted. It makes the following key claims:

First, design thinking and practice are often lacking in aging technology development. Design thinking can bring people, and the messiness of everyday life, into this field,. This would create a set of constraints that directs attention to what is presently possible with existing technology.a Second, engaging with design practice would force an engagement with the present, not technology visions of the future. One strength of design thinking is its ability to force an appreciation of the networks of things and people – systems – in which technologies tend to emerge. Design thinking works with the competencies, infrastructure, resources, and cultural practices that currently exist. It works with the present to advance towards the future.

Simply stated, I propose that by engaging with the present, through design thinking and practice, the desired 'ambient assisted living' future is more likely to take shape than by focusing on this future and looking beyond the present. Design thinking and practice certainly is no panacea, but it can help check the stridency of technology visions. It has the potential to give to people, the proposed users, a more equal voice in the creation of a technologically augmented future.

The proximate future of ambient assisted living technologies

There is much activity in technology development in the R&D [research and development] labs of major corporations and academic institutions worldwide to address the challenges of an aging world. Significant funding has been committed to the promise that, on paper at least, this is a large and growing market.

The types of technology that are being conceived and developed are diverse. Much of it is designed to support independence in later life. Independence is defined as the ability to perform basic activities of daily living, such as personal care and household activities. At the heart of the concept of independence is the ability to remain community-dwelling. Technologies to support independence that are being developed include systems to detect and even predict falls, which are a major source of hospitalization and healthcare costs. Equally, devices are also being developed, which support social engagement at a time when decreasing mobility and shrinking social networks can impact on older people's independence. Other areas of activity include platforms that attend to cognition in the context of aging, including reminder systems (e.g. for medication), 'brain training', and other cognitive prosthetics in the context of increasing incidence of Alzheimer's disease.

Some of these technologies are already available commercially; others exist as ideas ready to undergo 'proof of concept' testing. Many have been proved out but never implemented beyond small-scale pilots or trials. They also range in terms of their complexity from simple stand alone devices to complete systems or networks of connected technologies. At the more complex end of the scale, these technologies are expressions of the Ubicomp vision. Ubicomp refers to a post-desktop model of computing in which information processes are embedded or integrated in everyday objects and activities. In a Ubicomp environment, people interact – often without explicit awareness of the fact – with many computational devices or systems. In the context of an aging technology environment, Ubicomp takes the form of sensor networks that can monitor activity, or its absence, and use complex inferencing logic to determine whether a situation in an environment is normal or requires intervention – e.g., that a fall has occurred or there is an absence of activity in a certain space such as a kitchen.

Ubicomp provides the context for 'ambient assisted living' (AAL), which is the use of information and communication technologies (ICT) to support independent living. AAL is a natural bedfellow of the idea of 'Smart Homes' – homes with sufficient computational power, intelligent inferencing, and connected devices to provide enhanced automation, efficiency, and support for their inhabitants. Since the publication of Weiser's seminal 1991 article *The Computer of the 21st Century*, Ubicomp has sustained an entire generation of computer scientists and, significantly, attracted a strong social scientific and human factors input. The vision for the future it proclaims would be familiar to any non-specialist

who has ever watched a futuristic film or browsed magazine articles about homes and cities of the future. However, Ubicomp as seen through the lens of an aging world has its own specific vision, and it is to this which I now turn.

Technology for an aging future

> *Picture this: A few years from now, a home augmented with technologies supports an older person to live independently within their own home. Sensors pick up movement around the house; wall panels and digital photo frames proffer reminders for medications and a checklist of things to remember before leaving the house. A suite of sensors monitor the environment – able to detect flood, temperature extremes, and dangerous levels of carbon monoxide. A lamp in the corner of the living room glows, signaling to the inhabitant that her daughter has returned home from work safely. Picking up her walking stick to go out triggers a text message to a neighbor nearby suggesting a meet up in the local park. Upstairs, bed sensors detect when the occupant has left her bed and automatically switches on some lighting, which guides her to the bathroom and back again. In the bathroom, smart mirrors, toilets, and basins have powerful diagnostic and communication capabilities.*

This vision mixes fact and fiction, the present and future. Elements of what are depicted in this description are already reality; some technologies exist only as 'Wizard of Oz' (See Tran et al. 2005) demonstrations in research labs. Others are seen in glossy videos that depict this future world or exist only as sketches or storyboards on the walls of R&D labs. The future depicted in such vision videos never looks far off in time or space, and the experiences and interactions they support seem fluid and comfortable. In that sense, despite being staged in the near future, they jar with many of the everyday experiences we ourselves might have with recalcitrant technology. Whilst inhabitants of these proximate futures have seamless and simple experiences with technology, back in the present day many of us still struggle to get a video cassette recorder to work.

These visions of the future are responses to the present, a present in which demographic change, increased longevity, and the rise of chronic – as opposed to infectious – diseases are challenging the health and social care systems of the developed and developing world. In the context of the convergence of these powerful demographic, health, and economic forces, new ways of imagining, and providing, care are being encouraged. The intent is to transform a model of reactive 'illness management' in locations such as hospitals towards a more decentralized, self-managed, and proactive or preventative mode of 'personal' care in the home. Into this reimagining of care, technology is cast in a lead role.

New classes of devices, variously termed telehealth, telecare, or ambient assisted living technologies, are regarded as essential to such new models of care.

Of course, visions of the future, such as those narrated in such videos or other visual artifacts, while neither entirely reliable indicators of what is currently considered possible or plausible, do speak to present understandings about what is considered desirable. Equally, as commentators on the great Modernist spectacles such as the World's Fairs have noted (Rydell 1993), such representations of the future embody current outlooks, attitudes, and (in)sensitivities. As Bell and Dourish (2006) suggest, visions of the future can provide 'useful analytic focus for considering how the problems of today are perceived, framed, and understood'.

Much of what is envisaged in such future visions is technologically sophisticated *and* provides a seamless experience for those using it. However, following Bell and Dourish, I want to question the extent to which this focus on the future postpones our attempts to understand what technologies we already have to hand and instead creates a desire to endlessly make new technologies and systems. Furthermore, visions of a technologically suffused present tend to 'render contemporary [sociocultural] practice [. . .] by definition, irrelevant or at the very least already outmoded' (ibid.). Taken together, these two issues suggest why much of what is envisaged has yet to make the permanent transition from drawing board to home, from concept to shop front.

My contention is that the absence of design thinking, which foregrounds the way we live today, makes the easily imagined future difficult to create in the complex reality of the present., Instead a technology-oriented agenda is pursued. This seeks a perfectly configured, interoperable, implementable network that joins people, devices, their homes, and communities with business, information providers, and healthcare systems. The agenda, it would appear, is the creation of 'perfect' infrastructure for ageing.

The design and practices of a proto-industry

On the basis that current demographic change represents a significant economic opportunity for technology developers, many national governments and other entities (such as the EU Commission) have committed large tranches of funding to this area over the last decade. Industry-academic research collaborations have been created to explore the technology opportunities in this space. Many are funded under the EU's Framework Programme Funding schemes, including the Ambient Assisted Living Joint Programme, a 'joint European research and development funding activity' that will run from 2008 to 2013 and has the objective to 'enhance the quality of life of older people' and to 'strengthen the industrial base in Europe'. Projects vary in terms of their focus and scale, but several summaries of those awarded funding as the result of a 2007 call for projects provide an indication of the general areas of interest and activity:

> AGNES The vision is to provide a user-sensitive ICT-based home environment that supports a person-centric care process by detecting, communicating, and meaningfully responding to relevant states, situations, and activities of the elderly person with regard to mild cognitive impairment or dementia.
> http://www.aal-europe.eu/calls/funded-projects-call-1/agnes/view

> CARE targets the automated recognition and alarming of critical situations (like fall detection) using optical sensor and real-time processing while preserving the privacy and taking into account system dependability issues, especially ensuring reliability, availability, security, and safety from a holistic point of view.
> http://www.aal-europe.eu/calls/funded-projects-call-1/care/view

> REMOTE will advance the Software Architecture in fields of tele-healthcare by enhancing the elderly's home with audio-visual, sensor/motoric monitoring, and automation abilities to trace vital signs, activity, behavior and health condition, and detect risks and critical situations as well as provide effective and efficient support at home.
> http://www.aal-europe.eu/calls/funded-projects-call-1/remote/view

Given the focus on creating environments and networks, much of what gets produced in the world of AAL technology research are network architecture diagrams[1] and other visual artifacts that represent the underlying technological and infrastructural order of the 'solutions' being proposed. Jara et al. describe a good example of such an output from a Spanish project in which they 'define an architecture so that people can live alone at their homes with a suitable assistance condition' (2009, 883). In their account, there is a rapid progression from the briefest of descriptions of 'different kinds of users' – distinguished not in terms of the social or cultural differences, outlooks, expectations, or practices but in terms of their different levels of need for 'teleassistance' – to the technical complexities of electronic health records, ISO standards, and 'modular architecture'. In passing, reference is made to the need for 'simple and intuitive interfaces [...] because we work with older people who are not fully adapted to the world of new technologies' (ibid., 885).

The diagram below demonstrates the high-level conceptual work of architecting the communications infrastructure or network within the domain of ambient assisted living. Such diagrams, whatever their apparent simplicity, mask very considerable complexity at a technical level. They represent visually the 'lashing' together – to use a concept popularized by Molotch (2003) – of different devices on different networks that are likely to use different technical

1 Network architecture is the design of a communications network. It is a framework for the specification of a network's physical components and their functional organization and configuration, its operational principles and procedures, as well as data formats used in its operation.

standards. Major technical hurdles such as device interoperability are effaced in such diagrams. Infrastructures are concatenations of different elements that rarely get rolled out in one piece but are lash ups of different elements.

Getting technology to work is hard work, as Tolmie et al. point out with respect to the 'digital plumbing' that such Ubicomp visions entail (2009). Maintaining it in working order is no small task either. Furthermore, aside from variations in the distribution of technological infrastructures of the sort implied by AAL visions, the technical skills and competencies assumed in these depictions of ambient assisted living cannot be taken for granted. Therefore, to quote Bell and Dourish:

> [...] thinking of infrastructure as stable, as uniform, as seamless, and as universally available is clearly problematic. It is not merely a dream of a world not yet realised it is a dream of a world that could never be realised. (2006)

What we have then are visions created in the laboratory – abstracted, high-level maps which provide a formal technical challenge against which network specialists and computer scientists can map out a solution. But the messy reality of everyday life is not allowed to intrude into such visions. As such, the problem is one of scale and resolution. Mapped out in the abstract, the vision seems constrained, realistic, and achievable. However, if we focus in everyday life and its contingency, variability and unpredictability become evident. And yet, I would argue, by allowing the user to intrude into the ordered world of the network architecture, it might be possible to expose, in a positive way, the competencies and infrastructures that are available to work with in pursuit of the goal of technology supported living.

Enter the user

This is not to say that the 'user' plays no role in the thinking that animates ambient assisted living projects. The motivation of the funders and the research collaborators is to enhance the quality of life of older people and make advances in health and social care. 'Users' do play a role in these projects. However, I would suggest that their role is severely circumscribed., There is considerable research conducted on aging often through similar funding mechanisms to that which fund AAL projects. Indeed, AAL projects are required to conduct research and consult with their 'end users'. However, the role imagined for users in the design process is often restricted to the identification of needs to be met through technology innovation.

In this sense, the sort of projects I am discussing are engaging users in much the same way as many other commercial organizations do. 'User' research,

stakeholder engagement, and market research are staples of product and service development techniques (see Wakeford 2004). While there is insufficient space in this essay to discuss in detail the development and practices of such research, recent publications provide useful accounts of the mainstreaming of social scientific enquiry and design thinking within business (e.g. Cefkin 2009; Dourish 2006;, 2007; Sunderland and Denny 2007). These approaches have arisen, in large part, out of a concern to understand the social organization of everyday activity practice (for example, in the field of computer supported collaborative work) and out of a 'democratic' urge to conduct technology or product research in close collaboration with its likely 'end users'.

Such 'user' or people-centered research takes a variety of forms. For example, it extends from interviews and focus groups through to more lengthy ethnographic studies. Accordingly, it varies in the degrees to which people are engaged in the research process and the initial research framing is open to interrogation. However, beyond the research itself, there are important variations in the extent to which a process exists to integrate or translate the research findings into the design of technologies and interactions. It is this process, made explicit in the practice of designers and design studios, that creates the possibility for rupturing the idealized visions of network architects.

The issue is not whether research is conducted at all but the extent to which people are allowed to inform the direction and intended destination of the technology. In terms of research or design practice, this is about whether intended users are used to validate ideas already created or engaged as sources of design inspiration. My contention is that in the AAL industry, and indeed other settings, the former is the normative practice. People are used less as sources of creativity, or even co-inventors, and more used to verify that a technology direction adopted is satisfactory. This difference is analogous to the distinction drawn by Anderson (1994) in his account of the use of ethnography in system design: between ethnographic enquiry to create a space for an analytic cultural account of a specific context and conducting research merely to draw out a series of design requirements for a technology. Often, within the context of AAL, research is not used to create currently creating the space for a re-conceptualizing of the role of technology as people age, but used either to derive requirements or validate technology already developed.

One way of exploring this distinction between, on the one hand, using research to either create a list of requirements or using research to validate existing creations, and on the other hand, engaging in research of a more creative and analytical nature is to focus on the mutually constitutive relationship between technology, everyday practice and the creativity inherent in technology use. This requires us to think of users not as passive recipients of predefined technologies or products, but as actors engaged in the active construction of the contexts and

consequences of these technologies (e.g. McKenzie and Wajcman 1985; Silverstone 1992). This perspective has been common across a variety of disciplines, such as Human Computer Interaction, and cultural and media studies. An understanding of the 'social shaping of technology' has become a powerful antidote to more technologically determinist thinking. In this view, processes of adoption and use patterned by local sociocultural ideas, competencies, and practices come to the fore, allowing us to appreciate the dialogic relationship between people and technology.

The work of Elizabeth Shove and Mike Pantzer demonstrates that we can move beyond the binary distinction between 'people and technology' to think about the dynamic relationship between 'material objects and associated images and forms of competence' (2000, 43). As they argue, 'products alone have no value. They do so only when integrated into practice and [...] forms of competence and meaning' (49). Enter then the messiness, or at least the dynamism and variety of everyday practice, and with it the varied distribution of skills and narratives that might impact the use or adoption of a particular technological intervention. Returning to the tidy and seamless 'network architecture' or the vision painted in the scenarios with which I began, we can begin to appreciate the gap – what Ackerman (2000) in another context called the 'socio-technical gap' – between the technology vision and the way that life is actually lived. The gap is not a gap created by insufficiently 'smart' or intelligent technology, but rather by attention not being directed to what resources or practices intended users bring to bear on these creations. This point is well made by Richard Harper and colleagues at Microsoft Research, writing against the idea of 'Smart Homes':

> We think of the home as already smart, smart not in terms of technology, but in terms of how people conduct their lives in the home. Recognizing this, our approach is to augment and support these existing practices, learning from the ways in which people already live their lives, and the tools and artefacts they draw on to do so. (Harper et al. 2006)

Were Harper and his colleagues to ignore the already smart practices of homes' inhabitants, the work of smartness would be considered a primary responsibility of the technology. Thinking of smartness as a quality of people, not of technology, has the consequence of reconfiguring the human-technology relationship and reducing our expectations of that technology. Technology then is seen as playing a supporting role in enabling existing practices, and the technology requirement might be simply to 'lash together' existing technologies rather than create afresh an entirely new system.

However, too often the practices of the AAL technology industry seem to suggest that an entirely new technological infrastructure is required. If that

industry was to work with practices as is, recognizing the heterogeneity, fluidity, and dynamism, their technological vision might be less visionary and more realistic.

The vision videos and future scenarios portrayed in the industry are less, it seems, designed futures than technological futures. The future is presented in terms of technology not in terms of experiences or cultural practice. To my mind, while design thinking and practice is unlikely to be a panacea to the problem of the gap between what is possible and what has been realized to date, I would argue that design thinking could help refocus the work of ambient assisted living technology practitioners.

Conclusions: Design thinking for the present

Up till now, I have argued that current approaches to technologies for aging populations too often present a vision of the future that is expressed through a technology narrative. The ambition of the network architects and computer scientists, and their totalizing system architectures, obscures the messiness of everyday life – the socioculturally located practices of 'real' people and existing technology infrastructures.

I have implied that a more design-led approach to developing technologies might help counter a focus on technological requirements and visions, letting messiness into the conversation as productive force of creativity, not simply as an obstacle to the realization of a vision. In this view, 'design thinking' would direct attention to where people 'are' currently. That could create a constraint to the technological 'roadmaps', since taking account of how homes really are, and how people really cope with low and high-tech devices, would be highlighted. Such a focus would include thinking about what people are trying to achieve, what resources (cultural, economic, and educational) they possess, and what environments they dwell in (architecturally, spatially, and ontologically). The contention is that working with those constraints, rather than trying to obscure them, would actually hasten the industries arrival at their desired destination.

However, 'design thinking' is a nebulous term and it seems necessary to devote some space, in this concluding section, to exploring what design thinking might mean exactly. In a piece in *Harvard Business Review,* Tim Brown, CEO of IDEO, a design studio, defined design thinking as:

> [...] a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos. By this I mean that innovation is powered by a thorough understanding, through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported [...] it is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity. (2008, 86)

For Brown, design thinking is less a methodology, but rather a practice underpinned by a way of thinking, despite the term's apparent focus on the cognitive aspects. At the heart of design thinking, at least as practiced by his company, is a desire to align what is culturally desirable, technology feasible, and commercially viable. At the heart of design thinking lies the axiom of putting people first, using an understanding of intended users, and their contexts, as a pivot around which all other creative and business thinking is centered. Of course, there are multiple connotations and uses of the word design, and it is worth drawing these out.

Design, in its most traditional sense, can be understood as an aesthetic wrapper – the addition of form to prior considerations of function, although many would argue that good design combines form and function. Design in both these senses is about the creation of something that is desirable *and* attends to considerations of usability and functionality. I have argued elsewhere in relationship to the development of technology for older people that we should strive to make technology that connects people to their own aspirations, their own projects of self-development, self-esteem, experience, and identity, not just focus on functional 'need' (Roberts 2010). Designer Matt Jones makes a similar point as this in talking about the need to make Ubicomp 'sexy and desirable [...] able to be appreciated as cultural design objects rather than technology,' and he adds that such creations need to be 'tasteful, simple, clear, clean, contemporary, affordable in order to be invited into the home' (Jones 2010). To capture this point, he coins the portmanteau 'Mujicomp' (Muji is a Japanese retail company with a strong, clean design aesthetic).

Design in the sense invoked in Brown's definition is also a way of thinking that subjugates, or controls, the designer's creative urge through attention to the circumstances of the object's users. In this sense, design tempers the force of the technological script – the desire to do something merely because it is technically feasible. Instead, attention turns to how the design can support experiences. In this understanding, design is about attending to practices and focusing on what people are trying to achieve and then to design for that. Perhaps most significantly, design thinking can encourage those intent on developing a technology, object, or product to take heed of Eliel Saarinen's injunction to 'always design a thing by considering it in its larger context [...] a chair in a room, a room in a house, a house in an environment' (quoted in Jones 2010). One specific criticism of ambient assisted living technologies that I have made is that they are seemingly created within a vacuum. They purport to entail new and complete infrastructures to be introduced on top of devices and infrastructures, past and present. An ability

to think in terms of systems, technical and sociocultural, would be useful for those working in the AAL sphere because successful computing requires thinking about infrastructure, not just artifacts.

Design also operates in others ways, less as a practice of physical or digital construction, and more as a means of manufacturing ideas or alternative visions for the future. One criticism of my argument for focusing on the messiness of the everyday and the resources that exist in the present, rather than encouraging a strong vision for the future, might be that this is anti-visionary. It could be argued that the work of technologists in espousing a vision of computing future in an aging society is vital in bringing that future into being. I would counter that design as a discipline also plays that role in charting a course into the future and stimulates a conversation about what is desirable and feasible in that future. As Anthony Dunne has suggested:

> It's not about trying to predict the future and get into forecasting but simply about trying to move upstream and not waiting for science to become technology and then products and then design at that level. It's about trying to think about new possibilities while we are still at a scientific stage and design in a way that might facilitate a public discussion about what we want. (2007)

By capturing the imagination, creating a conversation, and exploring landscapes of possibility design acts as a vehicle for talking about future possibilities and is a set of practices, which can accommodate many different disciplines and outlooks. Design practice and processes informed by social scientific enquiry have the ability to engage with the visions of technologists to create ambient assisted living technologies that are not merely technically feasible, but also culturally desirable. In time, who knows, they might even become commercially viable.

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