Inside-Out: Reflecting on your Inner State

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Abstract—We present a novel sensor system and interface that enables an individual to capture and reflect on their daily activities. The wearable system gathers both physiological responses and visual context through the use of a wearable biosensor and a cell-phone camera, respectively. Collected information is locally stored and securely transmitted to a novel digital mirror. Through interactive visualizations, this interface allows users to reflect not only on their outer appearance but also on their inner physiological responses to daily activities. Finally, we illustrate how combining a time record of physiological data with visual contextual information can improve and enhance the experience of reflection in many real-life scenarios, and serve as a useful tool for behavior science and therapy.

Keywords-component; life-logging; wearable device; electrodermal activity; digital mirror; reflection; behavior monitoring.

Figure 1. Inside-Out: A system for emotional reflection.

I.   INTRODUCTION

Our affective state can have a large impact on our daily lives including in our decision-making, learning, work productivity and health. For more than 150 years, psychologists and behavioral scientists have thoroughly studied human emotions in laboratory settings. However, with the improvement of wearable biosensors, researchers have started to intensively study more natural and spontaneous emotions and their role in real-life interactions.

One of the major difficulties of field studies is the occurrence of unexpected and uncontrolled events that may alter or influence a person's affective state and corresponding physiology. For instance, when monitoring physiological signals such as electrodermal activity or heart rate to monitor emotional states, there are many stimuli that may result in similar autonomic responses. For instance, both stress and physical exercise may increase these signals. In order to disambiguate these cases and better understanding other confounding variables, scientists also need to unobtrusively capture contextual information. For instance, knowing that the participant is giving a talk or running on a treadmill may help differentiate between an increase associated with stress or with physical exercise.

Continuously monitoring a person's contextual activity is closely related to the concept of life-logging, where a person utilizes passive capture devices to record and digitize his life. The advancements in this area can not only help researchers to better study human behavior, but can also provide insightful information for a wide variety of applications. For instance, the monitored person can visualize his daily activity information to augment his memory, gain better awareness of his time allocation, or even glean insight into how certain factors may impact his health. In this work, we propose a wearable system that captures psychophysiological activation while recording contextual information, leveraging the form factors of current cellphones and biosensor technologies. Furthermore, we have created an interactive, gesturally controlled, digital mirror to display the information. This mirror allows users to naturally reflect not only on their outer appearance but also on the inner psychophysiological response. Fig. 1 shows a user interacting with the system.

II.   RELEVANT WORK

Since the development of the first wearable systems there has been a growing interest in the field of life-logging. The seminal paper of Mann [1], envisioned the scenario in which a person uses wearable computers to capture fine grain detail of his daily activities, and uses the information to enhance his human capabilities. Since this paper was first published, there have been many approaches to efficiently capture daily-life activities. However, adequately understanding the social and ecological context of these activities has remained a key research challenge.

Among all of the contextual modalities, images are probably one of the most effective means to capture information. Visual imagery not only can convey more information than words but also appear among the preferred