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Design and evaluation guidelines for mental health technologies

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ABSTRACT

It is increasingly recognised that technology has the potential to significantly improve access, engagement, effectiveness and affordability of treatment for mental health problems. The development of such technology has recently become the subject of Human–Computer Interaction research. As an emerging area with a unique set of constraints and design concerns, there is a need to establish guidelines which encapsulate the knowledge gained from existing development projects. We present an initial set of design guidelines extracted from the literature and from a series of development projects for software to support mental health interventions. The first group of guidelines pertain to the design process itself, addressing the limitations in access to clients in mental healthcare settings, and strategies for collaborative design with therapists. The second group considers major design factors in the development of these technologies, including therapeutic models, client factors, and privacy. The third group concerns conduct of the evaluation process, and the constraints on evaluating mental healthcare technologies. We motivate and explain these guidelines with reference to concrete design projects and problems.

1. Introduction

Recent research on the use of technology to support mental health has begun to address a range of problems, including access, engagement and affordability. Technology interventions to support mental health can take a number of different forms. Broadly speaking we can distinguish between systems designed for use in prevention of mental illness, standalone computer-based treatment and self-help systems, and systems intended for use in conjunction with face-to-face psychotherapy. Within these contexts of use, systems may be oriented towards monitoring of and self-monitoring by clients, communication (such as computed mediated therapy), delivery of content (for example, psycho-educational video material), and interaction with content (for example, interacting with a virtual reality environment to support controlled exposure treatment for phobia). Content may be pre-existing or client-produced. To date, a range of disorders such as depression, eating disorders and phobias have been targeted using a number of different technologies, including animated agents, 3D gaming, virtual reality, and mobile phones. The space of possible technology interventions is reviewed along with the state of the art in Coyle et al. (2007).

While both the problems addressed and the potential support offered by technology can vary widely, it is nonetheless possible to identify a set of common concerns, values and design factors shared by researchers in this area. Design guidelines have played an important role in Human–Computer Interaction (HCI), with usability inspection methods based on heuristics in widespread use (Nielsen, 1993). At this point, basic design guidelines are well established, with new contributions focussing on particular domains (Gelderblom and Kotz, 2009; Haber and Bailey, 2007; Karkkinen et al., 2008). As a new application area with very distinct concerns, there is a need to establish guidelines for the development of mental health technologies. As (Sutcliffe and Gault, 2004) note, there is a difficulty in deciding which guidelines are applicable as the number of guidelines increases. While they advocate a small number of heuristics as a pragmatic solution, we believe a number of important general guidelines can be useful in considering possibilities from the earliest stages of development. It is particularly important that we make good use of expert-based evaluation strategies in the development of mental health applications, given the problems surrounding access to users, and the ethical issues concerning the evaluation of systems.

This paper provides a series of recommendations and guidelines for the design and evaluation of mental health technologies; it begins with guidelines relating to the design process itself and the techniques most appropriate for use in this area. In Section 3 guidelines which address specific design factors are discussed, and in Section 4 guidelines are presented concerning evaluations of mental health technologies. As well as building on the literature in the area, we draw on our experience of a number of development projects: Personal Investigator (PI) – a therapeutic 3D game; PlayWrite – a content authoring tool for therapeutic games (used to produce a series of 10 therapeutic games); the Mobile Mood

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Diary – a mobile phone (cell-phone) based mood diary; and My Mobile Story – a mobile phone and desktop based system for constructing therapeutic "stories". In selecting the guidelines, consideration has been given to concrete impact, and applicability to a range of different types of mental health intervention. There is a strong case for future work addressing more specific guidelines for specific areas (e.g. monitoring applications to support behaviour change, such as Bojic et al. (2009) and Froehlich et al. (2009)).

2. Design process

Mental health care (MHC) settings place a number of constraints and limitations on the designer, particularly with regard to access to end-users and to evaluations involving users with mental health difficulties (Coyle et al., 2007; Matthews et al., 2008b). Access constraints will vary depending on conditions including the client group and the severity and nature of the difficulties experienced. Client involvement is more likely to be possible with adult clients experiencing mild difficulties. In more sensitive situations involving children and adolescents, or clients experiencing more severe difficulties, restrictions on access become increasingly severe. In many cases access by non-clinical professionals (such as designers) is not possible.

Access constraints have many implications for the direct application of established HCI approaches such as user-centred and participatory design. They affect all stages in a systems development lifecycle and also the specific techniques which can be applied at each stage. For example (Gulliksen et al., 2003) identify 12 key principles for the development of user-centred systems. Whilst principles such as user focus, holistic design, ensuring a professional attitude, and developing a user-centred attitude are applicable, other principles requiring regular access to end-users or regular evaluations in context of use may be less easy to apply directly. Regarding the development lifecycle itself, the framework for design and evaluation of complex health interventions of (Campbell et al., 2000) provides a useful conception of the process distinguishing the preclinical theory phase, the exploratory modelling phase, exploratory trial, randomised controlled trial and long term implementation.

In this section we provide several recommendations relating to how the design process itself can be adapted to suit constraints and requirements inherent to the mental health care domain.

2.1. Design for outcomes

In design projects it is beneficial to set goals and identify outcomes which a system will seek to achieve. These goals can include usability and user experience goals, but in the mental health care domain they will likely also relate to the impact of a new system or intervention on desired therapeutic outcomes. Goals and desired outcomes can help in establishing a design rationale for a project and can provide the metrics against which the success of systems may be measured. We can see this as a type of value-based design (Cockton, 2004), as it puts a focus on the intended benefits of the system.

In identifying desired outcomes it is beneficial to consider two of the key challenges facing mental healthcare services:

(1) The need to greatly increase the capacity of services and provide increasing numbers of people with access to professional support.
(2) The need to improve the outcomes of interventions by improving the effectiveness of treatments and increasing the levels to which clients successfully engage with treatments.

Many outcomes can be targeted which increase the capacity and improve access to services. For example several computer supported cognitive behavioural programmes have been developed in which electronic resources supplement face-to-face contact with therapists (Gega et al., 2004; Marks et al., 2007; Proudfoot et al., 2003; Wright et al., 2002). These systems have been shown to reduce the amount of contact time required by therapists to treat individual clients, thus offering cost savings and the opportunity to increase the capacity of services. They also offer an opportunity to provide increased support in primary care settings, such as general practitioners clinics, reducing the need for referrals to more specialised and expensive services. Systems can also aim to provide clients with increased support in their own homes or using mobile devices, thereby providing clients with greater flexibility in the delivery of services and again offering service providers with an opportunity to save on costs and therapists time.

Writing in 2004, Caspar stated that the use of technology has generally been justified on the basis of increased access, rather than on improvements in the effectiveness and outcomes of treatment (Caspar, 2004). However recent years have witnessed an increase in research aimed at improving the effectiveness and outcomes of services (Coyle et al., 2007). There are several examples of systems which use computer supported outcome monitoring to track outcomes more intensively than has traditionally been the case and seek to support more consistent outcomes and needs-based delivery of services (Percevic et al., 2004). Dependent on the specific nature of an intervention (e.g. the disorder experienced, the intervention methods applied) systems can be developed which aim to support, as well as monitor, specific therapeutic outcomes (e.g. reductions in anxiety levels, improvements in moods, improved coping strategies). As a designer it is therefore important to be aware of specific objectives of different intervention approaches and techniques. Jinks (2000) for example provides a categorisation of a range of eclectic strategies and intervention techniques across different intervention modalities, e.g. role-play, systematic desensitisation and relaxation training can support behaviour change; psychoeducation, cognitive restructuring and cognitive rehearsal can support changes in cognition. It is also possible to identify broad objectives which contribute to the success of a wide range of interventions. For example, the quality of the client–therapist relationship and the degree to which clients engage with treatments play a significant role in the success of interventions (Assay and Lambert, 1999). In developing the computer game Personal Investigator, improved therapeutic relationships and increased client engagement were specific goals for the design process (Coyle and Doherty, 2009). Increased levels of conversation between therapists and clients when PI was used provided a simple measure by which improved relationships could be judged, however more sophisticated instruments such as the working alliance inventory (Horvath and Greenberg, 1989) are also available and provide more robust evidence of improved therapeutic relationships. Other examples of outcomes that might be targeted include improved client self-efficacy, encouragement of increased levels of self-reflection by clients (Sas and Dix, 2009) or designing to support behaviour change (Consolvo et al., 2009; Fogg, 2003).

2.2. Design in collaboration with MHC professionals

While access to intervention settings and to people experiencing mental health difficulties may be limited, the same restraints do not apply to contact with MHC professionals. It is advisable that design teams in mental healthcare settings include both HCI and MHC professionals. It is however important to note that interdisciplinary collaboration is not a strategy without difficulties and the success of collaborative teams cannot be taken for granted. In

discussing the potential of multi-disciplinary teams in other healthcare areas Newell and Gregor (2000) find that they "*can be fraught with difficulties, as they [the team members] come from different backgrounds and have different jargon*". Many mental healthcare professionals have had limited exposure to technology in a work context, and may have genuine and reasonable concerns regarding potential pitfalls of introducing technology into therapeutic practice.

Coyle and Doherty (2009) describe the collaborative approaches applied in the development of the 3D computer game Personal Investigator. Lessons can also be drawn from related healthcare areas (Boyd-Graber et al., 2006; Johnson et al., 2005; Newell et al., 2003; Sainfort et al., 2003). An important lesson is that it is necessary to actively foster and develop a cooperative team. The use of techniques such as role-play and future workshops – discussed in subsequent sections – can contribute to this process. It is also important that the nature of the design process is clearly explained and that clinicians are fully aware of the motivations and methodologies of the design process. Similarly it is important that HCI professionals are aware of the theoretical background and day-to-day practice of mental health professionals. Clearly identifying the objectives of a project is also beneficial. For example, is it a short-term development project or a longer-term research project? In the later case it is beneficial to have research-oriented clinicians on the design team, as this helps to ensure the ethos of the whole team is a research ethos.

Allowing for balanced input from each member of a design team is another essential element of a successful collaborative design process. While clinicians should be actively involved in the design process, this does not mean that they should take a dominant role. While input from healthcare professionals is necessary, it must not come at the expense of input from HCI professionals. Identifying a set of key decision-making criteria covering both HCI and mental health issues (such as engagement, ethics, and considering the day-to-day experience of practicing therapists) can help to ensure that, when key decisions are made, there is an appropriate level of input from each member of the design team. We have previously described how such criteria played a significant role in the development of Personal Investigator (Coyle and Doherty, 2009).

2.3. Adapt the user-centred design process to the MHC setting

While design processes must be adapted to a degree to the specific needs of each development project, a broad framework can be helpful in considering possible design activities and in planning these activities. Existing processes in related areas such as learner centred design (LCD) (Soloway et al., 1994) or assistive technology (Newell et al., 2003) can provide a useful starting point. The LCD process in particular includes a number of stages, including needs-analysis for learners and teachers, selecting pedagogy, support curriculum and evaluating learning outcomes, which have direct analogues within the development of therapeutic systems. At the very least, a collaborative process with therapists is necessary, while a variety of participatory design (PD) techniques can be leveraged for involving therapists. Here we consider some of the techniques that can be used to support an overall collaborative design process.

2.3.1. Background information gathering

Research literature and reports are critical to building up an idea of potential end-users and their likely environments. For example, in designing applications to support adolescent interventions, we have found the British Medical Association's report 'Child and Adolescent Mental Health' to be very helpful. It identifies groups of children and adolescents in the UK that are at an increased risk of suffering mental health problems and describes their likely characteristics and backgrounds (BMA, 2006). Analyzing and reviewing treatment manuals, an approach taken by Bang et al. (2007), can also be useful in identifying characteristics and typical therapeutic settings.

Interviews with therapists help the designer to build up a picture of the user group, the nature of their workload, their environment, and normal working patterns, the therapeutic approaches that they use, and the materials that they work with. They can also provide insight into the client group, their interests, background and challenges facing them in their daily lives. It is recommended that interviews are conducted in situ so that the designer can get a sense of the clinical environment. Muller has written about the benefits of visiting end-users' work space: the environment is easily referenced and work materials are on hand (Muller, 2003; Muller et al., 1995). Surveys can supplement interview studies; they are non-invasive, relatively low overhead and can be used to build up a broad picture of the domain and identify trends. Within our own research, surveys have been used to identify existing therapist uses of technology, and attitudes towards technology.

2.3.2. Future workshops

Future workshops are a PD technique for generating ideas, which can "*involve participants in new perspectives on their work and help to develop new concepts and new initiatives*" (Muller, 2003). They involve critiquing current practice, envisioning the future and implementing movements from present to future (Kensing and Madsen, 1991). As an emerging technology area with many unexplored possibilities, future workshops can be very useful in generating ideas for new mental health technologies. They were employed, with the participation of a group of therapists, in the development of the mobile phone Mood Diary and My Mobile Story. They provided a useful way to develop ideas at an early stage of development, and also helped to establish common ground at the start of the design process.

2.3.3. User-centred design workshops and expert evaluations

Once concrete design options are being explored, there is an opportunity to involve therapists and other stakeholders in the generation and critique of these options. Over the course of the development the focus of these activities will shift from design to review. During early design workshops techniques such as paper prototyping, which are accessible to non-technical professionals can prove useful. At this point it can also be useful to introduce a conceptual model of the design process to therapists, and particularly the notion of rapid prototyping. This can help to head off detailed discussions of low-level design details and keep the sessions moving.

Later in the development, user-centred design workshops can provide a setting in which to begin early evaluations of design concepts. While general purpose usability heuristics can be exploited at this point, there may also be opportunities to make use of more specific frameworks and expert evaluation methods. In particular it is beneficial to choose frameworks which are accessible to both HCI and non-HCI professionals. For example, the Cognitive Dimensions framework (Green, 1989) is intended to address the analysis of visual programming environments, while still being accessible to lay people. The Cognitive Dimensions were applied in early stage evaluations of PlayWrite, to analyse the interfaces used by mental health professionals to create and adapt therapeutic computer games.

2.3.4. Role-play

Role-playing has been used in the design process in other areas to generate new concepts, to test design ideas on potential users and as a technique for designers to help them "*imagine better...*

to empathise better" (Burns et al., 1994). Role-playing is particularly suited to use in mental healthcare, as therapists are comfortable with the approach. In most therapist training, therapists are required to practice role-playing therapeutic sessions (Liddle et al., 1988). Role-plays were used in development of Mobile Mood Diary and My Mobile Story to observe the use of these systems in simulated therapeutic sessions between a therapist and client. Participating therapists are provided with simple role cards, which contain basic character details. For the therapist role, this includes information such as experience of technology, years of experience and their attitude toward technology. For the client roles, it can include elements such as their name, age, mental health difficulty, current mood and attitude to technology. It is recommended that the client role cards be based on realistic client scenarios and, where possible, on actual client cases. These can be local cases, or alternatively derived from the mental health literature.

Simsarian (2003) has described using role-play to debug a system; "*working out, and working through, details of possible scenarios before delivery or implementation*". In this case, 'debugging' the clinical system means that problems related to clinical issues can be identified prior to clinical use and also that the system that emerges fits into the existing work practices of therapists and is appropriate to their technological ability. Role-play can also provide therapists with a safe environment to clarify any issues and to ask questions about technology. It can also help to increase their confidence in using these systems in clinical situations. In this case, as well as helping in the design of new technologies role-play can help to two further important aspects of the design process: development of system protocol and the design of formal training procedures.

2.4. Develop protocol at same time as system, and refine throughout development

In mental healthcare settings it is essential that protocols for use of a system be delivered as well as the system itself. The development of system protocols should therefore form part of the user-centred design process. The protocol should address issues including which client groups a system is suitable for, at what stage of treatment should it be used, how should the system be introduced to the client, how long should the system be used for and under what conditions should use of a system be terminated. Methods for training therapists in the use of a new system should form part of the system protocol. As with many roles in the healthcare area, continued professional development and training activities are an integral part of the working life of therapists. The role-play activities mentioned above can give insight into the issues that training needs to cover. When system are deployed at a later date successful role-play scenarios which therapists can try themselves and recorded examples of role-plays can provide a useful vehicle for training.

We have also found that, while protocol may be provided in electronic form, a printed manual can also be helpful. A printed manual was produced to accompany a game-based cognitive behavioural intervention produced using PlayWrite. The manual closely resembled existing therapeutic workbooks; therapists were very positive about this.

While the initial protocol developed during the user-centred design process provides a starting point, the therapists that first use the system (e.g. in pilot studies) are best placed to further develop and refine the protocol, and so this information needs to be captured and fed forward towards subsequent users.

3. Design recommendations

In this section we examine several design factors found to have a significant influence on the success of applications designed to support mental health interventions. We begin by discussing design factors relating to the two key user groups for intervention technologies – clients and therapists. We then expand our view to consider factors related to the overall context in which mental health interventions occur. Finally we provide several recommendations relating to the nature of systems themselves.

3.1. Design for client users

A common tenet of user-centred design approaches is to know the user. The unique nature of the client group in MHC settings makes it worthwhile to explore this requirement in more detail. Empirical studies aimed at identifying common factors in the success levels of mental health interventions have found that 'client factors' (including a client's strengths and resources and those available in the client's environment) are the single largest contributory factor in determining the success of interventions (Assay and Lambert, 1999). In discussing initial research towards the development of an ontology for the mental healthcare domain (Coyle and Doherty, 2008b) identify elements which may be considered in designing for clients, see Fig. 1.

3.1.1. Design for client engagement

Engagement is critical to building client–therapist relationships and improving client self-efficacy. A quality therapeutic process will seek to actively engage the client's participation, by involving their interests, strengths and ideas. Similarly, designers should seek to develop engaging systems by understanding and building on the interests of client groups. It is however important to stress that designing for engagement in the MHC domain must place the emphasis on engagement with the treatment, rather than on engagement with the technology. There is little point in developing a system which, while deeply engaging for the user, does little to assist in achieving the overall therapeutic objectives. Successful technologies will achieve a balance, whereby an appropriate level of engagement with the technology enhances engagement with the overall therapeutic process (Coyle and Doherty, 2009).

3.1.2. Consider the social and cultural background of the client

Alongside genetic factors, past and current life events and physical illnesses, social and cultural factors are recognised as one of the major contributory factors in the development of mental health disorders. Some of the specific socio-cultural issues which affect mental health include: gender, social class, educational levels, religious or secular assumptions, race and ethnicity.

Clinical evaluations of the therapeutic game Personal Investigator (Coyle and Doherty 2009) highlighted the importance of such issues. Used with appropriate clients PI was found to deliver ben-

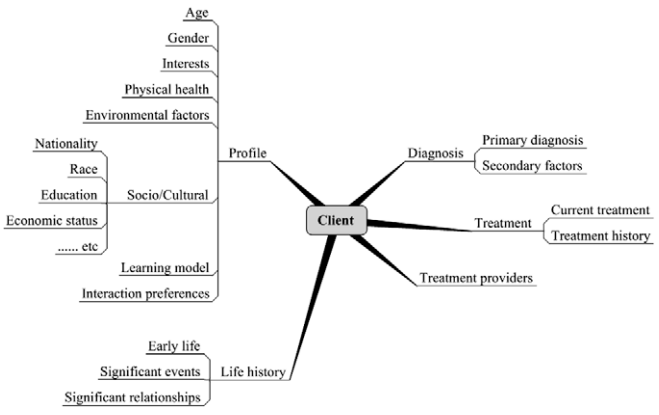

Fig. 1. Client ontology for the MHC domain.

efits including helping to establish effective client–therapist relationships and assisting in improving client engagement. However features such as the appearance of characters and the accent and language used in-game voiceovers, were found the limit the appeal and even make the game unsuitable for use with many adolescent clients. In one case the upper class accent of a character and the use of words such as 'splendid', was identified as potentially off-putting to adolescents from particular urban environments. In another case a policeman character was found to alienate adolescents who had been referred to MHC services through legal systems (e.g. social services or the police). Given the importance of client engagement to intervention outcomes, the impact of design factors which cause alienation is likely to be severe. Conversely the benefits of effectively matching the design and content of systems to the background and experiences of clients are substantial.

3.1.3. Consider clients with learning difficulties

Designers need to carefully consider the possibility that clients experiencing mental health difficulties may also experience learning difficulties. For example, the BMA highlight the high prevalence of literacy difficulties in young people with mental health problems (BMA, 2006). Evaluations of Personal Investigator (Coyle et al., 2009) found that failure to take account of the literacy difficulties of many adolescents experiencing mental health disorders lead to interaction difficulties, due to the game's reliance on on-screen text and text based keyboard input.

3.1.4. Leverage technology familiar to clients

Clients have a multitude of elements competing for their attention outside a session, including television, friends, work/schoolwork, sports and computers (including games). It is beneficial if technology used between sessions is readily available and does not require large amounts of focused attention. Both Mobile Mood Diary and My Mobile Story were designed for clients' personal mobile phones. Clients are more likely to be familiar with how to use their own phone and are consequently less likely to need technical assistance. This also avoids the cost of the clinic providing and maintaining a device for the system.

3.2. Design for therapist users

A broad range of professionals work in the mental health domain including psychiatrists, psychotherapists, social workers and counsellors. Technology is rarely used in day-to-day client work or in therapist training. While most therapists are generally open to the idea of using technology in their practice and optimistic about its potential, they can have significant concerns regarding issues such as personal privacy, added responsibility, the security of information, and the need for technical training. In medical healthcare, professionals are often uncomfortable to find themselves in the role of computer novice (Gosbee and Ritchie, 1997); this is true of therapists also.

3.2.1. Build on existing skills, experience, working methods and values of therapists

A frequent concern for many therapists with any new intervention, and particularly with technological interventions, is how to incorporate them into their current practice. For some systems, which have parallels in paper form, this is not a problem. For example, the Mobile Mood Diary already formed a part (in paper form) of certain forms of therapy. Where possible, it is advised that systems provide a means for therapists to incorporate their existing ways of working and materials. It is particularly important to take into consideration the substantial legacy of paper-based materials in therapy. My Mobile Story was initially designed as an open-ended therapeutic storytelling system. However, it became clear that this would require therapists to put more time into identifying ways to tailor the tool to their way of working. The design was modified to allow therapists to easily incorporate existing paper work sheets into the system, thereby helping them to continue to work with familiar materials in a new medium. Furthermore, seed therapeutic plans are provided which cover accepted therapeutic techniques that most therapists would be familiar with. The plans are provided to help therapists envision how they could introduce and use the system with clients. Using therapeutic plans helped to extend the range of the system by allowing the addition of any number of plans in the future.

3.2.2. Do not place burdensome time demands on therapists

Many therapists have busy work schedules and it is important that technologies do not add to this pressure by placing extra demands on their time. One of the outcomes mentioned above is time savings for therapists, allowing them to deal with more clients. There are numerous aspects to this, including making the system easy to install and configure, and importantly making it easy to switch the system on and pick up from where the discussion halted in the previous session. Making it easy to review the progress of the client to date can help in achieving this goal, and can also have a therapeutic value in itself. Systems should also be easy to put down; supporting this includes providing a number of natural places to stop. This guideline motivates against including any unnecessary or complex features as the benefit from these is unlikely to outweigh the costs in terms of training, and time consumed in the session dealing with these features.

3.2.3. Consider the responsibilities placed on therapists

A particular concern for therapists is that the introduction of a new technology brings greater responsibility and more opportunities for client–therapist contact. For example, some therapists were concerned that the introduction of mobile technology may add to their workload and responsibility by introducing a constant line of communication between them and a client, which they would feel obliged to monitor. The solution to such issues may lie in practice rather than the design of the technology – protocols for the use of systems can help to prevent misunderstandings and ease concerns related to the use of the technology.

3.3. Consider the dynamic of client and therapist together

In 1957 Carl Rogers attempted to identify the '*necessary and sufficient conditions for therapeutic personality change*' (Rogers, 1957). The conditions identified focused on the therapeutic relationship between therapists and clients. The three most significant can be summarised as follows:

- The therapist maintains unconditional positive regard for the client, that is, a positive, non-judgemental and accepting attitude.
- The therapist attempts to gain an emphatic understanding of the client's view of the world and to communicate that understanding.
- Therapists must be congruent or genuine within the relationship, that is, what they do and say reflects their personality and attitude and is not put onto influence clients.

Rogers posited that the healing effects of therapy occur through the client experiencing an emphatic, non-judgemental, positive and accepting relationship that frees them to achieve greater self-acceptance and congruence.

Although modern research suggests that an empowering relationship is not in and of itself sufficient for achieving positive change, the central importance of effective client–therapist rela-

tionships is now recognised in most intervention theories. While different theoretical approaches favour differing styles of client–therapist relationship – e.g. person-centred therapy is largely non-directive whereas CBT favours an active-directive approach, outcome focused research has demonstrated the importance of effective therapeutic relationships across theoretical models (Assay et al., 1999).

It is therefore essential that designers working in this area are aware of the importance of the client–therapist relationship. Systems which help to establish, maintain or enhance client–therapist relationship are likely to prove highly beneficial. At the very least it is necessary that systems do not have a detrimental effect on this relationship. Improvements in client–therapist relationships was a key outcome targeted in the development of Personal Investigator. The game is not a therapeutic tool in and of itself, rather, when used in clinical sessions, it assists in raising issues and helps in creating a context for more detailed conversations between therapists and clients. Evaluations suggest that the game can serve as a useful ice-breaker in the early stages of relationship building and can then help in maintaining relationships and client engagement, a concrete example of which was the increased levels of conversation between therapists and clients.

Support for client–therapist relationships was also a key objective in the design of the Mobile Mood Diary. While mood information is collected between clinical sessions using a mobile phone, the system includes an online charting feature for reviewing collected mood recordings. In sessions the client and therapist can view this information together, creating a context further conversation. The Mobile Mood Diary raised several examples of issues which impact on the client–therapist relationship. For example the online charting feature is accessed via a secure login. The question arose of who should control this login. In the case of the Mood Diary it was decided that the client would control access, and would login to the system to share information with the therapist at the session.

This is one example of the type of agreement or 'contract' that often exists between clients and therapists in mental health interventions. Therapeutic contracts assist in setting the bounds of a therapeutic process and establishing the responsibilities of both therapists and clients. Dependent on the nature of the intervention such contracts may be more or less explicitly stated, but in most cases they represent an understanding jointly agreed between the therapist and client. Design decisions which affect the therapeutic contract should be carefully considered, and made clearly visible to both the therapist and client.

3.4. Consider the requirements and traditions of mental healthcare settings

The preceding sections have focused on the key participants of a mental health intervention. In this section we expand on these considerations and discuss guidelines relevant to the broader context in which mental health interventions occur.

3.4.1. Adhere to international and local ethical requirements

Mental healthcare settings have well developed and rigorously applied ethical guidelines. These guidelines incorporate the recommendations of major international medical guidelines such as the Declaration of Helsinki (World Medical Association, 1964–2004) and Declaration of Geneva (World Medical Association, 1949–2006), but are also expanded to take specific consideration of mental healthcare settings, see for example Roberts and Dyer (2004). A more detailed discussion of these guidelines is beyond the scope of this paper, however it is important to note that designers should familiarize themselves with the relevant national and international guidelines on ethics and ensure that design decisions made in developing systems do not contradict such guidelines.

3.4.2. Build on accepted theoretical models of mental health care

In order to ensure that systems have clinical validity, it is recommended that they are based on accepted theoretical approaches to MHC (Coyle et al., 2007). While Kazdin has estimated that there are at least 550 different types of therapies (Kazdin, 2000), there are only a handful of 'major schools' and in practice most therapists take an eclectic approach using techniques from different therapies. Roth urges caution when trying to determine whether one therapeutic approach is better than another because this could "obscure the importance of common factors that operate across all therapies, such as the contribution of the therapeutic alliance or therapist skillfulness and competence" (Roth, 2006).

3.4.3. Make it clear that data is secure

Respect for clients' privacy is a critical requirement for all mental healthcare interventions. It is therefore essential that systems must be secure, and also perceived to be secure. Measures such as using a Personal Identification Number (PIN) or password to access client data are helpful in increasing the confidence of the client in the security of the data, particularly if the client rather than the therapist logs into access their data. A security PIN was added to the Mood Diary application in response to client concerns. Likewise for systems which are used outside of the therapy session, it can be helpful to give the client control over when data is sent.

A related aspect is privacy – systems should allow discreet use of the system where possible, and for example should not use audio without warning. Within evaluations of the Mood Diary, the title of the application was changed from "Mood Diary" with an emoticon-style icon, to "MD" without an icon as some clients were concerned about others finding the application on their phone. Another recommendation impacting on privacy is to avoid incorporating client-identifying data into the interface whenever possible – for example the online mood diary graph screens do not include the user's personal details. For safety reasons, it may be desirable to include some non-identifying username to reduce the risk of confusing one client's data with another.

3.5. Make the system adaptable and sustainable

Adaptability has been identified as a key design requirement for new technologies in the MHC area (Botella et al., 2006; Coyle and Doherty, 2009; Coyle et al., 2007; Riva and Gaggioli, 2008). Therapists, particularly in public health care services, are required to work with a broad variety of clients, from a broad variety of socio-cultural backgrounds, and experiencing a broad range of disorders of varying degrees of severity.

The impact of small design and socio-cultural details on the usefulness of PI has been noted in Section 3.1.2. It is however important to note that the issues identified in PI were not critical to overall operation of the game, nor were they critical to the new form of interaction which the game enabled between therapists and clients (Coyle and Doherty, 2009). The strength of PI lay not in its use of specific characters or conversations. It lay in the game's ability to create a context for more detailed therapeutic conversations between therapists and clients. It is recommended that rather than producing a fixed game, or indeed any other fixed system, a better approach is to produce games which can be adapted to suit the needs of various client groups.

Alongside adaptation to suit the needs of clients, further forms of adaptation are also desirable. Teams of therapists often have different theoretical backgrounds, and often adopt a variety of eclectic approaches to working with clients. For example, evaluations suggested that the use of solution focused therapy in PI had the po-

tential to make the game unsuitable for therapists not trained in this approach.

It is suggested that for technologies to be of practical use in a broad range of interventions, they should ideally be adaptable to a range of theoretical approaches, disorders, client groups, and the needs of individual clients. This approach was applied in the development of PlayWrite, a flexible game authoring system that allows mental healthcare professionals to create and adapt games that can then be used with a broad variety of clients (Coyle and Doherty, 2008a).

3.6. Provide flexibility in the delivery of support

The preferences and circumstances of clients will vary, for example some may have limited cell-phone coverage or internet access. The designer should consider providing clients with multiple ways of accessing materials/provide flexibility in the delivery of services. In a survey of teenage peers, we found that while 85% would prefer to use their mobile phone for diaries, 15% would prefer alternatives such as paper. Preferences are subject to change – one therapist reported that her "*client reported wanting to avoid her phone when she felt in a low mood*". Another issue encountered concerned clients who lived in remote areas where there was no access to a mobile network. For the Mood Diary, entries could be made online as well as via the mobile phone.

While technologies to be used within the therapy session are an obvious place to start, it is also worth considering possibilities for providing support to clients between face-to-face sessions. This may be fully standalone support, activities which feed into the face-to-face sessions, or computer-mediated communication with a therapist. Flexibility in supporting clients making initial contact with services is particularly important, given the stigma which prevents many people in need of help from making contact; technology can be particularly beneficial in this circumstance as a more anonymous means of communicating with a service provider.

3.7. Make the system tangible

It can be helpful to provide concrete artefacts which can be used for discussion throughout the therapeutic process. The designer should consider providing these in the form of print-outs of key information. For example PI and other games produced using PlayWrite include an in-game notebook in which players answer questions and keep a record of ideas discussed during the game. This notebook can be printed out at any point during the game, providing a tangible record of success in the game and also a useful starting point for further reflection and conversation with a therapist. Similarly the online interface for the Mobile Mood Diary includes a printing option. In one clinical case weekly mood charts were taped together and, with the clients permission, were used as a key part of discussions with the client, parent and collaborating psychiatrist.

4. Evaluation

In this section we provide several distinct recommendations regarding the evaluation of new technologies in mental healthcare settings. We consider issues relating to both formative and summative evaluations, and the likely progression between the two.

4.1. Acquire ethical approval for all evaluations

The issue of adherence to ethical guidelines has already been noted in Section 3.4.1. In the context of evaluations in this domain it is important to emphasise that appropriate ethical clearance must be received prior to any studies. In relation to ethical clearance, the Declaration of Helsinki states that proposed studies "*should be submitted for consideration, comment, guidance, and where appropriate, approval to a specially appointed ethical review committee, which must be independent of the investigator, the sponsor or any other kind of undue influence*". The nature of the ethical review required is likely to vary dependant on the nature of the evaluation being proposed; will it focus on usability testing with a non-clinical population, or will it involve use of a system in clinical practice? The next section of this paper discusses the use of a staged evaluation strategy. When such a strategy is used the results of early non-clinical evaluations – e.g. to demonstrate the usability of a system – will likely feed into the review process for later clinical evaluations.

Alongside considering the readiness of a system itself, an ethical review committee will also consider the procedures that have been put in place to deal with unforeseen risk. For example privacy has been highlighted as a critical consideration in designing for mental healthcare settings. For clinical studies a plan for dealing with a privacy breach should be put in place; existing privacy breach guidelines for clinical studies are a useful resource in formulating such a plan, see OPCC (2007) for example. Particular care should be taken with novel or unusual technologies (even high end mobile phones), as they may attract attention and risk compromising the privacy of the client.

4.2. Evaluate in several distinct stages

Mental health interventions have been identified as examples of complex healthcare interventions – interventions involving several components and interconnected parts. Previous research in medical settings has highlighted the need for step-by-step or phased approaches to evaluating such interventions (Campbell et al., 2000). While the ultimate aim in evaluating a new technology or intervention approach may be to conduct randomised controlled trials, there are several distinct stages of evaluation to be considered before this stage.

Early stage evaluations are likely to be non-clinical. They can be conducted by experts and can consider issues including the fit with mental healthcare theory and therapeutic practice, contribution towards useful therapeutic outcomes and initial HCI issues. Once a concrete prototype is available for testing, initial evaluations may focus on usability issues, making use of peer users (see Section 4.2). Subsequent testing will move onto issues such as engagement and adherence. Again peer users may be used. The aim of early evaluations is to improve the usability of new technologies and build confidence in their therapeutic validity. This approach parallels the approach suggested in learner centred design, where evaluations focus on validating both usability and learning outcomes.

Prior to conducting larger scale clinical studies it is beneficial to first conduct smaller pilot studies. Clinical pilots will provide initial indications of the clinical impact of new systems and will also provide the answers to questions regarding the fit of the technology to the setting and to the needs of the client group.

For systems which aim to improve therapeutic outcomes to a significant degree and gain wide scale acceptance, it will ultimately be necessary to conduct larger scale formal clinical evaluations, such as randomised controlled trials (RCTs). Such trails are likely to require substantial commitments of time and resources and should only be undertaken when there is sufficient early evidence of the therapeutic effectiveness of a new system or intervention. Prior to beginning a large scale study, and before submitting an ethics request for the study, it is necessary to have a completed version of a system in place, which cannot then vary over the course of the study. A staged evaluation process, including pilot clinical studies, can help to provide the necessary evidence for longer term studies. It also minimises the possibility of costly failure due to unexpected clinical factors or HCI issues (e.g. usability difficulties).

It is important to note at this point that the progress of complex interventions through a staged evaluation progress is unlikely to be entirely linear. At each stage of an evaluation process it is likely that issues will be identified that require further iterations of design and potentially a step back to early stage evaluation techniques. Even at the stage of large scale clinical evaluations or RCTs it is important to continue the process of collecting data, not just on the success of a system at achieving therapeutic outcomes, but also on issues related to usability and users experience. Clinical questionnaires are an integral part of any formal MHC study, and can potentially provide a rich source of information of a kind which would be very difficult to obtain under normal circumstances; for example measures of the therapeutic alliance between client and therapist can be useful in obtaining insight into the effect of the technology on therapeutic relationships. Detailed information of such issues can feed into subsequent versions of an application or future design projects.

4.3. Evaluate with peer users

Evaluating with non-clinical peer users can help to understand the client factors which impact on the engagement and usability of the system. Non-aphasic individuals were used to identify usability issues by Moffatt et al. (2004), who concluded that some usability problems were common to all users. It can also be argued that it is not ethically sound to evaluate software, which might have significant usability problems, on clients who have come solely for treatment. When dealing with clients from a particular background, we can obtain a further benefit from conducting trials with users who are close in age, education, social background and interests to the target users. It is possible to complete evaluations with peer users relatively quickly and apply a more iterative approach. Having a safer situation to fail in also allows for more experimentation.

Running usability trials of initial prototypes with peer users has helped us to identify usability problems and provided feedback on designs through direct observation and dialogue. Peer trials have been used at a later stage of development to help evaluate the suitability, viability and appeal of systems in realistic contexts (Matthews et al., 2008a). One benefit of this type of evaluation is that it can provide evidence that the system is engaging and is suitable for clinical use. Peer evaluations of My Mobile Diary compared existing methods of recording mood information with a new mobile phone system. A large, and statistically significant effect was found for improved compliance, providing a strong case for proceeding to clinical evaluation (Matthews et al., 2008b).

One issue with peer-user evaluations is that some applications and content may not be meaningful or appropriate for a more general population. For peer-user evaluations of My Mobile Story peer users were provided with a more generic "Mobile Reporter" template, which they used to create non-therapeutic stories. The existing formats, such as the "Thoughts, Feelings and Behaviours" template which was developed to support a CBT intervention, would not be appropriate for peer users.

In their evaluation of the usability of an interface used by therapists to control a client's virtual environment (Gunawan et al., 2004) made use of a combination of therapists and students who were trained as therapists for the purpose of the experiment. Another option could be to evaluate systems for therapist use with trainee therapists. Each of these approaches could be an effective method to overcome difficulties with accessing therapists for long period of time.

4.4. Use the therapist as proxy

While access by the designer may be limited, the therapist is likely to have extensive contact with the client, they can provide informal feedback in terms of problems and impressions of the system, debrief interviews, anonymised case reports (as commonly used in the MHC research literature), and questionnaires. As mentioned above, introducing the concept of the design process to the therapist can be useful, as it will help them to understand the importance of this information and feedback to the designer. In the context of a MHC research study, questions of interest to the designer can also be incorporated into the study protocol.

Formal mental health evaluations make heavy use of questionnaires, and can provide an opportunity to receive useful feedback from clients. While issues such as literacy may impact on the application of questionnaires, they provide a key opportunity to hear from the client, particularly if there are some open questions which allow the client to respond in their own words. With the Personal Investigator game, client questionnaires were administered before and after clinical use of the technology. As well as formal questionnaires, which a therapist might not always feel is appropriate, the designer may agree with the therapist a list of issues to be discussed with the client in a debriefing session after use of a technology.

While telephone debrief interviews with therapists were used to good effect in the evaluation of My Mobile Story; there are limitations to this approach; while therapists can provide valuable insight on clinical issues, it may be more difficult for them to pick up on subtle interaction problems.

4.5. Evaluate in clinical practice

According to Kazdin, "*the ways in which psychotherapy is studied depart considerably from how treatment is implemented in clinical practice*" (Kazdin, 2003). He recommends that research should be undertaken in full consideration of the practicalities of day-to-day practice. Formal clinical trials in mental health generally take the form of RCTs. Formal trials are conducted in more tightly constrained situations than everyday practice, the interventions are more structured, with many exclusions (symptoms too mild or too severe), and minimal co-morbidity. They also make heavy use of monitoring in the form of clinical questionnaires, which themselves constitute an intervention. Although formal trials measuring outcomes are important once a final system has been produced, much can be learned from evaluating systems with practicing therapists in day-to-day clinical practice. While this raises logistical issues, the benefit is that we have a greater chance of generating useful design inputs, which have a degree of real-world validity. It is also important that clinical evaluations should consider factors of significance to the therapist as well as the client, for example is the system taking up too much of the therapists time?

4.6. Exploit application logging

Therapist feedback from clinical sessions tends to focus on the impact of the technology from a therapeutic perspective. Application logging can provide low-level client interaction information that would otherwise not be possible to capture. In situ logging has been used recently as a research tool on mobile devices to help capture contextual user experiences (Froehlich et al., 2007). The clinical pilot of Mobile Mood Diary provided an indication of the potential of even relatively sparse logging information. Application logs showed clients opening the diary without making entries, and also opening the diary, and recording entry a significant period of time later. Both of these cases suggest that the clients take the time to view (and perhaps reflect upon) diary entries. As mobile devices become more powerful, it will be possible to record more detailed interaction information without any perceivable performance impact on the system.

As long as it is done sensitively, with the awareness and consent of the client, the logging of client interactions can provide the designer with contact-free interaction feedback. Such data offers a glimpse into the clinic and the client's world, and encourages a degree of empathy with the client; for example, mood diary data may reflect a client having difficulty coping.

4.7. Explore declined and unsuccessful cases

Attitudes to technology and perceptions of the system as described to clients are important; the designer may glean valuable information from cases where the client chooses not to participate. In a number of cases, the Mood Diary was declined by clients who were concerned that their friends would find the application on the phone, even though it was protected by a PIN. This gives insight into the level of stigma and the concerns of clients regarding their privacy. The problems with the socio-cultural factors which made PI unsuitable for use with some clients shows how these cases can also help to identify the factors influencing the usefulness of the system. As an aside, it would be helpful if such practical problems were reported more often in the literature, as it is helpful to others to anticipate and counter the impact of such factors in design.

5. Discussion

In the sections above, we have drawn together lessons learned from a number of development projects which have reached the point of clinical evaluation. It is likely that this set of guidelines will be extended in the coming years as more systems are developed and as technology becomes more widely used in therapeutic practice. It is also important to recognize that technology may well have a profound effect on therapeutic practice, particularly in the context of large-scale service providers. The variety of working practices, disorders, cultural and social factors influencing the design of a particular application makes it difficult if not impossible to come up with a canonical set of guidelines which applies to all applications in the area. While this may motivate the development of more specific guidelines to cover particular types of application (e.g. virtual reality treatments for phobias), and particular disorders, it also motivates the type of process-oriented guidelines presented in Sections 2 and 4 above. We see these guidelines as formative rather than prescriptive; while they flag important design concerns and can be used to review a design, they can just as easily be used to generate new ideas and spur innovative responses to issues such as privacy, security, tangibility and engagement.

In terms of the scope of the guidelines, many are relevant to a range of systems including prevention and standalone systems, however there is clearly a focus on interventions involving a therapist, as this is the service delivery model for most providers. In terms of system capabilities, the guidelines are relevant to systems including monitoring, interaction, and content delivery. While the guidelines touch on the issue of communication, further research on the impact and opportunities for computer-mediated communication in mental health is needed, and there is certainly scope for more specific guidelines concerning this aspect of mental health technology. In discussing the coverage of proposed guidelines, it is worthwhile considering the available frameworks for reasoning about this issue. Potential frameworks can be drawn from both mental health and HCI theory. Candidates include the skilled helped model (Egan, 2002), behaviour change models such as the trans-theoretical model (TTM) (Prochaska and Velicer, 1997) and activity theory (AT) (Engström, 1995), which has previously been applied to a range of healthcare settings. Both skilled helper and TTM have a focus on the client and outcomes, which are covered by the guidelines. However they also take a staged view of change, which is not explored above, and which might be fruitful to consider. While a full AT analysis of this setting would be a substantial undertaking and beyond the scope of this paper, it is worth briefly considering what such an analysis might yield. From an AT perspective, we see that several guidelines relate to the subject, object, artifact and outcome, but we also have those which touch upon the division of labour between client and therapists, and the rules within which the therapeutic activities are conducted. The guidelines do not focus on the community element (beyond involving stakeholders) and there may be an opportunity to consider the community element in greater detail. This would be particularly important for a group therapy context, which at the moment has seen little application of technology, and for mental wellness technology, which is a promising area for future development.

As the number of applications increases, it may be worthwhile to extract more concrete design heuristics to facilitate usability inspection later in the design process. Such guidelines would also be amenable to a formal study of their effectiveness in identifying usability problems in a given design, as found in Hvannberg et al. (2007) for example.

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