# Chapter 91
# A Computational, Cognitive, and Situated Framework for Emotional Social Simulations

**Jordi Vallverdú**
*Universitat Autònoma de Barcelona, Spain*

**David Casacuberta**
*Universitat Autonoma de Barcelona, Spain*

## ABSTRACT

*Human emotions and social processes are evolutionary intertwined, as the result of neuromodulatory mechanisms that define the nature of how bodies interact with the world and create strategies with other bodies and agents. This article presents the previous simulations of TPR, TPR 2.0 and The Game of Emotions. Ideas are also justified in order to achieve the next research level into social emotional simulations. This article describes a defense of the epistemological value of computer simulations for the analysis of emotions and social interactions. Finally, the elements of the model are described as well as is defined a basic sketch of the basic control algorithm.*

## 1. INTRODUCTION: THE ROLE OF EMOTIONS INTO SOCIAL EVOLUTION, A SITUATED APPROACH

Some years ago, one of us (Vallverdú) was invited into an informal workshop together with sociologists who were working on computational social simulations. At some point of the talk, one of the leaders of the group addressed Vallverdú a fake question "I do not understand why our simulated agents should integrate emotions". That was as astonishing statement: human beings regulate their individual and social actions throughout emotional mechanisms. They lie at the bottom of any action and information processing, even from their neuromodulatory basement (Vallverdú et al., 2015). We've thought a lot about how emotions are implemented into cognitive architectures or studied into human-related researches. Two

DOI: 10.4018/978-1-7998-1754-3.ch091

facts can be affirmed: a) emotions are still considered collateral and even noxious action modulators; b) in case of being implemented into cognitive systems, they are added or embedded as one module among others, usually useful for affective computing environments.

In order to understand human beings actions, games theories can be useful at certain point, but from the real studies on the multivariated heuristic approaches that human beings follow into their daily as well as professional activities (abductive, deductive, inductive, formal, modal, etc.) (Stadler, 2004; Douven, 2011). Even more, emotional mechanisms are fundamental for the existence of consciousness (Tsuchiya & Adolphs, 2015) and also for moral regulations (de Waal, 2015; Spikins 2015; Tomasello 2009) emergence. Therefore, cognition must be situated into bodies and social cultures, both aspects deeply rooted into emotional mechanisms.

## 2. BACKGROUND RESEARCH

Living entities increase their range of possible interactions and behavior according to the complexity of their embedded information processing systems, which reached a maximum level with the emergence of central nervous systems and brains. Encephalization, adjusted by the Encephalization Quotient (EQ), was understood by first modern researchers on cognition as the capacity for running high level cognitive tasks, situating symbolic thinking at the top of the possible brain performances. Thus, intelligence, symbolic thought and encephalization were considered correlated variables. In this model, emotions had no space or role, but were even considered noisy or fuzzy elements that should be minimized or avoided. But the truth is that all these ideas were incorrect, at least in that naïve form: first of all, cognition not only happens into the brain, but there are morphological constraints that affect and direct cognition; secondly, extended cognitive processes are at the core of the cognition and make possible to understand how brains evolved towards the use of symbolic elements following auxiliary elements like external memories or graphical notations for better visualization; finally, emotions have demonstrated to play a determinant role into cognitive processes. This is valid for any cognitive system emerged from natural evolution, and consequently, for human beings.

But what does happen with artificial intelligence? Do machines have been reproducing this naturalistic approach? The answer is a rotund 'no'. Despite of several biologically inspired strategies like genetic algorithms, a-life, biorobotics, evolutionary computation and electronics, swarm intelligence, artificial neural nets or cellular automata, among a long list (see the excellent compendium of Floreano and Mattiussi, 2008), the presence of emotions is close to zero. There is an exception: the environments in which machines must interact directly with human beings; only these contexts explain the existence of the affective computing and social robotics research fields.

Perhaps we can find some small clues that show an basic interest among AI communities towards emotions, like the idea of 'drive nodes' of Stephen Grossberg, a pioneer of Artificial Neural Networks (inspired by the experimental results of 1971 by Walle Nauta on how brain frontal lobes controlled the interioceptive censorship of plans), or the basic Cognitive Architectures of Aaron Sloman in the 1980's (after the revival into the study of emotions supported by Ekman, Ortony, Scherer, Oatley, etc.). Even the emergence of Affective Computing, by Rosalyn Picard at MIT in 1995 followed the publication of a seminal and very influential work or a Neurologist: Descartes Error, by Antonio Damasio, in 1994.

Perhaps emotions are not at the backbone of AI systems but they neither have a real presence into most of economic and social sciences computer simulations. It is something absurd and shocking that those