IT-supported Stress Management

Mediating between Sensor Data and Individual Appraisal

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ABSTRACT

People are increasingly exposed to stress these days. There are numerous possible triggers for stress, e.g. multitasking or frequent interruptions. Although stress cannot be considered fundamentally negative, high stress levels can lead to negative health effects like depression or burnout. Therefore, it is important to act early in order to prevent stress or cope with it appropriately. While advances in sensor technology offer new opportunities to measure stressors and stress reactions automatically, considering individual appraisal is important in order to provide tailored assistance. We propose a framework for IT-supported stress-management that also integrates cognitive appraisal.

CCS CONCEPTS

• **Human-centered computing**

KEYWORDS

Stress management, stress measurement, stress appraisal, sensors

1 INTRODUCTION

The modern world is changing. Acceleration, multitasking, the flood of information, frequent interruptions, and a lack of opportunities for recreation are examples of hazards to cause stress. In the long term, stress can lead to negative health consequences. Studies show that mental illnesses have increased critically in recent decades. In Germany, for example, incapacity for work due to mental illness has been increasing over the last 20 years [1]. However, the advancing technological development offers new possibilities to measure and counteract stress at an early stage. While sensor-based measurements offer good conditions for IT-supported prevention or adaptation proposed for example in [2], cognitive appraisal plays an important role in the emergence of stress and capturing it may add further value to IT-supported stress-management. This short article presents a framework for IT-supported stress-management that focuses on the measurement and coping of stress based on the basic pillars of the emergence of stress, namely stressors, cognitive appraisal, and stress reactions.

2 THE EMERGENCE OF STRESS

Strain that can affect the organism is called stress [3]. Stress, which may be physical, mental or social [4], is triggered by so-called stressors, through which the organism is activated by means of challenge, threat, or harm. The cognitive appraisal of stressors plays a central role since all stressors are filtered and categorized by the human. Filtering is influenced (among other things) by personality, cultural perspectives and behavioral patterns. A stressor is then rated as positive, dangerous or irrelevant. If it is considered dangerous, an assessment of the available resources follows. A lack of adequate resources to deal with the situation creates stress [5]. The activation of the so-called sympathetic nervous system causes the reaction, in which stress hormones such as adrenaline, noradrenaline, or cortisol are secreted. These start the stress reaction in the brain and in the body [6]. After a stress situation, the parasympathetic nervous system is activated, which provides relaxation and recovery [7]. The resilience of humans differs and depends on the personality and the values of the individuals [8-9]. Thus, certain attitudes such as perfectionism or difficulties in setting priorities can lead to overstrain, which may be hardly perceived due to the underlying desires and fears. Overstrain presents a significant hazard for health [9].

3 FRAMEWORK FOR IT-SUPPORTED STRESS-MANAGEMENT

The framework for IT-support shown in Table 1 is based on the founding pillars of the emergence of stress: *stressors*, *cognitive appraisal*, and *stress reactions*. Based on the framework, it should be possible to use IT to derive and recommend suitable coping strategies from measured stress indicators. Thus, the framework comprises *IT-supported measurement* and *IT-supported coping strategies* that are related by the three pillars. Each field of the table then shows categories for possible measurements or coping

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Table 1: Framework for IT-supported Stress-Management

	Stressor	Cognitive Appraisal	Stress Reaction
IT-supported Measurement	Environment Noise, Light, Weather Communication Phone Calls, E-mails Organization Appointments	Well-Being Perceived Stress, Emotions (via self-assessment) Personality Neuroticism, Conscientiousness, Extroversion (via self-assessment)	Physiology Heart Rate, Skin conductance Behavior Sleep, Physical Activity, Technology Interaction
IT-supported Coping Strategy	Problem-oriented Avoiding Stressors, Time-/ resource-/ task-mgmt., Setting clear priorities and goals	Emotion-oriented Mindfulness, Relaxation, Social Contacts, Sports	Problem-oriented and/or Emotion-oriented Cf. Column 1-2

illustrated by examples. Regarding the automated measurement, it is distinguished between measuring *stressors* and *stress reactions*. While stressors are potential triggers of stress and thus have a more indicative character, stress reactions occur when stressors are appraised dangerous and adequate resources to deal with them are lacking. However, the consideration of the stressors is important in order to be able to recommend strategies against triggers even before stress arises. For the design of stress-sensitive assistance systems, methods disturbing everyday life should be avoided. Rather, the focus should be on unobtrusive options of measurement. Therefore, the category examples in the framework are chosen according to stressors and stress reactions that can already be measured unobtrusively. It has to be taken into account that sufficient reliability of the data is ensured. A combination of several stress assessment tools has proven to be much more efficient and valid than one-sided measurements and should therefore be preferred [10].

The *cognitive appraisal* is an essential part of the framework as it plays a key role in the emergence of stress. In order to be able to recommend appropriate strategies for stress prevention and management at an early stage, the individual's perception should not be ignored. Although considering cognitive appraisal for an assistance requires active user input (e.g. via self-assessment), it is a valuable complement to the auto-mated measurement in order to improve the accuracy and adaptation of an assistance.

Furthermore, the framework also relates the categories of measurement to *IT-supported coping strategies*, so that the information on stressors, cognitive appraisal and stress reactions can be used by an assistance system to recommend suitable counteractions. By relating measurements to coping, a person could e.g. in a stressful situation receive a recommendation by an assistance system on how to do mindfulness exercises to reappraise the situation. In order to even prevent stress, it would also be possible e.g. to adjust a time schedule based on the information collected. In such ways, it would be possible to reduce high loads and to maintain the motivation and well-being of the individual in the long term.

4 CONCLUSION AND OUTLOOK

We present a framework for IT-supported measuring and coping of stress. As subjects to IT-based measurement, it incorporates not only stressors and stress reactions, but also cognitive appraisal as an important part of the emergence of stress that should not be ignored. Our framework is intended to foster the design of assistance systems that measure stress-related factors and support the user in preventing and managing stress by recommendations. Next, we will empirically investigate the presence of stress as well as the acceptance of recommender systems and the willingness to share personal data, which is a prerequisite for such systems.

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