

Cognitive and assistive technologies in care practice: A view from the delivery end

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Abstract. Over the last forty years care has changed dramatically. Until the middle of the last century the norm was for care in institutions; now care is provided to people in their own homes, or in small care complexes. Person to person care has thus become more expensive, and cognitive and assistive technologies (CATs) are increasingly supplementing human carers. Care funding has been cut by approximately 20% per annum over the last few years. Moreover funding has become increasingly fragile as it is won in competition and retendered every three years or so: higher quality care must be delivered for less cost. In addition care is required by clients, funders and regulators to be increasingly personalised: defined by individual care plans and individually funded rather than block funded.

We will offer a definition of ‘good’ care and show how sometimes the demands made of staff and the pressures they work under may mean that care falls short of what is considered ‘good’.

We will address a number of questions:

- What is ‘good’ care? Is good care inherently human-delivered care and is CAT-delivered care inherently bad care?
- How can robotic, cognitive or assistive technologies replace or supplement human care?
- Rather than simply replacing human care do these technologies offer something in themselves to improve the life and well-being of people needing care and support?
- What are the main barriers to applying these technologies in real life care?

We will refer to the stories of people whose care was successfully enhanced by assistive technologies.

Nevertheless, very real barriers exist to implementing CATs in care. The way forward will rely on innovative practices, demonstration projects, leadership and champions to push forward the vision of care enhanced by these technologies to meet the needs and aspirations of vulnerable people.

1 SCENE SETTING

In this discussion we focus on the use of technologies in social care settings. We use the term ‘Cognitive and Assistive Technologies’ (CATs) to cover a wide range of applications from simpler technologies such as community alarms, smart homes, or telecare, to humanoid or animal-like robots. The simpler CATs are used commonly to monitor services users’ needs and activities or to enhance their capacities in the case of people with impairments. More complex CATs such as robots are more capable of providing personal care and help with housework, shopping etc.; and exoskeletons and intelligent prostheses can enhance the capacities of people with physical impairments. This paper addresses the potential benefits and risks offered by CATs, and the barriers to achieving these benefits.

Much of the discussion in AI circles (and in this symposium) focuses on the higher-end CATs such as robots in care (see, for example, [1-4]). While referring to higher-end CATs, this paper focuses more on the simpler CATs since these are in most widespread use in care currently. Experience in these more primitive applications provide pointers to how the more advanced systems still in the labs might best be deployed in time to come. The present discussion will look at the practical issues surrounding the delivery of care (in the UK context, although we believe that similar issues may be found across other parts of Europe). This will, hopefully, provide a pragmatic background to the more theoretical, futuristic ethical discussions raised in papers by others. I will draw on two decades of personal experience of running care provider organisations within the UK, and of working to introduce CATs into the day-to-day practices of these organisations. Hopefully this view from within the care profession will provide insights for those working on designing and developing AI and robotic technologies relevant to care provision.

The term ‘care’ covers a range of needs and settings: from people in their own homes to those in grouped or shared accommodation; those with mental health needs, those with physical impairments, those with mental impairments or learning disabilities, and the elderly. For each of these groups the funding regimes are different. As a very broad generalisation, the elderly are the least well funded and people with learning difficulties are the most highly funded. Cost cutting means the time allotted to each service user has been cut. The time allotted varies according to the different types of need. Elderly service users often only receive 15 minute time slots; people with learning difficulties usually receive more. If service users are living in grouped accommodation there is usually 24 hour staffing.

2 FOUR QUESTIONS

CATs are increasingly used in care, in what is often an intimate setting, occupied by people who may be vulnerable in many ways. Their use in such contexts has been seen as controversial. At the very least it raises questions which need to be addressed. CATs have the potential to bring great benefit to those charged with delivering care and to those receiving it. However, there may also be poor practice when CATs are used as simple cost-cutting measures, rather than to enhance care delivery.

In this paper I address the following questions:

- What is ‘good’ care? Is good care inherently human-delivered care and is CAT-delivered care inherently bad care?
- How can robotic, cognitive or assistive technologies replace or supplement human care?

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² It may be useful to compare this list with the list provided in the

- Rather than simply replacing human care do these technologies offer something in themselves to improve the life and well-being of people needing care and support?
- What are the main barriers to applying these technologies in real life care?

3 WHAT IS ‘GOOD’ CARE, AND IS GOOD CARE HUMAN-DELIVERED CARE AND BAD CARE CAT-DELIVERED CARE?

‘Good’ is of course subjective. However, a great deal of work has been done over the last twenty years to define ‘good’ care by working groups of stakeholders: service users, families and carers, staff, provider organisations and government. This culminated in 2007 guidance issued by the Department of Health [5]. This legislation gave rise to a raft of guidance and legislation promoting personalised care. Drawing on these, the following is a summary definition of ‘good’ care.

‘Good’ care . . .

- is reliable,
- promotes choice
- maximizes dignity and personal control,
- is personalised
- is engineered to match individual needs,
- empowers service users,
- is expert,
- is present, and
- is as minimally intrusive as possible.²

These standards are promoted through regulation and guidance. There are also informal champions chosen by the Department of Health to promote different aspects of this definition. For example I am a member of a Department of Health group championing dignity in care.

However, care delivery does not always match these standards. The employment of low paid, entry-level staff who change frequently, leads to inconsistent service, lacking continuity. These staff may be required to perform skilled, sometimes life-saving work such as monitoring vital signs, dispensing medicine, or dealing with self harming or suicidal or challenging behaviour. For example, in one organisation I worked for, front line staff, on relatively poor salaries, were sometimes required to inject antispasmodic medicines into the mouth of epileptic service users to prevent life-threatening seizures. Whilst this was done effectively it is evidence of the increasing use of care staff to carry out what are nursing functions.

So human delivered care may leave people isolated in dispersed settings, may mean frequent changes of personnel who are stressed, undersupported and paid minimal wages. Using CATs potentially helps to achieve ‘good’ care. CATs remain consistently present, and do not come and go as human carers often do. CATs are relatively minimally intrusive. For example smart homes enable service users to be monitored while in their own homes instead of having to be monitored by a human carer. Rather than having a human carer present in their homes, many

service users value the privacy offered by having their home to themselves, if they can be assured of their being safe. CATs can also empower people, offering them more choice and control, rather than creating dependency on choices and services provided by others. At the simplest level this might mean making their own tea at a time they want it; at a more complex level, it may mean carrying out gainful activity using their own skills.

4 HOW CAN CATS REPLACE OR SUPPLEMENT HUMAN CARE?

Rather than simply replacing human care, do these technologies offer something in themselves to improve the life and well-being of people needing care and support?

Five stories show how CATs can bring great benefit to those charged with delivering care; and to those receiving it. These stories are of service users in some of the organisations I have worked in. (Fictitious names are used.) The technologies used were relatively primitive and low cost and yet they transformed lives. These examples also illustrate the wide range of different kinds of AI-based technology that are relevant for consideration in relation to care provision.

(i) ‘Becky’ was a young woman in her early thirties diagnosed as paranoid schizophrenic. I had visited her in the psychiatric hospital where she shared a ward with around 15 other people. She was utterly non-communicative and virtually catatonic, all meals provided and totally cared for. The hospital was being closed as part of the community care initiative. My organisation won the contract to transfer several people from the hospital into community care. 18 months later I visited the new service supporting people in grouped flats and bedsits controlled by smart technology monitoring the movements of service users around their flats and their use of kitchens, bathrooms and so on, to ensure their safety. This was a move-on complex monitored from a mental health hub and assisted by visiting human carers.

Becky saw me coming up the shared drive. She rushed out of her flat and offered me tea with her own home-made cake. She showed me round her flat and talked excitedly about her new studies and her friends. While in the hospital with 24 hour human nurses Becky was disabled by her mental health state. Smart technology enabled her to live in a normalising setting with relative independence and dignity. She no longer needed human presence 24 hours day and welcomed the privacy of her own home. It would not have been effective, either in care or financial terms, to substitute smart technology with human care

(ii) ‘George’ is a man in his early forties totally paralysed from the neck down. He had previously been very active and a motorbike racer, and worked in IT. He had been paralysed following a motorbike accident. He lives in a bedsit flat within a grouped project. He blows through his mouth into a harmonica-like device to direct his own wheelchair, to operate his computer and to express himself creatively. He produces laminated art and posters from which he makes a small living. He is able to go out shopping alone to local shops. He also has an active social life. His motorbiking friends come to visit. He also has 24-hour human carers since he cannot cook or care for his physical needs.

Without the adaptations George’s life would have been extremely limited. However imagine how much George would benefit from an exoskeleton enabling him to use his arms and

² It may be useful to compare this list with the list provided in the symposium contribution by Coeckelbergh [6]; see also his [7].

legs, capable of being operated by his own brain. Also, given his technical competence and independent nature, robot carers might be more acceptable to George than human carers.

(iii) During the 1990s the organisation I headed ran a highly innovative project funded by the local health authority to establish whether sexual abuse was occurring in families. Families were referred to us by judicial courts when it was unclear whether abuse had occurred, and when the alternative would have been to remove the child. They stayed for an average 6 months in a project of 6 flats in a grouped complex overseen by central monitoring station. A very sensitive bug travelled at random through the rooms of each flat switching every two minutes to pick up the smallest signs of movement. One staff member monitored the console. Two roving staff members were available 24 hours to respond to any signal detected by the console.

In this project families sacrificed their privacy, accepting high levels of surveillance and intrusion into family life. They received, in return, a hopefully positive future for the family. This project would not have been possible without surveillance techniques supported by human carers.

(iv) A few years ago I was interviewed for the Chief Executive post in a large national provider of care for people with learning disabilities. Part of the assessment was an interview by a panel of service users, most of whom were non-verbal – either organically, somatically or by choice. They had what they called ‘word-boxes’, in which they pre-recorded their questions to ask me. Their carers had helped them prepare the questions. The word-boxes not only enabled them to communicate: some had also prerecorded sounds and music they particularly liked. These service users loved their boxes and carried them around with them all the time.

(v) The last story is to show how a simple robotic companion might have solved a young woman’s need for a little furry companion. ‘Sarah’ was a young woman in her twenties with learning disabilities. When I was attending a service user and family ‘fun day’ in a local leisure facility she approached me to beg me to let her have a hamster. ‘You’re the boss. You can tell my support worker to let me have a hamster’, she insisted. Sarah had lived in her own bedsit flat with visiting carers for the previous five years. She was, however, lonely, particularly since she had been rehoused from her previous institutional setting. She had been forbidden from having a hamster because of the demise of the previous four from her zealous over-love. The last one had died because it had been petted and hugged too enthusiastically. One had died from being fed a diet of sweets and chocolate exclusively. Another had died from drowning when Sarah had thought it was enjoying a swim in the bath.

Finally everyone involved in her care, particularly her individual worker, had decided enough was enough. Sarah was extremely distressed and almost beside herself with longing for a hamster and this caused her to behave badly in pet shops as well as at home. She might have found some relief were possible to provide her with a robot hamster capable of withstanding robust hugging and water play. Examples like Paro [1] suggest this might be relatively straightforward.

These examples show that assistive technologies can dramatically enhance peoples’ lives, providing capacities which human carers alone do not have. However in all cases the service user was also supported by human carers, and the CATs integrated with human carers. The technologies were specifically

designed and/or adapted to meet individual needs. They were simple and easily integrated into peoples’ care plans. Minimal training was necessary for staff and users. The corporate infrastructure ensured the human/technology interface was managed appropriately. The technology was maintained through a well-managed infrastructure

The choice of which CATs to use for different service users must be driven by their particular needs and choices. More primitive and passive assistive technologies, such as pendant fall alerts or CCTV surveillance technologies, are now accepted by all stakeholders in almost all care settings. However, they caused controversy at the outset. Images of Big Brother and 1984 were conjured up, and it was feared that service users would be intimidated. In fact CATs are now an established part of the care package. While they cause irritation for people having to work with them if not properly maintained, it would not be possible to run care services today without them. Similarly, robotic technologies or more developed CATs relying on service users’ active use, may intimidate or confuse some service users, depending on their capacities and on their attitudes to technology. However, for others they would be highly appropriate.

5 WHAT ARE THE BARRIERS TO IMPLEMENTING CATS?

The barriers to implementing CATs arise from different stakeholders within care, including service users and their families, care staff, leaders of care providers, legislators and commissioners. The technology/human interface is also a major barrier. Engineers, designers and developers of CATs need to work with the stakeholders to minimize the barriers inherent in the human/technology interface.

Over the last 20 years the more primitive CATs, such as telecare applications and smart home technologies, have been increasingly integrated into care. However, this has not been plain sailing. At each stage concerns have been expressed that CATs may confuse service users or dehumanise care. More recently some commentators have raised similar objections about the use of robotic agents: that they may affront the dignity of the users of care services, and that robot carers could not reproduce the complex affective interactions between human care professionals and service users, and so on [7-9]. While these concerns need to be taken seriously it is necessary to ensure that these technologies are used appropriately so that the risks are minimized and the benefits maximized.

Another concern raised by commentators is that there is a risk of ‘deception’ (see [10]). For example the Paro robot baby seal has appeared to deceive some service users into believing it was a live pet. There would be a more serious deception in the case of a humanoid robot. It is true that some might be deceived. The very power of a robot companion lies in its capacity to mimic or approximate to animal or human interaction. For this to be effective the service user must suspend disbelief. Any affective connection between service users and robotic companions needs to be managed in the care context and staff will need to be trained to ensure service users understand the robot is not alive. However, robotic companions can fulfil needs, as Paro shows.

Concern has also been expressed that CATs will mean staff reductions. Staff reductions are inevitable given the cuts in care

budgets. The advent of CATs is not the main reason for such cuts although they do make it possible to continue to run services with less staff.

Care risk is the main barrier to the use of CATs. Care is a risky business and the double whammy is that CATs are often seen as intrinsically risky within the business. Care providers implement sophisticated risk management procedures based on a complex infrastructure of systems and procedures running from individual risk assessment up through the organization to the top. The Chief Executive is ultimately responsible, and it has been known for a Chief Executive to be imprisoned for corporate manslaughter where inadequate corporate systems, policies and procedures were shown to be responsible for a service user's death or serious injury. The serious consequences which follow any care failure tend to make managers and staff more conservative and to prefer traditional human-delivered care to innovative CATs. Some of the literature has expressed concerns that robots might be held responsible for care failures (see [11], for example). In practice, however, the responsibility will always rest with staff and managers.

Another barrier to implementing CATs is management and staff resistance. Care is increasingly provided by large organisations with thousands of staff and with highly developed infrastructures of staff training, policies and procedures governing every aspect of care. Any slight change in care delivery will require changes to these infrastructures. This leads to resistance to change. For example I tried to introduce an RFID tracking bracelet worn by service users at risk of wandering, to alert staff to vulnerable service users' whereabouts. However we would have needed to invest heavily in appropriate staff training and deployment, and policies and procedures as well as in a monitoring hub. The bracelet itself was cheap and effective. It was not possible to introduce the bracelet despite this because of the greater additional expenditure. Thus inertia inhibits innovation in a care sector generally relying on traditional ways and working under pressure.

The human/technology interface is a major barrier to implementing CATs. CATs need to be integrated into a care practice dominated by staff who are not generally highly technologically able. CATs therefore need to be designed with the awareness that they will generally be deployed by such staff and used by vulnerable service users. Designers tend to concentrate more on the technologically innovative elements of their work than on how to design technologies that enable less competent people to use them. Younger staff tend to be more technologically competent, making this a decreasing problem in the future, perhaps. However, while some demonstration projects exist, only the most primitive CATs are in widespread use partly because there has not been enough focus on the human/technology interface.

Service users' attitudes to technology may hinder or enable CATs. Service users may not always be aware of the potential offered by more highly-developed CATs. Robotic technologies and technologies such as intelligent prosthetics could dramatically enhance human capabilities. This may seem like science fiction to lay people and is not taken seriously, or may even be seen as frightening, as a result. However, more technologically competent service users are often excited by assistive technologies. Thus the future is one where CATs will be increasingly acceptable to service users and the care staff who have to work with them.

Inertia within local and central government is also a barrier to implementing CATs. The UK Department of Health runs workstreams for developing policy and practice in CATs, telecare and robotics. They also fund demonstration projects, research and promotion. (For example I was Board member of an organisation, ATCare, funded to promote CATs in care. This was closed in 2012 because of lack of funding). This is not, however, part of their mainstream activity and there is a natural inertia. This inertia is arguably more marked at the level of local authority Commissioners of care services. What commissioners purchase on behalf of service users determines the shape of care services.

A further fundamental barrier to implementing CATs within individual care packages is the problem of informed consent in the context of limitations in mental capacity. Informed consent is necessary before any service or action is undertaken with service users. Service users certified as having permanently or temporarily impaired cognition or understanding may be considered not capable of giving informed consent to decide matters in their own best interest. This issue arises in relation to many interventions in such service users' lives, of which CATs are only one. However, surveillance-style monitoring in smart homes, or restriction of movement, trigger this concern. The 2005 Mental Capacity Act [12] defines when and how decisions must be made by a third party on behalf of service users. Having to resort to the Mental Capacity Act thus constitutes a further brake on implementing CATs.

6 THE CARE CONTEXT: ORGANISATION, FUNDING, LEGISLATION

To add depth to the discussion it may be helpful to briefly outline the context within which care is currently delivered in the UK, and the challenges faced by care providers. Some of this context has been covered in the media. This coverage has addressed the increasingly poor care quality received by care receivers and the poor staff working conditions prevalent over the last few years. [13,14]

Over the past 40 years care for people with mental health needs, learning disabilities, physical and sensory impairment, and for the elderly has changed dramatically. Until the late 20th century people needing care would have to leave home and be moved into large institutions or group homes. Now care is increasingly provided to people in their own homes, or, if they need to enter specialist care schemes, they are normally housed in flats clustered into care complexes. Being more dispersed in the community rather than delivered in bulk to groups of people in largely institutional settings, person to person care has become more expensive, and assistive technologies are increasingly supplementing human carers.

The care context is dominated by funding cuts. Care is funded largely by government. Over the last few years, funding has been cut by an average of 20% per annum. Local government purchases care on behalf of their own social services department and the local health authorities. Funding is won by organisations bidding against each other in competitive tendering to local authorities for services, usually with budgets of several million pounds. These services are re-tendered, commonly every three years. The current provider then has to bid for its own services against many other competing providers trying to win the service from them. If the tender is lost the organisation loses

often several million pounds; service users' lives are disrupted; and staff may lose their jobs or may have to transfer to the winning provider. To win, provider organisations have to offer the highest quality for the lowest price. For example, for over 15 years Organisation X ran a service for people with learning disabilities. The service was charged at £20 an hour. This was already a tight budget, but to win the contract back in 2010, when it was retendered by the local authority, Organisation X had to reduce the hourly rate to below £15 an hour.

Although staff costs constitute the largest element in any service budget it is rarely possible to simply reduce costs by reducing salaries. Cost reduction is achieved through greater efficiency in all aspects of the organisation's functions partly by increasingly automating both corporate administration and care delivery. Clearly CATs are vitally important to maintaining service delivery while reducing cost.

Care funding is fragile not only because of severe cuts but also because of the move towards more personalised care. Under 'Personalisation', the government no longer block funds a group of clients together. Each individual client is now more often funded by individual budgets. The provider can no longer be sure of how many people they will be caring for from year to year and this obviously means greater financial vulnerability. Also there is no longer a one-size-fits-all approach. Service users have greater choice over services provided and these are defined by care plans agreed with the commissioners. Increasingly, service users will hold their own money and purchase their own services from providers.

Care plans dictate the client's daily life, and the care and support offered, from physical support to leisure etc. CAT applications offered are defined by the care plan. Organisations are regulated on how closely staff follow the care plan. Care is a highly regulated sector and failure to follow care plans will lead to the organisation being downgraded by the regulator and subsequent loss of commercial position.

7 CONCLUSION: WAY FORWARD

CATs, particularly robot carers and exoskeletons, can potentially transform the lives of people needing care and support. However they cannot be used simply to cut costs and replace human carers. They must be part of a care package including human care as well as a range of other support systems and interventions. There are many barriers to implementing CATs, particularly the more advanced technologies. Apart from the pure technological challenges there are: care risk, the difficulties in the technology/human interface, and organisational inertia.

However, it is vital that CATs are more fully integrated into care practice to deliver more personalised care offering independence, choice, respect and dignity to clients, and increasing efficiency and cost effectiveness in care practice. We must more fully exploit their potential to improve the lives of service users. In the future, robot carers, intelligent prostheses and other advanced AI-based devices will be part of the menu of options open to service users when their care plans are drawn up, as commonly as fall alarms and telecare are now.

To achieve this future, more demonstration projects are needed showing how CATs can enhance people's lives. Such projects should bring together engineers and designers with care providing organisations, service users and their families, commissioners and regulators. These projects need to address

how robots, and intelligent prosthetics, etc. can enhance the lives of service users and how the human/technology interface can be simplified. Expanded networks of technologically well-versed champions are needed, who can demonstrate the potential benefits (and risks) and who can promote CATs in care.

A large European network project drawing together all stakeholders would enable the transference of expertise across member states. To achieve the promise of 'good' care using CATs requires research oriented not only at technological excellence but also at service users' needs. It also requires imaginative leadership at all levels, including commissioning.

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