Modeling the Dynamics of Mood and Depression (extended abstract)[1]

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Traditionally, emotions were often left out of consideration in the areas of cognitive, agent, and user modeling. Only few computational models of mood and depression have been developed [2]. However, emotions undoubtedly influence the behavior of humans. In recent years, there is a growing awareness that emotions play a role as well.

Modeling of emotions is important for the development of agents that should exhibit human-like behavior. For example, agents that are used in Intelligent Tutoring Systems to train humans should behave human-like, and show emotions as well. Similarly, virtual agents in games that should interact in a realistic manner have to incorporate the effect of emotions on behavior.

Secondly, also systems that reason over the state of humans should take the emotions and mood of humans into account. For example, one may think of ambient intelligent applications that react on the mood and emotional state of humans. Another category of applications that use knowledge about the mood of humans are systems that support therapy, such as systems the help to quit smoking addiction, or internet-based therapy for depression (online counseling systems).

In this paper, a formal model is presented that can be used to simulate the dynamics in the mood of humans, and more specifically, whether they develop longer periods a undesired moods, as in depressions. To come to this model, commonly used psychological theories about uni-polar (i.e., uncomplicated) depressions are studied. B The main concepts and relations are extracted from the theories and represented in a formal model of the aspects of mood and depression.

In the model, depicted in Figure 1, it is assumed that every situation has an emotional value, which represents the extent to which a situation is experienced as something positive. The *objective emotional value of situation* (OEVS) represents how an average person would perceive the situation. How one perceives the situation (*subjective emotional value of situation,* SEVS) influences the *mood* one is in and the *thoughts* one has. By changing or choosing a situation, one can influence their own mood level (e.g. choosing to go to a birthday party when one feels down increases the mood level). This regulation system is based on a current *mood level*, a *prospected mood level* (split into long and short term) and a *sensitivity* representing the ability to choose optimal situations.

For this model there are two decay factors: *diatheses* for downward regulation and *coping* for upward regulation. The term *diatheses* represents the vulnerability one has for developing a depression. The term *coping* represents the skills one has to deal with negative moods and situations. For more details on the mood and depression model, see [1].

[1] The full version of this paper appeared in [1].

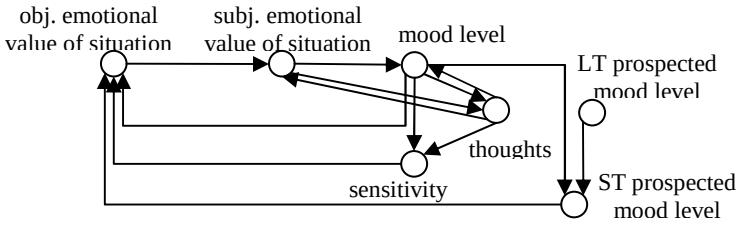

Figure 1. Model of mood dynamics.

The model has been used to simulate different scenarios with different personal characteristics. The different personality settings result in different effects of stressful events on the (long-term) mood of a person.

A mathematical analysis has been performed by rewriting the model in a continuous form of the system of (nonlinear) differential equations. The analysis showed the existence of different equilibriums in the model for persons with different characteristics. A number of properties derived from the most important psychological theories have been formally described using the Temporal Trace Language (TTL, [3]). By verifying these properties against a number of representative simulation traces, the adherence of the model to the most important ideas in the theories was validated. For more details on the simulations, the mathematical analysis and the formal properties, see [1].

The resulting model can be useful for developing human-like virtual agents. In addition, models like these can be used in systems that use knowledge about the mood of humans, such as systems for internet-based therapy. Currently, only the major general theories about depression have been involved. For specific applications, it might be required to use more detailed theories that focus on certain aspects. In future work will be investigated whether a model in line with the presented model can help to improve an existing online counselling system.

References

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