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# PERSUASIVE TOOLS FOR EXERCISE ADHERENCE IN MOBILE INSOMNIA THERAPY

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**Abstract.** *In this paper, persuasive tools are presented for mobile insomnia therapy based on principles from psychology and conversation. First, general characteristics of insomnia and insomnia treatment are discussed. The paper concentrates on methods from cognitive behaviour therapy (CBT) and improvement of motivation for exercise adherence. Persuasive tools that will be examined are: alignment, adaptation and motivational support. It is concluded that mobile systems are adequate devices to assess relevant momentary information and to deliver fully automated feedback at the appropriate time and location.*

**Keywords:** Adaptation, alignment, motivational support, chronic insomnia, mobile coaching, therapy adherence.

## 1 INTRODUCTION

The aim of this paper is to present a number of basic persuasive tools for a so-called mobile virtual coach in the field of insomnia therapy. These tools will be grounded in insomnia specific characteristics and general principles in psychology and communication theory. The overall goal of the coaching system is to improve the quality of sleep of people suffering from chronic insomnia by non-pharmacological treatments.

In the future, the virtual coach is supposed to offer a user-friendly therapy that 1. provides an automated training program based on a personalized model of the patient, 2. assists the patient's process of self-reflection with respect to sleep and wake behaviour, 3. provides tailored information about sleep and sleep behaviour and 4. regulates communication with other participants, such as peers and care providers.

## 2 INSOMNIA

The working definition of *insomnia* is 'a persistent difficulty initiating and/or maintaining sleep' [12]. Insomnia has an enormous impact on the individual and society. It impairs daily functioning, reduces quality of life

and enhances health care and other costs for millions worldwide.<sup>1</sup> For chronic insomnia, complaints have to stay for at least a month [1]. Chronic insomnia is a common sleep disorder with a prevalence of around 10% in the general population [13].

Insomnia can usually be discerned from clinical interview and shows a large variability of individual differences in both causes and symptoms [10]. In some individuals, insomnia is caused by their lifestyle (e.g., irregular times for sleeping, lack of exercise and relaxation, alcohol and drugs abuse, anxiety); in others, psychiatric or medical disturbances cause insomnia (e.g., depression, stress, asthma, pain). The underlying mechanisms are still poorly understood and in many cases the reason for the disorder is unknown.

### 2.1 Insomnia treatment

Today, it is widely accepted that cognitive and behavioural factors play an important role in the disorder of insomnia and that non-pharmacological treatments such as cognitive-behavioural therapy (CBT) significantly improve the condition of chronic insomnia patients [5]. Effective

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<sup>1</sup> Measurable costs of insomnia include reduced productivity, increased absenteeism, accidents, and hospitalization, as well as medical costs due to increased morbidity and mortality, depression and increased alcohol consumption (Daley et al., 2008). Roth (1996) estimated in 1996 the overall economic costs of insomnia in the United States at about 30 to 35 billion dollar!

interventions include a variety of (combined) exercises such as sleep scheduling, relaxation training and sleep hygiene [11].

CBT for insomnia (CBT-I) usually rests on two pillars: 1. a behavioural component to unlearn maladaptive habits and to learn sleep improving behaviour and 2. a cognitive component to change a person's dysfunctional cognition, such as negative thinking or unrealistic expectations with respect to poor sleep. Crucial factors in the therapy are the person's compliance with the exercises and the person's understanding of how the components facilitate or interfere with sleep.

Treatment protocols for insomnia usually take between 6 to 10 weekly consultation sessions [12]. Depending on the stage of the therapy, various activities may be scheduled during a session: for instance, presentation of a conceptual model of insomnia, review of the person's sleep diary, explanation of clinical procedures and their rational, evaluation of compliance with homework assignments and introduction of new assignments for the upcoming week.

Unfortunately, CBT-I has some critical shortcomings. Weekly face-to-face sessions are expensive and intense involvement of health-care professionals results in long waiting lists. Although self-help therapies from books and television improve coping with insomnia, these therapies often do not lead to sleep improvements [16]. An important aspect missing from many self-help therapies is the essential personalized support to encourage people to adhere to the therapy (see e.g. [9] and [17]).

### 3 THERAPY COMPLIANCE AND PERSUASION

In general, non-compliance (or non-adherence) to therapies is an important problem (cf. [3]) and CBT-I is no exception. In CBT-I, some exercises demand extensive self-discipline and stamina of the coachee.<sup>2</sup> People may find the exercises too strenuous (e.g. 'sleep restriction'), they do not believe that it contributes to a solution of the problem (e.g. a relaxation exercise) or simply forget to perform the exercise (e.g. filling in their sleep diary).

One of the keys to therapy adherence is the person's motivation to perform the exercises. People may enthusiastically start a particular self-help sleep therapy and discover that sizing down their time spent in bed or getting out of bed in the middle of a cold and dark night requires a great deal of effort. Consequently, sleep quality deteriorates, people feel worse, get into a downward motivation spiral and the therapy is terminated prematurely. Recognition of this process and adequately responding to it in terms of motivational support is necessary element in any insomnia therapy. Therefore, as any other computerized

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<sup>2</sup> We use the term 'coachee' or 'person' for the one who follows the therapy, instead of, for instance, 'client', 'patient' or 'user'.

CBT self-help system, a mobile CBT-I system has to include a variety of persuasive elements and strategies to improve adherence to the therapy. Let us, before we discuss some possibilities of motivational support in a mobile device, first explore the concept of motivation (c.f. [7]).

#### 3.1 Motivation, Activities and Goals

Motivation research has a long history in psychological science and definitions are not widely shared among researchers. Roughly, to be motivated means to be moved to do something [14]; motivation gives direction to people's activities. In formal communication and agent theories, motivation is often expressed in mental constructs such as wants, obligations or intentions to achieve a particular state, the so-called goal; these constructs are essential parts of the preconditions to generate speech acts or other activities [2]. Goals in insomnia treatment can be, for instance, improved sleep quality and daytime functioning, increased sleep efficiency<sup>3</sup> and reduced time to fall asleep. Activities are the exercises to achieve these goals.

In traditional motivation theories [14] different types of activities are distinguished: activities may be *intrinsically* or *extrinsically* motivated. Intrinsically motivated activities, or briefly 'intrinsic activities', refer to activities in which someone experiences a reward in the activity itself, a task that one 'wants' to do. Extrinsic activities refer to activities for which there is no inherent connection between the activity and the reward, a task that one 'has' to do for whatever reasons. The reward in the extrinsic activity is in the expected goal; the person has to invest a certain amount of energy and time, and expects that payback will happen once the goal has been achieved.

In line with the two types of activities, we also distinguish between goals that are intrinsic and goals that are extrinsic. An intrinsic goal refers to a state in which one experiences a reward simply by achieving the goal. Extrinsic goals refer to a state where one does not or hardly experiences a reward, a necessary and rationalized intermediate state to achieve the intrinsic goal. For instance, the overall outcome of CBT-I is an intrinsic goal, because improved quality of sleep implies that the person feels better after the therapy. Goals such as increased sleep efficiency are extrinsic, imposed by the coach and do not necessarily lead to an improved feeling of well-being.

In practice, however, the distinction is not always that clear. A particular activity may be assigned a particular value<sup>4</sup> and may vary over time and individual. In CBT-I, for instance, a relaxation exercise may be helpful for some individuals, but may be counterproductive for another.

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<sup>3</sup> Sleep efficiency is defined as the total sleep time in bed divided by the total time in bed.

<sup>4</sup> An option would be, for instance, to assign extrinsic activities with negative numbers ('punishment') and intrinsic with positive numbers ('pleasure').

What is important, though, is that intrinsic activities are rewarding in itself and can be used as a strategy to improve motivation and that extrinsic activities need more effort from the coach in terms of persuasion techniques. Intrinsic activities need only brief support, a simple trigger may be sufficient. Extrinsic activities may call for detailed explanation with respect to their purpose, expected investments or effects.

The notions of 'trust' and 'credibility' play a particular role in extrinsic activities and goals. A person performing extrinsic activities loses sense for direction and leaves the decision to perform a particular exercise to the coach. A person who doesn't trust the coach and, therefore, doesn't believe that an exercise is in the person's best interest can hardly be motivated to perform the exercise.

Motivation is not an invariant mental construct that remains constant during the therapy. In fact, as we discussed earlier, loss of motivation is one of the key factors in aborting the therapy. It's baseline value in the beginning of the therapy is influenced by many factors, such as the initial attitude, stage of change, personality, beliefs, moods, expectations, progress, current interests, circumstances, emotions, and so on.

This raises some important questions, such as, how can loss of motivation be minimized, when and how should motivation be monitored, and how should the coach adapt to a particular level and respond to the variations? Clearly, we have no definite answers to these questions, but in the remainder of this paper we will we briefly explore three processes that may influence motivation considerably in CBT-I: 'alignment', 'adaptation' and 'motivational support'. Alignment enables us to determine a motivational baseline, motivational support may improve motivation and take away motivational blockades, and adaptation is a way of adjusting information and exercises to a particular motivational level.

### 3.2 Alignment

CBT-I can be considered as an amalgam of individual and joint activities [3]. Coachees carry out individual exercises suggested by the coach and there is frequent coordination of (communicative) activity between the coach and the coachee. A sine qua none for joint activities, and conversation in particular, is common ground, a common understanding of the world around us and our communication partner.

To achieve a common ground, coach and coachee need to align their situation models, the so-called process of 'alignment' [8]. In human-human communication, alignment is largely an unconscious process where people align their representations at different levels.

We are convinced that incorporating alignment skills in mobile CBT-I is a prerequisite for tailoring information and thus minimizes a coachee's loss of motivation. In the alignment stage, coach and coachee are establishing familiarity and common ground. Since alignment is a two-

way process, the coach gets acquainted with relevant characteristics of the coachee and the coachee with relevant characteristics of the system.

Levels of alignment may refer to, for instance, the communication (e.g. interface design, formality, personal reference, gender, modality preference, language use), ethical aspects (e.g. privacy aspects, credibility, commercial interest, risks) and therapy related aspects (e.g. coachee's state of change, age, expectations and investments, sleep and wake habits, time schedules, earlier therapies, mutual commitments, therapy program, system role, insomnia related knowledge). A powerful persuasive instrument for later use is a mutual acceptance of the therapy and exercise goals [15].

We argue for an explicit stage of alignment of about a week in the beginning of the therapy, but we should keep in mind that alignment is a constant process throughout the therapy.

### 3.3 Adaptation

Adaptation in CBT-I may be considered as the process of adjusting information and exercises to the needs, abilities, cognition and circumstances of the coachee. Alignment and feedback are prerequisite for adaptation.

An important problem in CBT-I is that there is constant investment in the first three or four weeks of the therapy without any payback. Even worse, people feel drifted away from the overall goal of the therapy. There are at least two ways to reduce this tension: adaptation of the exercises and/or adaptation of the goal(s). Let us briefly discuss the first.

There is room for negotiating some of the exercise variables. On the one hand, sleep therapy requires discipline and, therefore, some extrinsic exercises are mandatory and just have to be done [12]. On the other hand, there is room for adaptation of the exercise's schedule. For instance, on the basis of an initial period of alignment, the coach suggests a particular threshold time to go to bed and rising time to get up. Individual preferences may indicate a delay or advance in rising time and threshold time. Also, some exercises may work better than others. So, substitution of comparable exercises may be an option in some cases. Substitution may work in particular for relaxation exercises. In other words, there should be room for exercise adaptation wherever possible.

### 3.4 Motivational Support

Motivational support, refers to verbal and/or non-verbal communication acts to improve motivation and to take away motivational or other blockades. It may vary from a single reminder to start the exercise to an explicit compliment of the coachee or feedback related to his or her progression. Clearly, motivational support should be adapted to the coachee's characteristics and the circumstances.

Motivational support relates partly to the cognitive part of CBT-I. Cognitive theory is a psychotherapeutic method designed to change a person's beliefs, expectations, appraisals and attributions. In CBT-I, cognitive therapy seeks to change dysfunctional sleep expectations, perceived causes and consequences of insomnia, and beliefs about sleep promoting practices [12]. Assume, for instance, a person that believes that one night bad sleep always causes poor work performance. As a result of this prospect, motivation decreases. The primary goal of the coach would be to support the coachee to re-evaluate the accuracy of this belief.

Other types of motivational support may be, for instance, praise, encouragement, self-awareness, awareness of progress and self-responsibility, or challenge.

## 4 CONCLUSION

In this paper, we have outlined the basic requirements for a mobile CBT-I coach to improve therapy adherence. In particular, it was suggested to incorporate at least the following persuasive strategies: 1. a possibility to negotiate exercises and goals, 2. communication strategies to improve motivation and to take away motivational blockades, and 3. an explicit phase of alignment.

Compared to traditional human-human therapy and self-help books, mobile devices have a number of important advantages. First, the use of mobile technology permits the assessment of relevant momentary information and the delivery of fully automated feedback at the appropriate time and location. Both the perception of the overall outcome and the effectivity of the therapy or a particular exercise is a dynamic process that should frequently be monitored and that requires an appropriate action from the coach. Second, current communication platforms and infrastructures facilitate information exchange between various user groups, such as peer insomniacs and sleep therapists; in other words, these systems can be part of a stepped health-care structure where care providers only are involved when problems are detected.

In the future, non-obtrusive sensory measurement may enable the obtainment of objective sleep data that can be integrated effortlessly in the treatment and may give valuable information to a sleep therapist.

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