Recognizing Bodily Expression of Affect for User Testing

Abstract
While recognizing affect from facial expressions has been studied widely, bodily expression of affect received far less attention in literature. We describe our plans to build a non-intrusive system for evaluation of interactive systems, which relies on automatic recognition of affect from the body. From this we envision to distill quantitative data for the analysis of test sessions, e.g. on task-related movements, expression of affect, and social interaction between users.

Keywords
Affect recognition, Posture, Body Movement, Embodied Interaction

ACM Classification Keywords
H.5.2 User Interfaces : Evaluation/methodology

General Terms
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Introduction
Embodied Interaction, as coined by Dourish [2], stands for an approach to human-computer interaction, which is based on regarding humans as embodied beings and
which acknowledges that the body plays a central role in how we experience the world around us. As such, it investigates the role the body plays when using interactive artifacts. So far, its main focus lies in the creation of new artifacts, which e.g. feature tangible qualities or stimulate social interaction. In our line of research we want to investigate what the body can tell us about the experience of a user, in particular in what way the body expresses affect and how we can use this knowledge for the analysis of user tests.

As the field of human-computer interaction moves beyond task-completion towards providing users with enjoyment and positive experiences, it becomes vital to understand how humans express affect. Such information can be used for the creation of systems that can recognize such signals and react accordingly. We can also use such information when we evaluate systems in user tests.

**Background**

The majority of research on non-verbal expression of affect has focused on facial expressions. Comparing studies on emotion in humans, de Gelder [4] estimates the use of faces as stimuli above 95 per cent. Amongst other important results this research has led to a well-known and well-established facial action coding system (FACS) [3]. The system encodes how facial muscles and groups of facial muscles (action units) can convey affect to others. Depending on the action units involved, it can for instance help to distinguish a genuine from a fake smile.

Only few studies have investigated whole-body expression of affect. Yet, research has shown that changes in affective states can be seen in changes in posture [8]. It has been put forward that facial expressions can be deliberately manipulated for deceptive purposes. Bodily expressions such as gestures are thought of providing a more honest image of a person’s affective state. The relationship between affective state and posture also appears to be bidirectional. Riskind and Gotay [7] present evidence that the sheer posture of a person has influence on the mental state. In their study, subjects put in a hunched and threatened posture report greater stress than subjects put in a relaxed posture.

Kleinsmith presents an approach based on low-level descriptions of body postures for affect recognition [5]. Her dataset includes postures obtained from actors given instructions to portrait specific emotions and non-acted postures obtained from video-gamers, which were subsequently rated by observers. In both cases, motion capture suits were used. While the acted posture set features stereotypical and arguably exaggerated postures, the portrayal of emotion is subtler in the non-acted set.

In our own research, we investigated the movements of video-gamers playing Nintendo Wii Sports games [6]. We found movement-patterns, which correspond to the strategies players used, based on their motivation for playing. Interviewing players revealed that some players are aware of changes in the way they move, depending on their current mood while playing.

Bianchi-Berthouze [1] investigated which types of body movements can be observed in the context of video games. In her model she distinguishes task-related movements (i.e. task-control, task-facilitating, and
otherwise task-related), expression of affect, and gesturing for social interaction.

**Affect Recognition from Bodies in User Tests**

Based on what is known on bodily expression of affect we want to develop a framework, which allows to automatically recognize posture, gestures and body movement and to infer affective states in user tests of interactive artifacts.

This could be used to add an additional channel for multimodal affect recognition systems. The more channels of affective information a system uses, the more robust recognition should be. Should some channels be unavailable, e.g. facial features be hidden from camera view, the system can still rely on other channels. Also, in case of conflicting information, a higher number of channels should make it easier to single out the most likely faulty channel.

Yet, our immediate interest lies in using bodily information of affect for enhancing user test of interactive products. In a first stage we plan to use video games as test scenario and stimuli for test participants. Games seem logical and promising for us in this context as they can be seen as highly emotive environments, which are specifically designed to provoke, excite, arouse, motivate, and sometimes even frustrate their users.

We envision a test environment, in which a single user or a group of users first play a video game and then are interviewed on their experience of the test session. During the test session, players are recorded and the footage is used for the post-interaction interviews.

Prior studies of body movement in human-computer interaction contexts have relied on motion-capture suits. Such suits consist of an exoskeleton frame equipped with sensors. From our own experience we can say that these suits are typically bulky and heavy. Our own test participants have reported that they find them intrusive and feel their freedom of movement limited by the bulkiness of the suits. In a situation where we want to investigate the experience of a person, the suits certainly bias the experience.

For our new test environment we want to use a Microsoft Kinect sensor for motion capturing. Microsoft released the Kinect sensor as input controller for the company’s Xbox video game platform. It features a “normal” video camera as well as a camera, which delivers a depth map of the scenery it records. This allows the Xbox to recognize individual players and their gestures. Since its release, a number of initiatives have released drivers to use the sensor with personal computers and there are even packages available for gesture extraction from its depth camera.

Using the Kinect sensor has a number of advantages for us. It is an optical system, which does not even require optical markers on the user. This makes it by far less intrusive than the exoskeleton suits, with no unwanted biasing effect. Also, acquisition costs are low as it is a system intended for a consumer market and less costly in upkeep as there is no tear.

We envision several benefits of such a test setup. First, we want to use the system for automatic annotation of the movement of test participants, e.g. into Bianchi-Berthouze’s movement categories *task-related movement, expression of affect, and social interaction.*
Having quantitative data on this as well as other features, which we yet have to identify, can help to analyze and interpret test sessions, without the cumbersome work of manual video annotation.

Conclusions
We discussed our plans for a non-intrusive evaluation system, which is based on analyzing body movements of test participants.

As physical beings the body plays a fundamental role in how we perceive the world around us. In our approach we want to find out how much it can tell us about how another person experiences the interaction. Embodied interaction often focuses on the creation of new artifacts, which acknowledge human embodiment. We acknowledge embodiment in what might be called embodied evaluation.

References