Emotions and Situated Cognition: A Connectionist Model

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1 Introduction

In Cognitive Science, little research has been done regarding emotions. Yet, Norman (1981), one of the founders of the discipline, had listed the study of emotions as crucial for the success of the new discipline. In this present paper, emotions are considered to range from pre-wired reflex-like responses, to accentuated predispositional tendencies, to recognized interpretations loosening the emotional arousal. In Neuroscience, the autonomic nervous system has been pointed at as offering a key to understanding the arising of emotions (Damasio, 1994).

Emotions are presently modeled as 'stored experience', located along the autonomic nervous system. Usually lying outside of awareness, this portion of the nervous system consists of nerve fibers located along the spinal cord. There are two distinct branches acting as a seesaw: the parasympathetic branch and the sympathetic branch, each stimulated by different neurotransmitters naturally present in the body (Restak, 1994). Each branch of the autonomic nervous system is responsible for the arousal of different emotions, which in turn lead to different behaviors and actions, the result of which feeds back to the cognitive system itself. One portion of the current model provides an illustration of the mutually exclusive effect of the autonomic nervous system branches.

In addition, emotions are presently modeled as 'situated cognition'. From this perspective, cognition is not solely a product of brain functioning but can be considered as a constant coupling between the nervous system and the environment (Varela, 1988). Considering cognition as context-dependent, the situated approach emphasizes the lack of objective representation of a pregiven world by a pre-given mind. Because emotions are strongly context-dependent, the study of emotions best lends itself to the situated approach to understanding cognition. The model therefore accounts for the role of the environment in its coupling with one subset of the nervous system (the autonomic nervous system), in the arising of emotional states: units modeling the nervous system are structurally coupled with units modeling the perceived environment.

Lastly, the modulatory aspect of emotional systems is addressed. Indeed, Zajonc (1994) found that changes of hypothalamic temperature (due to breathing patterns) can facilitate the inhibition or excitation of the release of a variety of neuro-transmitters. The neuro-transmitters are also modulated by the neuro-modulators (Rumelhart, 1994). The presence of a particular neuro-modulator determines the active amount of a specific neuro-transmitter, which in turn activates one branch of the autonomic nervous system. Depending upon which branch is active, different interpretations of the environment are reached. By allowing the network to learn to choose different interpretations of the environment that it is coupled with, the model illustrates how different emotional states can arise from this reinterpretation of the current situation. The *Boltzmann* machine was chosen for its annealing feature which allows to simulate changes of temperature in the network. For implementation details see Lisetti (1995).

2 References

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