Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 104 (2017) 517 – 524

Procedia Computer Science

ICTE 2016, December 2016, Riga, Latvia

Human Emotional Behavior Simulation in Intelligent Agents: Processes and Architecture

Mara Pudane[a,]*, Egons Lavendelis[b], Michael A. Radin[c]

[a,b]*Riga Technical University, Kalku 1, Riga LV–1658, Latvia*
[b]*Rochester Institute of Technology, Rochester, New York 14623, U.S.A.*

Abstract

The paper describes and discusses processes needed for human emotional behaviour simulation, in particular, emotion incorporation into rational thinking, as well as presents corresponding agent architecture. Such system would enable various application fields, perhaps one of the most important being enhancing smart devices with emotions. Decreasing frequency of social contact has become an urgent issue, particularly among young people. Emotional and social intelligence are however highly desired set of skills which is impossible to develop without interacting with others. Although this problem has been acknowledged, and there are some efforts to facilitate social contact, e.g., by augmented virtual reality games, that is still not enough. There is a need to develop environment that would allow learning exactly social and emotional skills. This on-going research aims at developing intelligent agents that are able to express and incorporate affects into rational processes.

Peer-review under responsibility of organizing committee of the scientific committee of the international conference; ICTE 2016

Keywords: Affective agents; Emotive agents; Human behavior simulation; Agent internal architecture

1. Introduction

The smart device age that we are experiencing now brings a lot of advantages, perhaps one of the most important being freeing our mind capacity from remembering simple things and doing small tasks, such as enabling alarm each night or planning the best route to work each morning. However, everything comes with the price – the smart devices also do not require any effort in communicating or managing one's emotions. The time when emotions were

* Corresponding author. Tel.: +371 2 6775551; fax: +37167089584.
E-mail address: mara.pudane@rtu.lv

Peer-review under responsibility of organizing committee of the scientific committee of the international conference; ICTE 2016
doi:10.1016/j.procs.2017.01.167

considered "a negative side effect" of rational thinking has been long gone, and currently the consensus among psychologists, physiologists and sociologists exists – emotions are crucial to our survival and decision making[1]. One of the most crucial roles of emotions is to enable making complex decisions and allowing humans to be adaptive to various situations. Loosing or not acquiring skills to manage, express, and understand own and others' emotions defects one's chance not only to incorporate themselves into a social group but also damages ability to make decisions, prioritize goals and learn[1]. In particular, this problem affects young people who have not yet developed their socials skills and there is also no motivation to develop them if the only interaction multiple times per day is with non-emotional devices.

The lack of emotion related skills is crucial driving force that has urged scientists to address these new occurring issues. One of the ways for exploring emotions and helping to develop emotional skills is to implement emotional thinking in devices we are using every day[2]. This goal, among others, has been one of the main reasons why in the mid of 90s affective computing was defined. Affective computing is a research field that explores how a computer can acquire, express and exploit emotions in order to achieve its goals[2].

Affective computing in general focuses on various directions and levels of complexity. The goal of this particular research is to create an artificial unit – agent – that is able to reason, memorise and learn in the same way as humans do thus fully simulating human beings. Such development would enable interaction with emotionally enhanced devices as a result developing emotion managing and expressing skills that altogether are called emotional intelligence.

There is a variety of terms for type of agents that are enhanced with emotional capabilities. In[3] such agents are called emotive agents; term emotional agent is often used in literature[4]. In the[5] agents that are endowed with emotions are called believable agents. Considering that the agent architecture described in the paper considers not only emotions but other affects as well the term used hereinafter is affective agent.

This paper in particular is focusing on defining the requirements for human simulation as well as represents how the emotional and rational processes should intertwine in an affective agent. The paper describes an on-going research and explains currently implemented parts of the system. The second section identifies the roles of emotions that need to be modelled as well as describes the related work. The third section introduces the architecture of the agent as well as explains the linkage among components. Finally, conclusions are proposed at the end of the paper.

2. Human behavior modeling

Affective systems vary depending on their purpose and complexity. The simplest systems use emotions only as an input or output, i.e., just expresses emotions. However, to simulate human behaviour, it is also crucial for artificial agent to actually "feel" the emotion – meaning that the emotion should be taken into consideration when agent performs rational processes.

The question in the focus here is – how to determine whether agent fully simulates human being, i.e., how to ensure that emotions in the artificial model fulfil the same roles and tasks that emotions do in a human? The assumption in this research is that for agent to be fully affective, all roles should be implemented thus making the identification of roles a crucial task. This section in particular focuses on answering this question as well as reviews existing works in this field.

2.1. The roles of emotions

The exact roles of emotions have been contentious issue. Hudlicka[6] based on emotion theories that come from psychology, physiology and sociology, have summarized and divided currently identified roles into two groups: interpersonal and intrapersonal emotions, in total naming eleven roles.

Considering the roles, a framework was also created for developing affective systems by proposing that there are two main processes – emotion generation and emotion effects on cognition and behaviour each consisting of several smaller, more detailed processes[6]. The emotion mapping to various reasoning processes is included as a subprocess, however, Hudlicka does not go into more detail about how the affect will impact reasoning. There is however, the process that encloses magnitude into model – the stronger emotion the larger its impact on reasoning[6]. Hudlicka views development of affective units from the process viewpoint not considering possible internal architecture of