Developing Virtual Healthcare Systems in Complex Multi-Agency Service Settings: the OLDES Project

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Abstract: Recent developments in internet and digital technologies offer increasing possibilities for transforming the delivery of care by virtual means. However, the care of older people presents challenges and issues at many levels. The realities of the world of older people and of the multiple institutions and agencies that provide care services for them have to be better understood if virtual services are to be configured appropriately. This paper presents the results of an action research exploration of the complexity of needs found in care environments and the difficulties of configuring services when delivered in multi-agency settings (i.e. jointly across organizational, professional and occupational boundaries). The deployment of a computer-based graphical demonstrator is illustrated as one means through which, visualizations of different socio-technical scenarios can be generated. We suggest that this tool can support processes of shared sense making amongst care agencies and institutions. In so doing, it can provide the basis for facilitating more effective 'user' engagement with the design, development and implementation of virtual healthcare systems.

Keywords: socio-technical systems, healthcare, older people, virtual services, action research

1. Introduction

Current developments in information and communication technology (ICT), it is claimed, offer great opportunities for the use and development of telemedicine applications in a number of medical and related care domains. These developments, it is suggested, have the potential to transform the cost-effective delivery of medical practices. Apart from medicine, other health and social care provision could equally benefit from the application and use of ICT, such as services for disabled people, those discharged early from hospital, community healthcare services and particularly healthcare provision for older people (see e.g. Fitch 1999). As such both medical, healthcare and other care professions - as well as potential patients - are being encouraged to make more and better use of the opportunities offered by digital technologies to provide health and social care services by virtual means.

This paper outlines the early results of an ongoing action research intervention in a virtual healthcare project called OLDES - see www.oldes.eu -. The project is concerned with deploying internet and digital technology to deliver virtual health care and related services to older people. The intervention is based on the principles of socio-technical systems design and in particular the concept of 'co-production'. It is intended to assist in equipping stakeholders - including health informaticians, service providers, system designers, technology suppliers as well as end users – with an orientation to the design process that allows them to develop systems that more purposively fit the everyday practices of those using them. This process is being facilitated by the deployment of a pilot system or 'demonstrator' tool that supports stakeholders in visualising different socio-technical scenarios for the configuration of virtual services for older people.[1]

2. The use of virtual technologies in delivering care services to older people

Older people are becoming an increasing percentage of the population of all European Union (EU) countries. In the member states 23% of the population will be aged 65 or over by 2020 and 31% by 2050 with major implications for 'the labour market and the health and long-term care sector' (European Commission, 2005: 19). Older people frequently require access to public and other services to support them in their daily lives and to deal with the onset of medical and other conditions that arise from the ageing process and that can progressively reduce their degree of autonomy. The

[1] The demonstrator tool is a fully operational synchronised audio-visual recording environment (including screens; cameras; microphones and editing/publishing suite plus supporting software) which captures the complex social learning interaction activity occurring in the Social Informatics lab.

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ageing of the population is also accompanied by a growing number of older people living alone. These changes place new pressures on both formal health care and social service resources and the extensive networks of informal care that frequently underpin or compensate for these arrangements. They also emphasize the need for a more integrated approach in the delivery of care for an ageing population (see e.g. Foresight, 2000).

Information technology is seen by many policy-makers and others as a key enabler if not driver of such responses to the needs of an ageing populace and trends in health care. The European Commission sees virtual service delivery as an opportunity to improve illness prevention and safety of care, facilitate active participation of patients and enable personalisation of care by offering new opportunities in health and disease management (EU, 2007). The European 'e-Health Action Plan' (2004) initiated a commitment by all EU member states to develop a national or regional roadmap for e-Health. As such, e-health and virtual healthcare form a key part of the Commission's vision towards an 'Information Society' (see Commission of the European Union, 2004, 2005, 2007), in which advanced technology driven clinical systems, telemedicine services, personal wearable and portable communicable systems and health network applications will assist prevention, diagnosis, treatment, health monitoring, and lifestyle management.

3. The design-reality gap

Proposals for developing virtual healthcare systems for older people have focused on empowering care recipients by enabling remote interaction, between clinicians and patients (Lenaghan, 1998). The promise of virtual healthcare is that it will revolutionize the practice of medicine by providing personalized proactive and prospective health services through the implementation and use of home telemedicine, telemonitoring, teleassistance, and telehealthcare (Kun 2001; Rialle et al., 2001). For policy makers and clinicians, these services offer the potential to provide ease of access to specialist care, an increase in the speed of referral and medical decision making and a reduction in the costs of service delivery (NHS, 1998). For older people it is expected that virtual healthcare applications will contribute to individual empowerment and stimulate learning, and thus increase the possibility of independent living at home. Available research findings suggests that telecare applications for old people can result in reducing hospital admissions, unblocking beds and better managing of chronic diseases. Other studies point to reduced healthcare costs where ICTs are deployed in the home-based healthcare of the elderly and the likely reduced burden on pension financing where the elderly are able to remain in the workforce longer (Colmer, 2007:1)

However, in practice, the implementation and use of virtual healthcare systems is somewhat more contentious and problematic than these technology driven visions suggest (Lehoux et al., 2002). Although, proponents value the potential benefits they may bring, such virtual services typically fail to become part of routine healthcare delivery (May et al., 2001). For example, in a European context, a number of virtual healthcare initiatives have been piloted over the years, however only a few projects have progressed beyond their initial phase of funding. Thus, whilst there is now widespread experience of using technology through pilot and demonstration projects, its introduction into mainstream care practice has proved far more problematic. While some of these projects have been discontinued due to limited funding resources others lacked a sufficiently 'user friendly' interface or configuration. These problems appear to be compounded by the lack of understanding that can exist between the various stakeholders involved during the design process – for example between clinical concerns for such things as safety on the one hand and the concern to improve the quality of life for older people on the other - and the cultural, ethical and other complexities of the context of use (Blythe et al., 2005). This lack of understanding can develop into long delays in meeting milestones, while the needs of the potential user(s) tend to be neglected by designers in preference to meeting other criteria such as ease of design and operation. One suggestion has been that, these potential barriers could be overcome by improved communication between the widely different disciplines involved in the design process, each with their own culture, ethos, and knowledge (Dewsbury et al., 2002). The question, then, is how might such improved understanding and capacity to communicate effectively be brought about amongst the many stakeholders in a project seeking to configure virtual healthcare systems and services to better meet user needs?

4. Co-production in multi-agency service environments

To answer this question we start from a socio-technical perspective. Many studies in this tradition have tended to emphasize the distinctive roles of "system user" and "system designer" and the need to improve user-centred interventions (communications) across the gap in order to make sure the

values embodied in the designed system reflect more than just those of the designer. The embodiment of user values is sought through a variety of intervention techniques e.g. 'socio-technical design' (Mumford, 1983), 'participatory design' (Suchman et al., 1993), 'soft systems' (Checkland, 1999). These approaches usefully move us away from more 'technological determinist' understandings of design being largely technology enabled and driven and thereby design decisions as largely the province of 'technical experts'. Instead, the central role of 'the user' is emphasised and the importance of opening up the decision process to their input stressed if final system outcomes are to be accepted by the user community.

However, in practice the extent to which user involvement has been achieved and design outcomes improved has been limited. In particular, practical problems of finding appropriate points in the design process for users to intervene and providing them with the means to do so have limited the extent of user engagement. One issue here is that in the main socio-technical approaches, often implicitly and/or explicitly, assume a clear demarcation between the domain of 'the problem owner' and 'solution provision' and between the 'designer' (as 'solution provider') and 'user' (as 'problem owner'). More recently much greater stress has been given to the innovation that users engage in through 'design in use' during implementation and operation. Nevertheless, the idea that this is a separate temporal activity to that of formal system design and development still prevails.

However, recent conceptual development suggests that the boundary between "system user" and "system designer" and the distinction between design and use should not be taken as socially given. Rather, how these distinctions are made and established is context dependent and variable. In more conceptual terms the boundaries can be seen as both socially configured and socially configurable thus allowing alternative ways of constructing social relationships in the system design and development process (Mackay et al., 2000; Grint and Woolgar, 1997; Woolgar, 1991). Moreover, the idea that social values (be either these of 'designers' or 'users') are at some point 'embodied' or 'frozen' within a system design or configuration is also misleading when the every day use of systems is more closely examined. In particular, what users seem to interact with in practice is their own context specific, situated and institutionalised understandings of a system rather than some notion of the social values embodied within technology by a 'distant' designer (see e.g. Whittington, 2006; Orlikowski, 2000). Such understanding further emphasises the context of use as a major arena in configuring 'working versions' of systems where users may be engaged not only in the technical configuration of a system but also in the constructions of new understandings and meanings through which they make sense of the system in relation to their own everyday practice.

Addressing this challenge requires a new conceptualization of intervention to engage both 'designers' and 'users' and other stakeholder in the configuration of systems and associated organisational arrangements. In this type of intervention the traditional asymmetries of designer/user, practitioner/ client, provider/customer and design/use are reassessed and open to renegotiation. We refer to this type of intervention as 'co-production'. We define this as: *a socially organised, situated learning methodology, aiming to facilitate interventions which seek to better enable multi-agency user communities to shape technologies/systems in practice*. In the following section we outline the experience to date of one such co-production intervention. This is taking place in the context of a European Union supported technology project to develop a pilot virtual health care and related services system.

5. The OLDES project

The OLDES project (www.oldes.eu) aims to offer new technological solutions to improve the quality of life of older people. The project is part of the European Union's Information Society Technologies (IST) Framework 6 Programme (FP6) for 'Ambient Assisted Living (AAL) for the Ageing Society'. The overall objective of the programme itself is to, 'to facilitate life conditions of the elderly generation' using, 'highly innovative ICT-based solutions that are cost effective, reliable and user friendly for assisted living taking into account design-for-all principles where applicable' (http://cordis.europa.eu/ist/so/aal/home.html). The project involves a collaboration of local public health and social care providers, system suppliers, intermediary research organizations and ourselves as university action researchers. The project is a three-year programme that commenced in January 2007. In what follows we report on progress and experience to end February 2008. At the core of the project is the objective to develop an easy to use entertainment, health and social care platform intended to 'ease the life' of older people 'in their homes'. The OLDES platform will be based on a PC corresponding to Negroponte's paradigm of a € 100 device, giving the guarantee of an affordable

system. User entertainment services will be provided through easy-to-access thematic channels and special interest forums supported by animators, and health care facilities will be based on established internet and telecare communication standards. The proposed system will include wireless ambient and medical sensors linked via a central contact centre to social services and health care providers. OLDES will also cover the definition, implementation and evaluation of a Knowledge Management (KM) program, an advanced user profiling system that will enhance the communication and information sharing between care agencies. The platform will be tested at two different 'user' locations: (1) a group of 100 elderly (including 10 suffering with cardio disease) in Bologna, Italy; (2) a group of 10 diabetic patients in Prague, Czech Republic. Alongside these objectives is a commitment to 'user-centred' development that, 'puts older people at the centre and makes their needs the main priority in all developments' (OLDES Project Description).

The first phase of the project focused on 'system requirements and user engagement' and was led by the action research team. The objectives were:

- To ground the design of the OLDES technical service components, and the broader architecture in which they fit, in the needs of older people, their carers and the networks of service provision
- To promote a wide range of appropriate, well informed and creative participation in the definition and shaping of the OLDES products
- To ensure that the products are as widely applicable as possible across the range of approaches to the commissioning, funding and delivery of care to older people in Europe
- To ensure that all aspects of work of the project take into account the ethical and professional standards appropriate for research and development in a socio-clinical setting

The methodological approach followed to deliver the required relationship between the project and the contexts of use and benefit delivery was based on what we term 'ethnographically informed action research' (Vaughan et al., 2003).

6. Abstraction and world views: Establishing a space for a valuable dialogue with stakeholders

Conventional system development methods and practice face great difficulties in making sense of the realities of complex care environments and social needs (Martin, 2007). Typically the tools, methods and procedures of system development, abstract user requirements in such circumstances by selecting only those aspects that are meaningful from the rational scientific, clinical or engineering points of view. As a result they ignore many aspects of the real worlds of the users, in particular those that appear the most incoherent and problematic. This process can lead towards developing a system that may be powerful and logical but which bares no real relationship to the needs, constraints, risks and opportunities of those engaged in care or those in need. In short, such systems can exhibit little relationship to the way the providers of care and those cared for make sense of and cope with their everyday world.

As we have already noted, one of the major challenges for socio-technical systems design is to develop effective and well informed 'design space' to enable dialogue between a number of different constituencies with quite different ways of making sense of the world. To bring these parties together through a co-production approach requires the ability to draw, share and communicate a 'big and rich picture' compiled from these different viewpoints, or world views. The first step in this process is an identification of the different domains themselves and the use of ethnographic methods to create rich pictures of the identities of actors, groups and their interactions and practices both within and between domains.

Our intervention in the first phase of the OLDES project has involved observing and constructing, five typical worldview domains which have bearing on the delivery of health and social care in Bologna (our work in the Prague pilot has yet to commence). Each of these complex domains gives rise to their own norms of technical discourse and culture and existing patterns of historical interaction between them. The planned deployment of a range of virtual healthcare and related services envisaged by the OLDES project requires the development of an elaborate understanding and representation of these worlds and the manner in which such a system might cut across them. Moreover, in order to develop the espoused 'user-centred' approach, our intervention, has stressed to all stakeholders that the project needs to take the issues as expressed in the community of care as its starting point.

However, in order to engage stakeholders in the activity of co-production, a conceptual framework and language in which to discuss what is appropriate, acceptable and governable is required. In this way the interests and concerns of service providers and users can be articulated and their needs and concerns expressed effectively. In our intervention we are seeking to facilitate this through the use of the demonstrator tool. The following example is used to show the basic concepts behind the tool and the kinds of possibilities that the demonstrator provides.

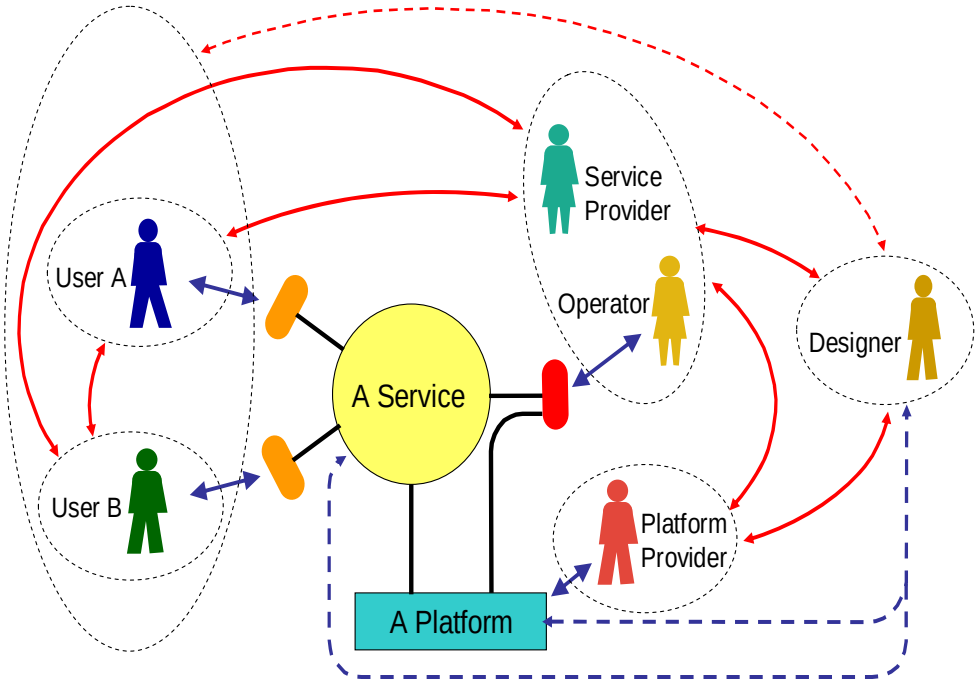

Figure 1: A simple service

Let us imagine a simple service relationship in which two 'users', in this case both service providers, operate in a context of use - in this case let us assume it is health care (see Figure 1). User A is a GP and User B is a hospital consultant. User A interacts with User B with respect to care of specific patients – say the GP refers the patient to the Consultant. This is actioned through a 'conversation' of some kind – in this instance say a referral letter which when it arrives at the hospital is input in to a computer-based health care system of some description by a member of hospital staff. The content is then accessed by the Consultant as an output from another computer. The GP and the consultant have a relationship with the Service Provider who in turn has worked with a designer to provide the technological platform, operated by the Platform Provider that supports the hospital IT system. The relationships between the service provider and designer are the means through which the service as a whole may be redesigned. Let us imagine such a redesign is intended.

With the aid of the demonstrator tool the range of organizational and technological options can be represented and explored in the form of animations which allow a visulisation of different service models and scenarios. This is done by segregating the entities and relationships in the service model into separate graphical representations or 'projections'. One of these projections – the 'roles and relationships projection' – represents, at its simplest, people and places that act as 'mirrors' to users of their practice and 'windows' into the practice of other stakeholders. Asking users to create scenarios involves story telling, making lists and tables, drawing diagrams and pictures and is one way of making visible current practices and attitudes. These initial models are then analyzed with the users to identify more abstract 'conversations' and 'transactions' on the one hand and real interactions on the other. If these projections represent 'the problem' then other projections represent the offered 'solution'. In particular what are termed 'functional' and 'deployment' projections.

For instance, functional projections might show how abstract conversations can be implemented through different processes, media and channels. A deployment projection would then show how these functions might be deployed within networked systems across organizational boundaries. Such projections represent a 'solution' to the 'problem' in the sense that they are iteratively posed as questions to the other stakeholders in the form of: 'Do you, stakeholder, take this execution of this functionality allocated to these human and system resources, to mean the implementation of those roles, the performance of those transactions and the discharge of those responsibilities?'. The questions can be posed at an individual through to organizational level and the responses are neither correct nor incorrect. Rather, in a co-production approach, these are matters of exploration and negotiation by the stakeholders. For this reason a final projection is concerned with the (re) design, evolutions and governance of the emerging system. That is, the means and mechanisms by which the service is defined, commissioned, delivered and evaluated by those with the rights and responsibilities to do so in order to ensure that the service environment is directed and operates in an appropriate and effective way.

The demonstrator tool is intended as a means of facilitating and nurturing this process. The system and organizational architectures that emerge from it, to the extent that they indicate a growing shared vision and understanding (which might further develop through implementation and use), can be seen as symbols of the success or otherwise of the process. At this stage of the project the tool has yet to be fully deployed and our work has been focused upon the initial development of 'people' and 'places' projections in order to shift the focus of the project away from a purely technological starting point. In so doing, we are inviting participants to start to think about key issues of the OLDES environment themselves and to start to develop alternative scenarios which place the needs of service users and providers at the centre of the discussion.A possible further output from this process is provided in Figure 2 as an indication of a possible direction of travel that might flow from co-production as we are seeking to develop it in the project. This provides a graphical depiction of one potential alternative 'people and places' projection of the OLDES multi-agency virtual healthcare and related service environment.

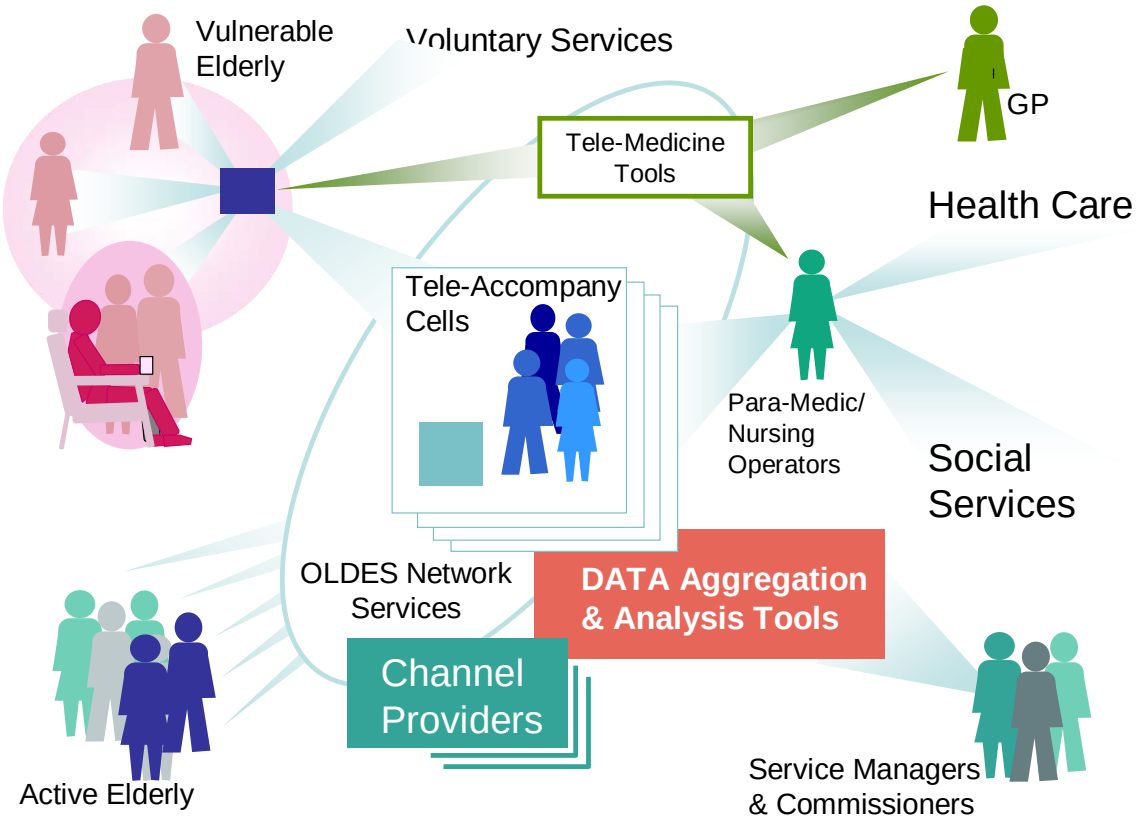

Figure 2: A possible OLDES environment

This figure distinguishes between two groups of older people – the 'vulnerable' and the 'active'. The latter group might be provided with Internet access and VoIP (Voice over Internet Protocol) services as a free post-retirement service and provide a technical infrastructure to support networking and the growth of a culture of mutual support and self-care. The former would have more sophisticated services provided in their home through an individual 'OLDES home hub' that would provide remote and personal contacts. Personal contacts would take place through a tele-accompany cell (a central contact centre, an extension and evolution of a current telephone-based contact facility). The interfaces between the contact centre and medical professionals would be managed through a para-medic/nursing operator who would manage clinical data, filter information and be responsible for things such as activating escalation procedures.

The contact centre would also generate data for service monitoring and planning by the funding and commissioning bodies which would support the need at this level to be able to respond to ever changing demands for data and evidence and the ability to set up new investigations to test as yet unknown hypotheses about the efficiency and effectiveness of new policies and initiatives. Finally, the environment depicts channel content providers the identity of which will be shaped by both social and cultural value as well as financial costs (for example religious foundations who may wish to broadcast church services into older people's homes where they are unable to attend the services themselves). The relationship of content providers with the providers of the core OLDES services and infrastructure will require careful management (for example some content may be objectionable to older people and so forth). This and/or alternative representations will under go several further iterative developments as the in-depth enquiries necessary to flesh out its detail, provenance and acceptability as a framework for developing shared understanding evolves. At the same time, work on the 'solutions' projections will also begin and be informed by and inform this process.

At this stage, we emphasise again, that in the first phase activity reported here the project deliverables have focused upon establishing stakeholder acceptance of the need for an understanding of the OLDES environment, based not on designer's technology driven assumptions, but upon a more in-depth understanding gained through qualitative and ethnographically informed observation of current practices in the user domain. In subsequent phases of the project our intervention activities will focus more on the observation and support of the processes by which the OLDES developments are presented to, explored and evaluated by users and by the various actors in the service delivery networks. The outcomes of these observations will then be incorporated in further versions and elaborations of the demonstrator tool and the visualisations that it allows. This will progressively involve more connections being made to the technical platform and the instruments, resources and content that it supports.

7. Conclusions

Recent developments in internet and related digital technologies offer increasing possibilities for transforming the delivery of care by virtual means. Both medical, healthcare professional groups as well as potential patients are encouraged to make more and better use of the opportunities offered by digital technologies to provide health and social care services by virtual means. This paper has outlined the early results of an ongoing action research intervention in a virtual healthcare project. Our intervention in the project has been based on the principles of socio-technical systems design and in particular the concept of co-production. The intervention is intended to facilitate the development of a system that more purposively fits the everyday practices and needs of older people and the agencies and institutions that provide care services for them. This activity is supported by the deployment of 'demonstrator' tool that supports stakeholders in visualising different socio-technical scenarios for the configuration of virtual services. We have sought to show in the above discussion the potential for this tool to support processes of shared sense making amongst multiple care agencies and institutions in complex care environments. Our belief is that this activity will result in an OLDES system platform for a virtual healthcare system that is more likely to be valued by those whose needs it is intended to serve and those who exercise a duty of care in meeting those needs.

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