Chapter 13

Modeling Motivation and the Emergence of Affect in a Cognitive Agent

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Emotion and motivation play a crucial role in directing and structuring intelligent action and perception. Here, we will look at the relationship between motives, affects and higher-level emotions, and give directions for their realization in computational models, with a focus on enabling autonomous goal-setting and learning.

13.1 Introduction

Any functional model that strives to explain the full breadth of mental function will have to tackle the question of understanding emotion, affective states and motivational dynamics (Sloman, 1981; Lisetti and Gmytrasiewicz, 2002). Consequently, the field of affective computing has made considerable progress during the last decades. Today, several families of models are available for incorporation in agent implementations.

This chapter is not concerned with giving a comprehensive review of these approaches (for an overview on current emotion modeling, see Gratch, Marsella, and Petta, 2011; and for a look at its history Hudlicka and Fellous, 1996; Gratch and Marsella, 2005), but mainly with a particular approach: how to build a system that treats emotion and affect as emergent phenomena. I will also refrain from giving a particular implementation (if you are interested in that, see the author’s work: Bach, 2009), but instead, I want to supply a general framework for emergent emotions and motivation, that could be adapted to various different agent architectures.
Most emotion models start out from a set of pre-defined low-level or high-level emotions, which are characterized and implemented as stimulus related functional parameters (appraisals, see Roseman, 1991; Lazarus, 1991; Ellsworth and Scherer, 2003). These parameters give rise to complex behavioral tendencies, which can then be functionally classified (Ortony, Clore, and Collins, 1988; Plutchik, 1994). The term appraisal describes the relationship between stimulus and emotion; an appraisal is a valenced reaction to a situation, as the agent perceives it. In this view, emotions are triggered by a causal interpretation of the environment (Gratch and Marsella, 2004) with respect to the current goals, beliefs, intentions and relations of the agent. By evaluating these, a frame of the appraisal and a corresponding affective state of the agent are set, which in turn enable it to cope with the situation. Here, coping subsumes the external and the cognitive behaviors with relation to the appraisal: actions and speech acts, as well as the modification of beliefs, intentions, goals and plans. This way, the agent influences the external environment (the world accessible by action and communication) and the internal environment (its model of the world, along with its plans and goals) to address the issues according to their valence and context. Appraisal frame and affective state are the link between external and internal situational stimuli, and the internal and external response (see Figure 13.1).

Fig. 13.1  The role of appraisals in the cognitive system (Gratch and Marsella, 2004, p. 11)