



2014 ISEK Congress Keynote Lecture

Personalized Coaching Systems to support healthy behavior in people with chronic conditions

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ABSTRACT

Chronic conditions cannot be cured but daily behavior has a major effect on the severity of secondary problems and quality of life. Changing behavior however requires intensive support in daily life, which is not feasible with a human coach. A new coaching approach – so-called Personal Coaching Systems (PCSs) – use on-body sensing, combined with smart reasoning and context-aware feedback to support users in developing and maintaining a healthier behavior. Three different PCSs will be used to illustrate the different aspects of this approach:

- (1) Treatment of neck/shoulder pain. EMG patterns of the Trapezius muscles are used to estimate their level of relaxation. Personal vibrotactile feedback is given, to create awareness and enable learning when muscles are insufficiently relaxed.
- (2) Promoting a healthy activity pattern. Using a 3D accelerometer to measure activity and a smart-phone to provide feedback. Timing and content of the feedback are adapted real-time, using machine-learning techniques, to optimize adherence.
- (3) Management of stress during daily living. The level of stress is quantified using a personal model involving a combination of different sensor signals (EMG, ECG, skin conductance, respiration).

Results show that Personal Coaching Systems are feasible and a promising and challenging way forward to coach people with chronic conditions.

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1. Introduction

The burden on healthcare services in the Western world is increasing substantially during the past decades. Both the quality and quantity of the care has to increase to meet the demands, especially for people with chronic conditions. The demand for an increase in quantity is due to the aging western population and an increase in prevalence of chronic diseases. Life expectancies have increased yearly with a rate of 0.24 years over the past century in the United States, Europe and Japan (Christensen et al., 2009). This increase in life expectancy however has hardly resulted in more healthy life years; in contrast, these additional life years are years with chronic conditions. This is becoming especially apparent now as the baby boom generation is reaching the age of retirement, also an age at which many chronic conditions are becoming more prevalent. These trends make that in the near future, we have to cope with a growing population in need of chronic care, during longer periods of time and on the other hand a smaller workforce that is able to pay and deliver the care. Consequently, healthcare services have to be innovated towards

more automated services that are scalable and limit the need for trained healthcare professionals.

The need for such drastic innovation is most evident when considering people with chronic conditions. Their chronic conditions cannot be cured but their behavior has a major impact on further progression of the disease, quality of life and the occurrence of secondary health problems. It is becoming more evident that actual and perceived health can be influenced positively by creating awareness of adverse behavior and developing a sustainable healthy behavior. Regular physical activity reduces the risk of (chronic) diseases like coronary heart disease, type II diabetes and some cancers (Kohl et al., 2012; Lee et al., 2012). For example, in Chronic Obstructive Pulmonary Disease (COPD) patients avoid physical activities due to their symptoms, which cause a downward spiral towards lower physical condition and quality of life. Stress has also a substantial impact on health; it is a major cause of sickness absences (EC, 2010) and is strongly related to burn-out and depressions (Leka and Jain, 2010). Chronic neck/shoulder pain has often no clear cause and is often associated with a downward spiral of experienced pain and changes in behavior. Behavioral

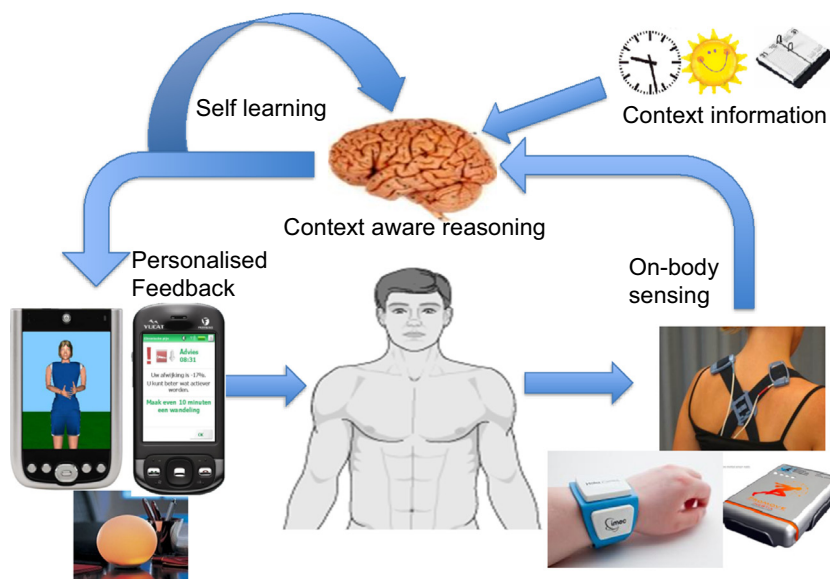


Fig. 1. The concept of the Personal Coaching System (PCS).

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