keynote article

The potential of internet-delivered behaviour change interventions

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The Internet is set to play a crucial role in the delivery and evaluation of behaviour change interventions in the near future. Behavioural interventions—packages of advice and support for behaviour change—have traditionally been delivered principally face-to-face, and this continues to be the overwhelmingly dominant method of delivery, whether by therapists, teachers, coaches or other professionals. A major problem with this mode of delivery is that it is extremely resource intensive, severely limiting the scope for cost-effective interventions; clearly, it is not feasible to provide every individual with 24 hour access to personal advice and support for managing all aspects of their lives. In contrast, internet-based behavioural interventions can be made available to most of the population for little more than the cost of development (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006). Whereas the quantity and timing of information, advice and support that can be delivered face-to-face is very restricted, internet-based behavioural interventions can be accessible at all times and provide extensive and intensive advice and support. Currently delivered principally by PCs, digital interventions will increasingly be flexibly accessible through mobile phones, interactive digital TV etc.

The 'motivational' dimension of interventions involves providing relevant information, advice, education and decisional aids in order to promote knowledge, beliefs, attitudes and intentions consistent with the desired behaviour. Interactive internet-based behavioural interventions can provide information and advice specifically 'tailored' to address the particular situation, concerns, beliefs and preferences of the individual, and may therefore be more persuasive than generic printed information. Additionally, a 'volitional' dimension is often vital in order to help people translate good intentions into behaviour. Consequently, effective internet-based interventions provide a variety of techniques to support and sustain behaviour change, such as aids to goal-setting, planning and self-monitoring, skill and confidence-building, cues and reminders, and systems of incentive and social support (Webb, Joseph, Yardley, & Michie, 2010). Interactive internet-based behavioural interventions can provide a rich, stimulating, engaging and actively supportive environment, with audiovisual illustrations, reminders, personalised feedback regarding progress and concerns, and opportunities for peer-to-peer support and comparison (Danaher, Boles, Akers, Gordon, & Severson, 2006; Kerr, Murray, Stevenson, Gore, & Nazareth, 2006). Supporting long-term maintenance of desirable behaviour changes is a major problem that has not yet been solved. Internet-based behavioural interventions may for the first time offer a cost-effective means of providing long-term support.

How *you* can create internet-delivered interventions: the LifeGuide

Until very recently, it has been necessary to programme the software infrastructure for each intervention individually. This has restricted the number of interventions that can be developed and evaluated, thereby limiting the accumulation of knowledge about intervention effective-

ness, and the relative effectiveness of intervention components and the causal mechanisms on which they are based. Using this traditional development method, the initial development costs are typically greater for digital interventions than for traditionally delivered interventions, and once programmed they cannot easily be modified, acting as a barrier to innovation and enhancement of interventions. Lack of access to resources for programming interventions has also restricted the numbers of researchers that have been able to engage in developing and testing digital interventions, and in particular has made it more difficult for postgraduate students and junior researchers to engage in this type of research. Commercial software packages have been developed recently that allow professional users some scope to enter the content for the particular intervention that they wish to create, but these restrict the researcher to those components pre-selected by the developers, and do not offer the research community the crucial advantages of free access and the ability to innovate methods and integrate findings.

Since the essential components, functions and underlying infrastructure required for Internet interventions are common to a vast range of applications, it makes sense to develop an open-access set of shared software resources that researchers can use to easily create and modify different interventions themselves. For this reason we have developed the LifeGuide, which is a set of open source software resources designed to allow people with no programming skills to create interactive digital interventions themselves. The LifeGuide is embedded in a virtual research environment that provides the research community with facilities to collaboratively devise complex interventions, with immediate access to components that have been validated in previous LifeGuide projects, that can then be utilised in new applications (copied and modified as necessary, and only with permission of the authors). The research community can then work together to rapidly recruit participants from geographically dispersed locations, and integrate the data to form very large data-sets that can be used to carry out more powerful analyses than have hitherto been possible, such as mediator and moderator analyses of intervention effects.

As Internet interventions become very widely used in many spheres of life, this platform could in the future provide the basis for national and international 'population laboratories' for the continuous further refinement of interventions. Ultimately, a semantically enriched and adaptive LifeGuide system should be able to continuously and semi-autonomously model and refine interventions, based on the preferences and outcomes of lay users. We also plan to ensure that LifeGuide interventions can interface with existing medical systems (e.g. patient records), and with remote monitoring devices (e.g. monitoring blood glucose levels, physical activity, heart functioning etc.), and can be delivered via a range of digital media (e.g. mobile phone, television).

The LifeGuide: where we are now

We have used a co-design approach to ensure that the LifeGuide offers the flexibility needed to deliver a very wide range of interventions with different formats and ingredients, and is sufficiently user-friendly that novice researchers can readily use it to develop interventions, with the aid of the basic online manual and demos we have also developed. LifeGuide interventions can include features for: creating questionnaires and quizzes; delivering advice tailored to the individual based on their responses to questions; adding images and videos; monitoring users' progress over time; sending automated emails and texts (e.g. for sending reminders, motivational messages and feedback on progress). Intervention authors create their own 'look and feel' for the intervention, using templates and a flexible

drag and drop interface to alter background, layout, font, colours etc. LifeGuide is designed to run experimental evaluations (typically randomised controlled trials of interventions), and authors can create interventions that create user accounts and automatically stratify, randomise and follow-up participants. All data (including user inputted data and which pages were viewed by the user for how long and in which order) are securely stored in encrypted form and can be exported to Excel. To future-proof the LifeGuide we have adopted open standards that are technology independent, facilitating easy updating.

An international network of nearly 500 researchers has been recruited through our workshops, demonstrations and website. Some of these researchers are independently developing their own interventions, others are collaborating with us in evaluating and developing the LifeGuide by applying it to a range of very different health problems. Examples of interventions that are already being developed and trialled using LifeGuide include: interventions to provide people suffering from common conditions (e.g. colds and flu, bowel symptoms) with tailored advice that enables them to cope with their symptoms; a twelve session eating and physical activity programme for obese people seeking to lose weight; an intervention to promote and support hygienic behaviour to reduce the spread of infection, especially during pandemic flu; an NHS e-learning and assessment programme that has been used by thousands of smoking cessation trainers nationally and a web-based smoking cessation programme; an eight session cognitive-behavioural programme for people with irritable bowel syndrome; and an intervention to support people who have just had a stroke to carry out rehabilitation in their own home. The first (beta) version of the LifeGuide software was only released in January 2010 and so there are not yet many published evaluations of LifeGuide interventions, but early accounts of successfully piloting these interventions are now starting to appear (Miller, Yardley, & Little, 2011; Yardley, Morrison, Andreou, Joseph, & Little, 2010; Yardley et al., 2010), and large-scale trials are underway.

Our hope is that LifeGuide will not only provide a tool for developing interventions, but will also support and encourage more productive collaboration and prove a catalyst to more rapid advances in the science and practice of technology-supported behaviour change. More details of LifeGuide and how you can access it can be found at: www.lifeguideonline.org

The future: UBhave

The next phase of research and software co-design to be led by the LifeGuide team is UBhave, a three year collaboration commencing autumn 2011. UBhave will build on three existing programmes of work: the LifeGuide; EmotionSense, a pioneering system created at University of Cambridge for using phones to collect real-time data about phone users' social activities, contexts, locations, and emotional states; and MyPersonality, a Facebook application in which 3 million users have already completed psychological surveys.

Previously, digital behaviour change interventions have mainly been delivered by PCs and provide advice based on users' answers to questions about their past or future activities and feelings. Our aim is to investigate how mobile phone technology and online social networking applications can gather this kind of information during daily life without the need for users to answer questions. Mobile phones can sense the user's activities, mood, location, and who they are with or talking to, while online social networks can provide information about users' attitudes and social contacts. This information can then be used to deliver exactly the right kind of messages to users at the right time, depending

on what the user is doing and feeling. We will demonstrate and experimentally test the capabilities, performance and effectiveness of our tools and techniques by developing a range of intervention components designed to address the major public health problem of weight management. We will investigate the use of Facebook to recruit very large samples of people to try these intervention components, and will examine how social networking data can be integrated with the data sensed by phones and used to create a supportive virtual community.

Clearly, this kind of intervention raises important issues about privacy and intrusiveness, and from the start we will work closely with users to develop ethical, acceptable and practical methods of phone-based measurement and behavioural intervention. Finally, we will start to develop new methods to analyse the vast amount of information we will be gathering across time and space from a very large number of people. We will also have a programme of activities for disseminating the tools we are developing for immediate use by the public, private and third sector for different types of behaviour change—so we hope that our current network of LifeGuide researchers will soon become enthusiastic members of the UBhave network too.

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