Chapter 37
Psychometric Assessment of Cardio-Respiratory Activity Using a Mobile Platform

Nicola Carbonaro
University of Pisa, Italy

Pietro Cipresso
IRCCS Istituto Auxologico Italiano, Italy

Alessandro Tognetti
University of Pisa, Italy

Gaetano Anania
University of Pisa, Italy

Danilo De Rossi
University of Pisa, , Italy

Federica Pallavicini
IRCCS Istituto Auxologico Italiano, Italy

Andrea Gaggioli
IRCCS Istituto Auxologico Italiano, Italy & Catholic University of Milan, Italy

Giuseppe Riva
IRCCS Istituto Auxologico Italiano, Italy & Catholic University of Milan, Italy

ABSTRACT

It is increasingly recognized that stress has negative effects on growing numbers of people. Stress assessment is a complex issue, but different studies have shown that monitoring user psychophysiological parameter during daily life can be greatly helpful in stress evaluation. In this context, the European Collaborative Project INTERSTRESS is aimed at designing and developing advanced simulation and sensing technologies

for the assessment and treatment of psychological stress, based on mobile biosensors.In this study a wearable biosensor platform able to collect physiological and behavioral parameters is reported. The developed mobile platform, in terms of hardware and processing algorithms, is described. Moreover the use of this wearable biosensor platform in combination with advanced simulation technologies, such as virtual reality, offer interesting opportunities for innovative personal health-care solutions to stress.

1. INTRODUCTION

Research interest in psychological stress and its cognitive and bodily responses has been growing over the last decades.

It is increasingly recognized that stress has negative effects on growing numbers of people (Cipresso, Gaggioli, Serino, & Riva, 2012; Villani, Grassi, Cognetta, Toniolo, Cipresso, & Riva, 2011). Chronic stress is responsible for premature mortality in Western countries, and work-related stress accounts for premature cardiovascular mortality rates.

Growing interest has surrounded the roles of cognitive appraisal and emotions in psychological stress (Blascovich, Ernst, Tomaka, Kelsey, Salomon, & Fazio, 1993; Feldman, Cohen, Hamrick, & Lepore, 2004; Feldman, Cohen, Lepore, Matthews, Kamarck, & Marsland, 1999). According to Cohen, Janicki-Deverts, and Miller (2007), psychological stress occurs when an individual perceives that the environmental demands exceed his or her adaptive ability to meet them. This gap gives rise to the label of oneself as stressed and elicits a concomitant negative emotional response.

The previous definition of stress integrates and extends the following classical approaches to stress:

1. **Response-Based Model (Selye, 1974):** "Stress is the nonspecific response of the body to any demand made upon it."
2. **Stimulus-Based Model (Holmes & Rahe, 1967):** Stress involves "…events whose advent… requires a significant change in the ongoing life pattern of the individual."
3. **Transactional Model (Lazarus & Cohen, 1977):** Stress involves the "judgment that environmental or internal demands tax or exceed the individual's resources for managing them."

Within this panorama, it is easily understandable that stress assessment is a complex issue. Although discussion and verbal responses are generally the first approach in stress assessment, there are many evidences that nonverbal communication include a wider set of measures to assess stress and might represent a therapist's tool to coping with stress. More, many psychophysiological measures have come to age in the understanding of internal states and can be greatly helpful in stress assessment too (Magagnin, Mauri, Cipresso, Mainardi, Brown, Cerutti, Villamira, & Barbieri, 2010; Mauri, Magagnin, Cipresso, Mainardi, Brown, Cerutti, Villamira, Barbieri, 2010).

In particular Mauri and Colleagues (2010) highlighted the ability to automatically detect stress through psychophysiological measures. However, the role and the advantages in using behavioural measures to improve the automatic stress detection system, are still underinvestigated in literature, above all from an empiric point of view. One of the main problem, that highly contributed to this lack, has been the difficult to objectifying subjects' behaviours.

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