Digital Therapy: The Coming Together of Psychology and Technology Can Create a New Generation of Programs for More Sustainable Behavioral Change

Pål Kraft[1], Harald Schjelderup-Lund[2], and Håvar Brendryen[1]

[1,2] Department of Psychology, University of Oslo, P.O. Box 1094 Blindern, 0317, Norway
[2] Changetech AS, Gaustadallèen 21, 0349 Oslo, Norway
pal.kraft@psykologi.uio.no

Abstract. By mapping critical psychological processes involved in an attempt at behavioral change, we can design digital programs to deliver specific cognitive therapy at the right moments, increasing the probability of successful behavioral change in a variety of domains. This breakthrough, named Digital Therapy, has been proven in random clinical trials to be a cost-effective way for people to achieve lasting behavioral change, with the help of modern psychological science, but without seeing a therapist.

Keywords: Digital Therapy, Digital Therapy Developer, Behavior Change, Chronology of Change, Self-Regulation, Cognitive Therapy.

1 Introduction

When people try to quit smoking, drink less, lose weight, exercise more, adhere to their medication, and other such behavioral modifications, the outcome is dependent on a series of psychological processes. Many people fail to maintain the change long term because they are incapable of managing these processes. Changetech is a company that is staffed by experts in psychology, technology and communications, and which collaborates closely with the University of Oslo. By combining modern cognitive therapy with the latest tools for interactive digital communication, Changetech has developed a brand new method to design more effective behavior change programs. This method is called Digital Therapy, and it represents the coming together of psychology and technology. The programs designed represent a breakthrough within the area of behavioral change, and allow people to benefit from the efficacy of modern psychological therapy, without seeing a therapist.

Changetech has developed a construction tool called Digital Therapy Developer (DTD). DTD was constructed to make it possible to design behavioral change programs on an industrial scale. DTD consists of a development unit and an operating unit that interacts with a technological platform used by the program owner to distribute the program. The main advantages of the DTD are as follows.

- It allows a more structured and shorter planning period.
- People with little domain knowledge can develop programs.

Y. de Kort et al. (Eds.): PERSUASIVE 2007, LNCS 4744, pp. 18–23, 2007.

- A shorter overall production time is needed.
- The development tools are directly linked with end-user technological platforms.
- All developments are made on the same development platform.

With Digital Therapy from Changetech based on the mapping of psychological processes and their chronology, people can get day-by-day therapy throughout the behavioral change period. This method can be used in a variety of fields where people need to change their behavior. This can be at their own initiative, such as weight reduction, stopping smoking, alcohol reduction and so on, but also in areas where behavioral change is recommended for medical or psychological reasons such as elevated levels of cholesterol, diabetes, asthma and after heart or cancer surgery.

2 The "Psychological Chronology" of Self- and Behavioral Change

Large proportions of the population are motivated to stop smoking, lose weight, get more physically active, control their drinking, stop gambling, and to pursue other such changes in behavior. In psychological terms, people often have the intention to change [1]. However, motivation or good intentions do not by themselves guarantee long-term goal attainment. On the contrary, intentions to change one's lifestyle are seldom successful [2]. Going from motivation to long-term change requires that one enters a volitional phase in which the intended change must be planned, initiated and maintained [3]. Whereas attempting to change requires motivation, staying on track requires self-regulation [4]. The inability to maintain the new behavior represents a self-regulation failure, i.e., an inability to exert self-control and acting in a way that runs counter to the person's long-term goals. In short, all successful change needs two ingredients: motivation and self-regulation. While motivation is more important early and late in a change attempt, i.e., in the deliberative states, self-regulation is a key factor in the volitional states of the change chronology. This is where technology and psychology have the possibility of coming together in e-Health interventions. In fact, there is an extremely promising fit between the multifaceted successful change process and characteristics of digital media (e.g., interactivity, individualization, presence and availability, persistence, reduction, tunneling, etc.). For an overview, see [5].

It takes time to change one's habits or personal characteristics. For example, people who quit smoking are at substantial risk of relapse for at least one year after quitting. However, the magnitude and nature of the relapse forces vary considerably along the timeline of the change attempt. Hence, stopping smoking (and the same goes for every change process) has a certain "psychological chronology", i.e., the timeline of the change is characterized by different psychological processes having varying importance throughout the change process. In fact, many self- and behavioral change processes to some extent reflect a generic core of "psychological processes", e.g., losing weight, coping with a disease, or recovering from depression. Albeit each type of change has a unique psychological make up (and there are individual variations within one type of change as well), many changes also seem to share some core characteristics as far as the "psychological chronology" of the change is

concerned. Thus, over different types of changes some psychological processes, i.e., predictors of successful goal attainment, seem to be more important relatively early in the change sequence, while other processes or predictors seem to be more important later in the change sequence. This is exactly what is reflected in many of the "change" and "phase" models of behavioral change that have been proposed in social- and health psychology during the past few decades, and this insight allows us to model the psychological chronology of the core ingredients of successful behavioral change.

In essence, personalized, interactive, digital media makes tailoring and individualization possible, that is, by providing information relevant to the phase of the change process that the individual client is in. Individualization can be achieved by designing a program that reflects the "psychological chronology" of the change timeline, but also by including feedback systems to ensure individualization of the change program. By collecting information throughout the change process, individualization is made possible. Hence, the amount of information, help and support that the client receives can be reduced and be more focused to the specific needs of the client. In other words, one can capitalize on the principle of reduction [5]. Reduction technologies make target behaviors easier to achieve by breaking a complex activity into more manageable steps, and providing only task-relevant pieces of information. For example, complex goals may be broken down into specific subgoals or behaviors that may foster successful goal attainment. Additionally, and perhaps more importantly, the reduction implies that the information that the client needs during the change process is broken down into chunks that are presented to the client at the relevant time, stage, phase or even situation in the change process. Hence, this will increase the client's perceived utility of the program, a key factor for the use of any kind of media or communication channel. Also, since the content appears relevant and useful to the user, the likelihood of elaborated information processing will be increased.

Having modeled the "psychological chronology" of the change process that the client goes through, a natural next step is to lead the client through a predetermined sequence of intervention components, step by step. To some extent, this resembles the idea behind what has been called tunneling [5]. For the client, tunneling makes it easier to go through a process. He or she is not introduced to a web-based help-yourself library of information, but is instead "led by the hand" through the change process. The client enters the tunnel (i.e., starts the program) when they initiate the change attempt. By entering the tunnel they give away a certain level of self-determination in that information and activities are presented to him/her in a predetermined sequence. However, the principles of reduction and tunneling ensure that the client is led through a predetermined change sequence and receives the most appropriate information, support and therapy at the right time.

3 The Digital Therapy Developer (DTD)—A Construction Tool

Based on the above ideas, we have created a construction tool, called the Digital Therapy Developer (DTD), which can be utilized to design individualized intervention programs that are delivered by means of interactive, digital media (the web, cell phone, PDA, mp3 player, etc.). The DTD is a *construction tool*. More precisely, DTD is a tool

suite for designing interventions, and combines psychological know-how with digital communication technologies. Our core idea was to digitalize and industrialize the construction of interventions aimed at supporting psychological and behavioral change through the support of a "digital therapist".

The DTD provides an environment for designing digital health behavior interventions (e.g., alcohol use, smoking cessation, dieting, exercise), health problems (e.g., depressed mood, tinnitus, sleeping problems), individual changes and transitions (e.g., divorce, retirement, unemployment, pregnancy), patient support (e.g., adherence to medication and health promoting lifestyles), and rehabilitation (e.g., heart and cancer rehabilitation). DTD contains: (i) a basis of psychological theory and research giving a point of departure for the construction of psychological interventions; (ii) a careful selection of intervention and therapeutic principles; (iii) a carefully selected set of core predictors for successful change; and (iv) a set of evidence-based therapeutic tactics and techniques. In other words, DTD bridges psychological theory and research with practical interventions and procedures, all in the service of supporting successful change. Hence, DTD contains tools that provide an environment for: (i) defining the chronological nature (phases and timeline) of the relevant change process; and (ii) linking specific therapeutic techniques (which reflect the specific predictors of specific changes) with relevant digital communication tools. Consequently, DTD is a support system for managing the psychological predictors and relevant therapies in an operative environment. In effect, this is done by the construction of *intervents*. Each intervent represents an intervention element, which: (i) is based on and reflects psychological theory and research; (ii) is constructed according to accepted principles of psychological therapy; (iii) reflects a specific predictor of successful change; (iv) is launched according to a reasoned chronology of the change process; and (v) is distributed via appropriate digital, interactive media.

A central premise for making DTD has been the fact that individual change processes in different behavioral domains share some communality. For example, different types of changes seem to reflect some communality as far as the phases and chronology of change are concerned. Additionally, a successful outcome of different change processes seems (to some extent) to be predicted by a set of common antecedents or predictors. The generic chronology and core predictors of much individual change have been incorporated into DTD. However, importantly, the total set of predictors and underlying processes of change in one specific (behavioral) domain are not totally identical with those in a different domain. Consequently, although many types of changes share some communality, every domain of change also has a certain amount of uniqueness and a set of specific predictors of outcome that are not common or shared with other types of change. This reasoning supports the notion that intervention programs that are produced to help people change, can contain both a *generic* component and a *domain-specific* component. DTD is a tool for constructing the generic components; i.e., the basis of numerous domain-specific applications. Consequently, when applied within a specific domain of (behavioral) change, the core of DTD must be *supplemented* by the construction of domain-specific elements; a unique set of predictors for successful change within the specific domain addressed. Furthermore, a domain-specific application (a "skin") must always be added to DTD (the "backbone" of the intervention) in order to represent a complete domain-specific intervention.

Broadly, three "layers" of psychological insights are reflected in DTD. The first layer represents a selection of psychological theories and research that identifies and explains *basic mechanisms* involved in successful individual change. The second layer contains a selection of *general psychological intervention techniques, therapies and procedures*, which are based on the more general theoretical insights. Finally, the third layer contains a set of processes and predictors related to successful change. These processes and predictors, organized in a reasoned and explicit chronological order, are deducted from the two "layers" described above, and reflect more specific factors that may promote or hinder successful change. They have all been described in psychological research as predictors of sustainable individual change. Importantly, these predictors are utilized for constructing specified and detailed intervention components, called *intervents*, which are delivered by means of digital media. To the end user, an intervent appears to resemble a communication message. Importantly, however, each intervent is *based* on and reflects psychological theory and research; is *constructed* according to accepted principles in (for example) cognitive therapy; *reflects* a specific predictor of successful change; is *delivered* through interactive, digital media at a carefully selected *time point* of the change process; and is *individualized* to the needs of the specific client going through the change process. Hence, messages that are distributed to end users do not only carry information. Rather, they reflect theoretical reasoning, clinical expertise, the chronology of change, the characteristics of the digital channel through which the message is distributed, and are individualized to the specific needs of the end user.

4 Happy Ending—The First Practical Application of DTD

The team behind Changetech has recently developed a program for smoking cessation, delivered by means of the web, E-mail, and cell phone (Interactive Voice Response and Short Message Service). Adaptations of this program are now being launched worldwide in combination with quit-smoking medicines provided by Pfizer Inc. (Champix/Chantix) and Johnson & Johnson (Nicorette). The program, called Happy Ending (HE), has been evaluated in two randomized clinical trials (RCTs). In both RCTs, motivated smokers were randomized to receive either HE or a control intervention (a self-help booklet). In study 1 (n=396), both interventions were combined with the supplement of nicotine replacement therapy (NRT), whereas in study 2 (n=290), NRT was neither offered to nor intended to be used by the quitters. Abstinence (abstinent over the previous seven days) was based on self-reports and assessed at 1, 3, and 6 months. The intention-to-treat principle was applied, and nonresponders were counted as smokers. Both studies revealed a significant and substantial treatment effect of HE on both short- and long-term abstinence (odds ratios varied between 2.01 and 3.46). For both intervention conditions, higher abstinence rates were observed in study 1, while higher effect sizes of the treatment conditions were observed in study 2. In conclusion, both trials demonstrated the benefit of HE as compared to a self-help booklet. Moreover, the effect of HE was very favorable when compared with other digital smoking-cessation programs that have been described in the literature.

5 Conclusions

By mapping the critical psychological processes that arise throughout a behavioral change attempt, Changetech can design digital programs that deliver specific cognitive therapy at the right time, increasing the probability of successful behavioral change in a variety of domains. This breakthrough, named Digital Therapy, has been proven in RCTs to be a cost-effective way for people to achieve lasting behavioral change, with the help of modern psychological science, but without seeing a therapist. Changetech has developed a construction tool denoted Digital Therapy Developer (DTD) that makes it possible to design behavioral change programs on an industrial scale. The DTD consists of a development unit and an operating unit that interact with a technological platform used by the program owner to distribute the program.

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