Influence of the agent personality on its mood

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Abstract. When simulating emotions in an affective agent we must include factors that can affect the agent emotional behavior such as mood or personality. Personality can make a person more prone to feel certain types of emotions and mood. In this work we present the preliminary results obtained in an experiment carried out to find the factors that affect human emotional behavior in order to simulate this behaviour in an affective agent. We have focused on the effect of personality on the differences between agents mood. Preliminary results show that there is a correlation between the participants' personality and their initial mood.

Keywords: personality, agent, behavior, emotion modelling.

1 Introduction

There are several theories that try to explain the human behavior. One of the most relevant is the practical reasoning that is based on the idea that humans use the reason to decide how to act [7]. But human behavior is not always rational. This is due in part to emotions, mood and personality [12]. Many psychological studies have shown that personality influences cognitive processes (e.g. decision making process) as well and affective processes (e.g. making a person more or less prone to feel certain moods) [2, 20, 23]. Therefore, in order to simulate human behavior through an affective agent, it is necessary to study the influence of its personality on the agent cognitive and affective processes [15, 16]. In this article we show the preliminary results obtained in an experiment with 300 participants conducted to develop an affective agent model in the *GenIA*^{3} architecture [1]. We have used a regression model to analyze the effect of personality on mood represented using the PANAS model [21].

2 Background

When analyzing human behaviour from a rational point of view, we can observe certain inconsistencies when facing situations like a decision-making problem. These inconsistencies are due in part to the influence of emotions, mood and personality [4, 6, 23]. From a psychological perspective, emotions can be defined

as a rapid response to a stimulus while mood has a longer duration in time than emotions (e.g. hours or days) [3]. In addition, mood is not related to any particular stimulus, but rather it is the result of a succession of stimuli and emotions. On the other hand, personality is an affective characteristic that does not vary over time. Although the debate about what is personality is still open, today it is accepted that personality is a set of psychic characteristics that involve different cognitive processes and that produces differences in behavior between individuals when facing a given situation. Personality influences the way in which emotional responses to certain stimuli occur and the processes associated with the emotion elicitation. Personality also refers to the characteristic way in which a person thinks, feels, behaves, and relates to others [12].

Over the years different models have been proposed to represent different affective characteristics such as personality, emotions and mood. One of the most used models in psychology to define affection and personality is the PANAS model [13]. This model uses two dimensions to represent personality: *Positive Affect* (PA) and *Negative Affect* (NA) [21]. According to this model PA and NA can be considered as two independent variables. For example, the state of relaxation corresponds to a low level of negative affect, while calm is conditioned to a low positive affect. The positive affect reflects how enthusiastic, active, alert, and energetic a person is. While the negative affect reflects how disgusted, disinterested, angry, guilty, cowardly, and nervous a person is. Some moods are the result of the combination of both variables. Happiness for example, is related to a high level of positive affect and a low level of negative affect, while sadness is related to low levels of positive affect and high levels of negative affect [19]. The PANAS model can be used to analyze human personality using questionnaires in which the questions are conducted generically [11]. For example, in the question *"Are you usually feel sad?"*, the PA and NA factors can be interpreted as personality values instead of mood because the question refers to the "usual" emotional state of the person. The simplicity of this model make it appropriate to be used in modelling agents personality. There are other psychological models to represent personality using quantitative variables such as the Five Factor Model [10] that uses five variables to define personality: Openness, Consciousness, Extraversion, Agreebleness, and Neuroticism.

Different studies have been carried out to relate emotions and personality. For example, the trait of Extraversion is related to positive emotions and moods while Neuroticism is related to negative emotions and moods [5, 14, 15, 20, 17]. Similarly, in the PANAS model the PA and NA variables related to personality have a relationship with the PA and NA variables related to mood [22].

In recent years, different models have been proposed to simulate affective human behavior [8, 9]. One of the most innovative proposals is *GenIA*^{3}, which is a general purpose architecture for affective agents based on the BDI model (beliefs, desires and intentions) [1]. This architecture allows to create agents with affective characteristics in a simple way, providing an environment that allow to develop agents that simulate human behavior. However, in order to simulate this behavior, it is necessary to analyze the effect that factors such as

Table 1. Summary of the results obtained in the experiment.

	Mean	Sd
P_PA	23.08	4.9256
P_NA	11.14	6.2885
M_PA	5.798	2.3522
M_NA	2.281	1.8860

personality or mood have on it. The design of experiments to determine the relationships between the different affective categories becomes necessary.

3 Proposal

Our main goal is to develop an affective agent capable of simulating human behavior through emotions, personality, and mood. However, as we argued before, in order to develop this agent model it is necessary to study the relationships between the different affective categories. As part of the development of our affective agent model, in this work we analyze the relationship between personality and mood. We have used the data obtained from an experiment [1] where 300 participants (159 female and 141 male) of different ages (between 18 and 50) played an adapted version of the Black Jack game. Each participant played independently against the bank. The main goal of this experiment was to analyze the variations of mood during the game and the impact of the mood on decision making according to participants personality. At the beginning of the experiment, participants were asked about their mood and personality using the questionnaire proposed in [13]. This questionnaire is a Spanish adaptation of the one proposed by Watson [18] using scales of positive and negative affect. The questionnaire for the personality is composed by twenty questions: ten for the personality positive affect (P_PA) and ten for the personality negative affect (P_NA). Each question has five possible answers using a *likert-scale* where 1 means totally disagree and 5 means totally agree. In the same way, the questionnaire for the mood is composed of six questions using the same *likert-scale*: three questions for the mood positive affect (M_PA) and three for the mood negative affect (M_NA). Participants selected the response moving a slider. For this study we have used a composite sample of those participants whose M_PA and M_NA was greater than 1, that corresponds to the default value of the slider.

4 Results

Table 1 summarizes the statistics obtained in the experiment. The domain of the P_PA and P_NA is $[0, 40]$ corresponding to ten questions using a *likert-scale* of five answers. As we can see the average of P_PA is higher than the average of P_NA and the same happens with the variables M_PA and M_NA. In addition,

Table 2. Correlation matrix of PANAS values for personality and mood. *P-value less than 0.05 significant.

		P_PA	P_NA	M_PA	M_NA
P_PA	Correlation	1.0000			
	P-value	0.0000*			
P_NA	Correlation	-0.0843	1.0000		
	P-value	0.1451	0.0000*		
M_PA	Correlation	0.6525	-0.14822	1.0000	
	P-value	0.0000*	0.0101*	0.0000*	
M_NA	Correlation	-0.3192	0.3008	-0.3837	1.0000
	P-value	0.0000*	0.0000*	0.0000*	0.0000*

Table 3. Linear regression model for M_PA variable. *P-value less than 0.05 significant

	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	1.0535	1.4063	0.749	0.455
P_PA	0.2620	0.0387	6.767	7.48e-10*
P_NA	-0.0437	0.0303	-1.443	0.152

the standard deviation of the M_NA variable is very small, indicating that the data may be concentrated near the mean. This is better shown in Figure 1, in which we can see that the data of the variable M_NA is concentrated in low values, while the variable M_PA has a more normal distribution.

On the other hand, Table 2 shows the correlation between PANAS variables for both personality and mood. As we can see, P_PA and P_NA have a moderate correlation with M_NA. While M_PA variable has a high correlation with P_PA and a moderate correlation with P_NA. We can also see that all correlations are statistically significant except for P_PA and P_NA. In order to analyze how personality affects mood we have performed a regression analysis on M_PA and M_NA variables.

The result of the regression analysis for M_PA variable is shown in Table 3. The only statistically significant variable in this regression model is P_PA since its p-value is less than 0.05. Figure 2 shows the statistical analysis of the regression model. As we can see, the residues of the regression model fall along the straight line at a 45% angle in the Q-Q plot which provide strong evidence that these numbers come from an uniform distribution. The residual graph (Figure 2) shows that the variation of the residues is constant, so we can assume that the assumption of linearity is met. Therefore we can assume that the regression model is valid for the M_PA variable.

The r-squared value is 0.2931 therefore this regression model explains the 29.31% of the variability of the variable M_PA. Although it is a low percent-

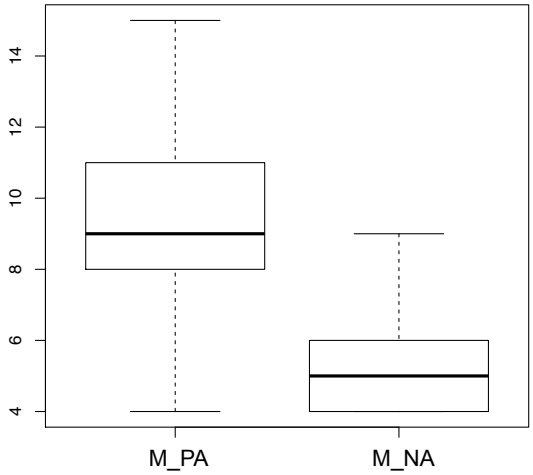

Fig. 1. Boxplot of mood variables.

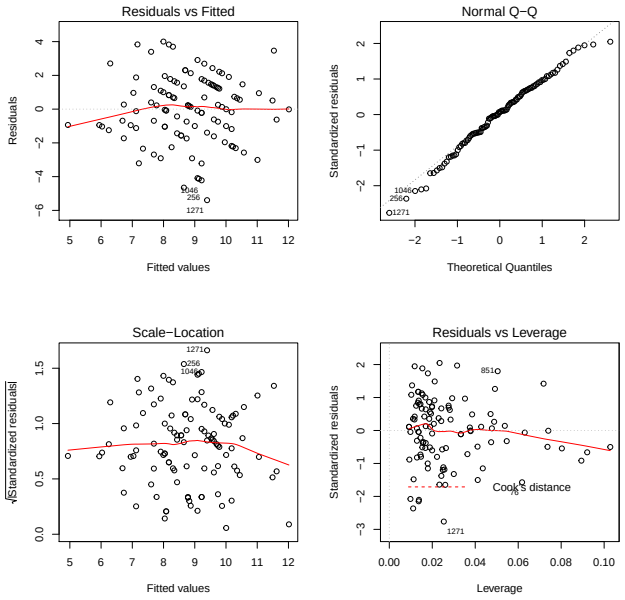

Fig. 2. Analysis of the linear regression model for M_PA variable.

age, we must consider the variability of the data when performing this type of psychological experiments. Therefore, both a r-squared of thirty percent can be a good value if we consider that we have only used personality to explain the differences between participants' initial mood. Therefore, each affective agent of our model will calculate its initial mood considering that thirty percent of its M_PA depend on its P_PA value.

For the prediction of M_NA value, as we mentioned above, the data is asymmetric and with low dispersion, which makes it difficult to apply a linear regression algorithm. We have tried to apply different transformations of the data and we have not found any linear regression model that met the normality conditions.

5 Conclusion

In this work we have presented a preliminary analysis of the influence of personality on mood using the data obtained in an experiment with 300 participants. This analysis allow us to obtain a model that partially explain the relationship between mood and personality and emotional behavior. We are using this model to develop a multi-agent system capable of simulating human behavior in a realistic way.

We have shown that the P_PA variable from the PANAS model has a positive correlation with the variable M_PA, which indicates that there is influence of personality on mood. However, the variable M_NA has an asymmetric distribution, which has made it difficult to find a linear regression model to determine the influence of personality on this variable. Nevertheless, in this work we have shown the importance of personality in mood, being able to explain almost thirty percent of the variability of the variable M_PA.

We are currently analyzing in deep all the results of the experiment in order to find a model that allows us to identify the proportion of variance of the NA variable that can be explained by personality. Once these models are obtained, we want to implement a multi-agent system within the *GenIA*^{3}architecture that allows us to simulate human behavior taking into account different personalities.

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