The "Resource" Approach to Emotion

(Extended Abstract)

Sabrina Campano, Nicolas Sabouret, Etienne de Sevin, Vincent Corruble
Laboratoire d'Informatique de Paris 6
4, place Jussieu
75005 Paris, France
name.surname@lip6.fr

ABSTRACT

In this paper, we present a model for the simulation of affective behaviour without emotion categories, centered around the *theory of conservation of resources* [3]. Each agent can acquire or protect resources, and behaviour choice depends on resources state, as well as agent's needs and preferences. We also present a first evaluation.

Categories and Subject Descriptors

I.2.11 [**Artificial Intelligence**]: Distributed Artificial Intelligence—*Multiagent systems*

Keywords

virtual agent, affective behaviour, believability

1. INTRODUCTION

Emotions have been at the core of many psychological studies for several decades. This topic gave rise to computational models of emotion, either aiming at the simulation of lifelike agents, or at the study of psychological processes. One remaining important issue is the influence of emotions on behaviour. Most computational models rely on emotion variables that must be manually parametrized so as to outline believable affective responses and behaviours. However, in the general case, finding the correct number of parameters, their value, and the influence of each one on the general model is a difficult matter.

In the computational model *Affective Reasoner* [2], several actions, like the somatic responses *flush* or *tremble*, are linked with one emotion label. Actually, the association between emotion and various behaviours can't be done easily. Authors of the OCC model [4] notice that "*the same behavior can result from very different emotions*" and "*very different behaviors can result from the same emotion*".

In 1994, R. Pfeifer published an article entitled "*The 'Fungus Eater Approach' to Emotion*" [5], in which he proposes to view emotion as an emergent phenomenon, that does not need to be engineered in a computational model. Actually, from a psychological point of view, emotions can be considered as interpretations of perceptions [1] instead of being entities acting on behaviours. Following Pfeifer's approach, we claim that it is possible to design an architecture capable of producing *emotional* behaviours (*i.e.* behaviours that can be described with emotion terms by a human observer) without using emotion variables, parameters, dimensions or categories in the model itself. Pfeifer's approach was applied to an environment and agents of "*extreme simplicity*" (*sic*), and was not validated by an evaluation protocol.

In order to apply this approach to virtual agents, we propose to design an architecture capable of handling various behaviours, from primary ones to social ones. Our hypothesis is that the theory of "Conservation of Resources" (COR) by psychologist S.E. Hobfoll [3] offers an interesting lead to this purpose. The main principle of this theory is that individuals strive to protect their resources, and to acquire new ones. The concept of resource refers to many types : social ones such as self-esteem or caring for others, material ones such as a car, or physiological ones such as energy. Hence, we propose an architecture based on this theory, that had not been computationally formalized nor implemented so far.

Appears in: *Proceedings of the 11th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2012)*, Conitzer, Winikoff, Padgham, and van der Hoek (eds.), 4-8 June 2012, Valencia, Spain.

2. PROPOSED MODEL

2.1 General Overwiew

Our model is centered around the dynamics of acquisition and protection of resources. It is based on the following principles : (a) when an acquired resource is threatened, an agent tries to protect it; (b) when no acquired resource is threatened, an agent tries to acquire resources that it desires.

Resources in the environment are associated with protective and acquisitive behaviours, that agents can realize in order to defend a threatened resource, or to acquire a new one. An agent can only perform one behaviour at the same time. The nature of protective and acquisitive behaviours depends on the resource type. For example "to talk" lets one acquire a resource of the "Social Interaction" type, and "to eat" lets one acquire a resource of the "Energy" type. Each agent has needs for resource types, and these needs define the resources desired by the agent. An overview of resource sets and corresponding behaviours is shown on figure 1.

Each behaviour can have both positive effects (acquisition or protection) and negative effects (threatening or loss) over resources. An agent i passing an agent j in a waiting line to acquire a rank threatens the current rank of j. In turn, agent j can engage in a protective behaviour in order to defend its rank, which may result in a resource loss for i.

Each agent has individual preferences over resources which determine the value of a resource from agent's point of view.

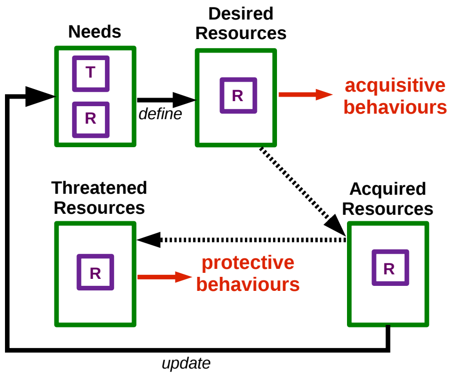

Figure 1: Resource Sets and Behaviours

This reflects in our model the personality of an agent, and to some extent its social role. As an example, for an agent i which is a politician, the "Reputation" type may be preferred to many other resource types, whereas for an agent j which is fond of pop music, the "Pop Music Concert" may be more important. This implies that j can risk to loose its reputation in passing someone in a waiting line for a pop music concert, whereas i will not take this risk. A payoff value is computed automatically for each behaviour according to these preferences and to the behaviour's effects. The behaviour selection is made according to behaviours payoff value, with protective behaviours having precedence over acquisitive ones.

Example : in the context of a waiting line, we define the set of acquisitive behaviours for a resource of "Rank" type $B^{+}_{Rank} = \{pass(i, j)\}$, which contains the behaviour of an agent i passing an agent j, and the set of protective behaviours $B^{o}_{Rank} = \{protest(i, j)\}$, which contains the behaviour of i protesting against j. For 2 given agents i and j we define $Reputation \succeq_i Rank$, which means that i prefers the "Reputation" type to the "Rank" type, and $Rank \succeq_j Reputation$. Agent i has an acquired resource that is the second rank in the waiting line and a reputation resource, and agent j has the third position. An effect of passing an agent in a waiting line ($pass(i, j)$) is to loose its reputation. Hence, agent i will not realize this behaviour, since "Reputation" is more important for it than "Rank". On the contrary, agent j can realize this behaviour because "Rank" is less important for it than "Reputation". When the "Rank" of an agent i is threatened by an agent j, i can realize the behaviour $protest(i, j)$.

3. EVALUATION

The evaluation conducted aimed at assessing if human observers can interpret emotions from agents' behaviours exhibited by our implemented model, and if they consider these behaviours as believable. It was our main hypothesis. Our protocol relies on written subjective reports made by observers watching a simulation video clip. Each participant had to respond to a questionnaire about a video clip submitted on Internet. There were 3 video clips from a scenario involving a fire (scenario 1), and 4 video clips from a scenario involving a waiting line (scenario 2). For scenario 1 two characters, an adult and a baby, were in a kitchen. A fire started in the room, and the adult could realize the behaviours : save the baby, save the bird, and save the hamburger. For scenario 2 some characters were in a waiting line, and they had the possibility to wait, to pass other agents, or to protest against intruders.

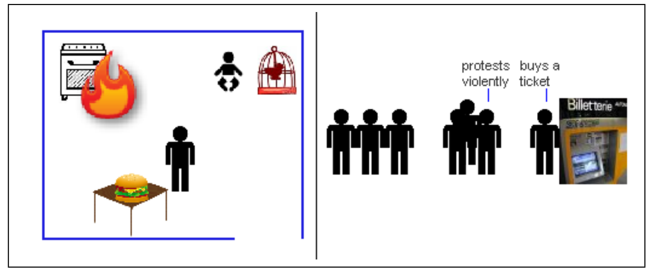

Figure 2: Left : fire scenario - Right : waiting line scenario.

According to our results, our main hypothesis was validated. Participants cited numerous emotion labels when they were explicitely invited to. They also used emotion labels when they were asked to describe and explain agents' behaviours at the beginning of the questionnaire. However, the percentage of participants who used emotion labels in the description remains below 50% per video clip. Participants also rated video clips in accordance with our main hypothesis in terms of believability and emotion interpretation. There were exceptions for two video clips : one was conceived in order to be not realistic, but participants rated it as realistic, and another one was rated as not realistic, which was not expected. An explanation could be that we underestimated the believability of agents' behaviours, and that the threat over some resources was not well represented in our simulation display.

4. CONCLUSION AND PERSPECTIVES

We presented an architecture aimed at providing virtual agents with believable emotional behaviours, which does not manipulate emotion categories. Our main hypothesis was that the simulation of such behaviours does not necessarily require an architecture grounded on emotion categories. Our results, based on the simulation of two different scenarii, validated this hypothesis. Therefore, we can rely on the model presented in this paper for future work on the simulation of affective behaviours. In particular, we plan to work on the hierarchy between resource types in agents' preferences, and to establish a general set of resources which could be used in every scenario.

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