

Culture-Personality based Affective Model

**Asad Nazir, Mei Yii Lim, Michael Kriegel,
Ruth Aylett, Allison Cawsey**
School of Mathematics and Computer Science,
Heriot-Watt University, Edinburgh
{asad, myl, michael, ruth,
allison}@macs.hw.ac.uk

Sibylle Enz, Carsten Zoll
Otto-Friedrich-Universität Bamberg
Kapuzinerstraße 16
D-96045 Bamberg
{sibylle.enz, carsten.zoll}@uni-bamberg.de

ABSTRACT:

This paper includes a proposed model for cultural characters based on the PSI model of emotions combined with Hofstede's cultural dimensions and the Big Five model of personality. It starts with an introduction to the research, followed by a discussion on the main features of PSI and Hofstede's cultural model along with the Big Five personality parameters. Finally it discusses the integration of the three models.

Author Keywords

Cultural Model, Hofstede's Cultural Dimensions, Conversational Agents, PSI theory, Big Five personality model

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous, I.2.0. Artificial Intelligence: General (cognitive simulation)

1. INTRODUCTION

Culture is an important factor which influences the way we interact with each other. It sometimes can also become the factor which makes interactions difficult, resulting in misunderstandings. Since it sets rules and norms within a social group that influence individual behaviour and social interaction, that is, how we react to the behaviour of others [Cox, 1993], it provides multiple occasions for misunderstanding and conflicts when rules and norms from different cultural backgrounds have to be addressed within one team or workgroup. Hence, with the rising number of cross-cultural teams and multi-national organizations, it has become increasingly important that people are aware of cultural differences and are able to work and live together.

The research presented in this paper concentrates on modelling synthetic characters which display cultural differences by belonging to synthetic cultures of their own.

Intelligent conversational agents should understand, and be able to embody different cultural personalities. This ability to understand and respond to cultural and personality

differences should go hand-in-hand with the apprehension of the agent's emotions and by appropriate responses.

In this paper we define certain concepts and models from inter-cultural communication and psychology and merge them to propose a model for cultural characters. The basic components are the dimensions of cultural variability [Hofstede, 1991]; the PSI model of emotions [Dörner, 1995] and the Big Five model of personality [McCrae & John, 1992].

2. BACKGROUND

2.1 Culture and Emotion

People modify their expressions on the basis of cultural display rules [Ekman & Friesen, 1969; Matsumoto, Yoo, Hirayama, & Petrova, 2005]. These are culturally prescribed rules, learned early in life, which force the management and modification of the universal expressions depending on social circumstances. Expression of emotions is largely universal, but there are subtle differences across cultures that can create a challenge for effective communication [Elfenbein & Ambady, 2003]. The research in this field is quite active, but not many studies have been published; some of the results are mentioned below:

[Camera et al., 1998] examined spontaneously occurring expressions in infants of 11 months of age from three different cultures (China, Japan and Europe/America) and indicated that Chinese babies were less expressive than babies from the other two cultures.

[Waxer, 1985] examined facial expressions in American and Canadian game show contestants. He found no difference in types of emotions, but found some differences in ways of expressions. For example, the American females were found to use their hands more than Canadians and the American males smiled more than Canadians did.

[Ekman, 1972] demonstrated the existence of these rules by conducting a study of watching stressful films alone and in the presence of an experimenter. Matsumoto and [Kupperbusch, 2000] extended the original Ekman experiment by using collectivistic and individualistic

encoders. They found that the collectivistic people showed less negative expressions in the presence of an experimenter.

2.2 Dimensions of Cultural Variability

Many anthropologists and inter-cultural communication experts came up with ways to describe cultures and how they differ from each other. Hofstede, Hall, Brislin, etc. advised various / different models. Amongst those, Hofstede's "dimensions of cultural variability" is the most cited model. Hofstede analysed large amount of data collected using a questionnaire related to cultural behaviours. He used people from around the world in his studies and came with these dimensions. Following is a brief introduction to the dimensions:

Identity (Collectivism Vs Individualism)

Collectivistic cultures emphasize community, collaboration, shared interests, harmony, traditions and public good. The members of a collectivist culture can suppress emotions according to the mood of the group [Triandis, 1994]. Body movements and other kinesics are more synchronized. Individualistic cultures emphasize personal rights and responsibilities, privacy, voicing one's own opinions, freedom, and self expression. The collectivism – individualism dimension is one of the most important dimensions as it outlines general differences between the behaviours in individual communication and in group communication.

Uncertainty Avoidance

In some cultures freedom produces uncertainty, which leads to stress and anxiety. These cultures may seek to avoid uncertainty by increasing rules of behaviour. This applies in varying degrees to countries like Greece, Portugal, Belgium, Japan, Peru, France, Chile, Spain and Argentina [Berger, 1975].

Other countries are better able to tolerate freedom and diversity without excess stress and anxiety. These countries include Singapore, Denmark, Sweden, Hong Kong, Ireland, England, India, etc. [Gudykunst, 2002].

A culture's rigidity and dogmatism are a function of the uncertainty avoiding dimension. It also defines uncertainty avoidance communication between individuals according to cultures and describes the different types of direct or indirect approaches to avoid or get rid of uncertainty.

Hierarchy (Low Vs High Power Distance)

The members of high power distance cultures see power as a basic fact in society, e.g. South Asia, Caribbean, France (compared to surrounding countries), etc. [Hofstede, 1991]. The members of low power distance cultures believe power should be used only when it is legitimate, this dictates the way people with different power distance and standing in a society or organization communicate with each other.

Gender (Masculinity vs. Femininity)

Gender is a big factor in defining rigidity in cultural roles. Members of cultures high in masculinity value performance, ambitions, things, power and assertiveness.

Members of cultures high in femininity value quality of life, service and caring for others.

Cultural Profiles

After reviewing cultural models we had to come up with a way in which we can define a synthetic culture for role plays and scenarios. Geert Van Hofstede [Hofstede et al., 2002] used a few techniques in cultural non-computer games. The following concepts provide an interesting way to parameterize and constitute a synthetic culture. The requirements for the characters based on the conceptualization would be as follows:

The core components of a culture are defined below. Note that these core values are for one of the dimensions mentioned above. But they are combined to make more complex cultures.

Core Value: This is the value of the extremity of cultural dimensions. It represents the obsession of the synthetic culture. This will in future refinement of the framework link to the need section of the motivational unit and contribute to the intention generation process.

Core Distinction: It is the basic distinction that the members of a particular culture make when observing the social world around them. This is part of the perception part of the framework

Key Behaviour: This is a list of golden rules for appropriate behaviour in the culture. This will define a cultural personality depending on norms and behaviours.

Words with a positive connotation: "Words people like to use and like to hear". These will be very important for emotional responses and recognitions.

Words with a negative connotation: "Words people don't like to use and hear".

At a glance:

- Language: theoretically there is no restriction of language between members of synthetic cultures, but certain words may carry different meanings.
- Non-verbal behaviour
- Stereotypes
- Outsider's evaluation of the culture

Gender Roles

So, an example profile for an extreme high power distance culture will look like:

Core value:

Respect for status (so the most important needs in this culture will be defined around the concept of respect)

Core distinctions:

Powerful/dependent (the behaviours will change according to this value)

Key Elements:

1. The more powerful a person, the more respectable he/she is.
2. Power, status and privilege go together.
3. Less powerful depend on more powerful.
4. Centralization. (Influenced by a powerful figure).
5. Low power people expect direction.
6. High-power boss is a benevolent autocrat.
7. Style of speech is formal and acknowledges hierarchical positions.

Words with positive connotation:

Respect, father (title), master, servant, older, younger, wisdom, favour, protect, obey, orders, pleasing.

Words with negative connotation:

Right, complain, negotiate, fairness, necessity, codetermination, objectives, question, criticize.

The key benefit of describing a culture in this way is that it simplifies the complex notion of culture and still focuses on the cultural differences. This way of defining a cultural profile will help in representing the rules and values associated with culture in the agent mind.

2.3 PSI Model

Emotions play a critical role in decision-making, perception, human interaction and human intelligence [Picard, 1997]. They filter relevant data and provide a global management over other cognitive capabilities, important when operating in complex real environments [Oliveira, 2003]. Furthermore, they are one important source and effect of any human-human interaction. For example, when we are happy, we tend to greet everyone we meet. However, if someone returns our greeting with a frown, we might feel insulted. Therefore, in order to create socially rich and believable interactions among synthetic characters, emotions are an essential element.

We view emotions as resulting from the modulation of cognitive processes including perception, motivation, action selection, planning and memory access as proposed by PSI [Hille, 2001; Dörner, 2003]. These processes work in concert for effective action regulation allowing the creation of biologically and psychologically plausible characters [Dörner, 1995; Bartl & Dörner, 1998; Lim, 2007]. Within the PSI theory, processes are self-regulatory because all

behaviours produced by a character are driven by a limited number of basic needs, including existence-preserving need, affiliation need, certainty need and competence need. The amount of the deviation from a set point constitutes the strength of each need and a character's aim is to reduce deviation as much as possible.

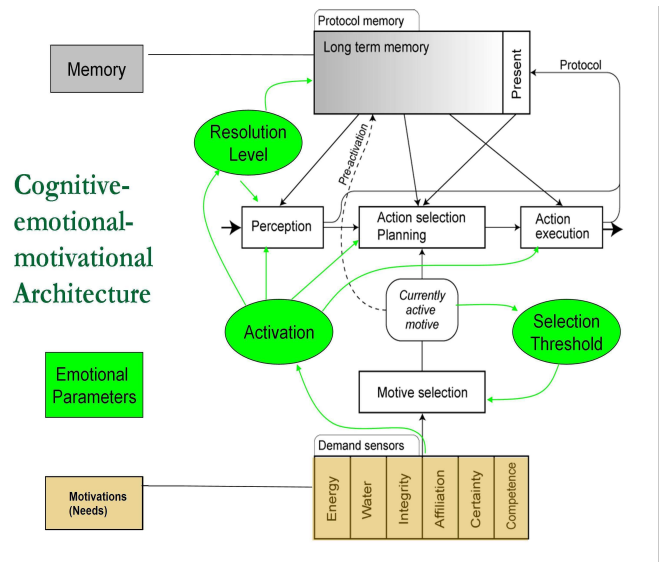


Figure 1: The PSI model (e.g. Dörner, 2003)

In addition to needs, a character has a set of modulators that affect cognitive processes – *arousal*, *resolution level* and *selection threshold*. *Arousal* refers to the character's preparedness for action, *resolution level* determines the accuracy of cognitive processes and *selection threshold* prevents oscillation of behaviour by giving the currently active intention priority. The values of these modulators are influenced by the current needs. An increase in needs will lead to higher *arousal* whereas a decrease in needs will lead to lower *arousal*. *Resolution level* decreases with heightening *arousal* while *selection threshold* increases with heightening *arousal*. Different combinations of needs and modulator values result in the subjective experience of emotions. For example, when *needs* are high, *arousal* and *selection threshold* will be high and *resolution level* will be low. In such a situation, time consuming search is forbidden as quick reaction is required. The character will concentrate on its current task to fulfil the deviated needs. Due to the lack of deliberateness in processing and fast actions, we might diagnose that the character is experiencing anxiety.

Functionally, a PSI based character perceives the environment continuously. It reacts to the environment by forming memories, expectations and immediate evaluations to determine the effect of an event on its needs. It then builds up intentions to satisfy the needs, stored in its memory. Once an intention is selected, three levels of goal-oriented action execution can be distinguished. First, the character tries to recall an automatic, highly ritualized

reaction to handle the intention. If this is not possible, a plan may be devised by combining parts of other action sequences. If planning also fails, trial and error is applied and this might involve exploration of the environment for more information to generate actions that may contribute to goal satisfaction. The choice of strategy for action execution depends on the character's current emotional state. For example, detailed planning or exploration will be performed only if the character's *resolution level* is above a certain threshold, i. e. when there is no immediate threat to the character's needs. By doing so, the character adapts its behaviour to different environmental circumstances flexibly.

Furthermore, a PSI character learns by experience and possesses a memory system in which all perceptions and activities are continuously recorded. This memory may be exposed to decay as well as amplification. The memory traces of the immediate past and those that are concerned with needs satisfaction are very dense and less susceptible to decay. These traces are stored in short-term memory. With continuous activation, this memory may eventually become long-term memory, whereas other weaker memory chains will be destroyed rather quickly [Bartl & Dörner, 1998].

Emotions in PSI and the OCC model (Ortony, Clore & Collins, 1988)

In PSI, emotions are modelled as emerging from the information processing and not as separate constructs. Behaviour emerges on the basis of needs and perceptions from the environment, and emotions are modelled as modes in which the actions are acted out, as described above. This innovative approach can be compared to models that are widely used to model emotions in the context of artificial intelligence and cognitive modelling, e.g. the OCC model of emotions (Ortony, Clore & Collins, 1988). It is an appraisal theory which means that emotions result from cognitive representations and appraisals of the current situation the organism is dealing with. These appraisals result in emotions and can refer to the outcomes of events, the agency of other agents or the attributes of objects. For each of them the appraisal criterion is different. Objects are appraised regarding their appealingness, agents regarding the praiseworthiness of their actions, and the outcomes (or consequences) of events are appraised regarding their desirability. Ortony et al. (1988) posit that different appraisals lead to qualitatively different types of emotions. In short, advantages of the PSI approach as compared to the OCC model are:

- Emotions need not be modelled separately but emerge from the system.
- There is no need to define a number of relevant emotions.
- Emotions emerge as a consequence of need states instead of being directly linked to events or actions which makes PSI a more psychologically sound approach.

- This leads to believable dynamics of emotional states that do not rely on thresholds and decay rates (as in OCC) but on current need states that also determine action selection.
- Arousal is already part of PSI and does not need to be calculated from the general intensity of emotions; rather, activation determines the emotional state (in PSI terms, arousal does not decrease in the absence of intense emotions, but when basic needs are satisfied).

2.4 Big Five Model

Besides emotions, personality plays a role in a character's social interaction. Characters with different personalities will have different emotional reactions to a particular event based on the context of communication, social status, culture, etc. The most popular approach to study personality among psychologists is the Big Five Model [e. g. McCrae et al., 1996]. It consists of five personality dimensions (OCEAN): Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (John, 1990; McCrae & John, 1992; Goldberg, 1990).

Openness to experience refers to the degree to which one is able to accept unconventional and new ideas. Conscientiousness is defined by one's self-discipline and dutifulness in performing a task. Extraversion is being energetic and outgoing, experiencing positive emotions and seeking the company of other people. Agreeableness determines how compassionate, altruistic and cooperative one is. Lastly, neuroticism refers to how vulnerable one is towards experiencing negative emotional states.

3. THE CULTURAL MODEL

In this section we are proposing a cultural model based on the theories reviewed above.

Memory

A character's long term memory will hold cultural rules that are rigid and will not change over time. On the other hand, cultural priorities and other cultural stereotypes will reside in short-term memory so that they can be updated from time to time. The other culture profile defines the stereotypical behaviour that is expected from the other characters. Lim [07] showed how a character can update its belief based on its emotional state, applying the PSI model. When a character's expectations do not match the events happening in the environment, its certainty level drops which leads to a higher *arousal*. This negative state is taken as a failure feedback and calls for discrepancy reduction [Harmon-Jones, 2000].

Hence, the character will try to revise its current mindset by updating its existing memory with the new information. This concept is applicable to our cultural model. Through interaction with characters from other cultures, a character can update its cultural stereotypes if some expectations about its interaction partner are not fulfilled. The other culture profile will be very similar to the character's own profile and will have some stereotypical behaviour related to it and will be updated over time.

Cultural Needs

Hofstede's cultural dimensions can be mapped to the PSI needs and modulators. Thus, culture can be modelled as emerging from the need states of the individuals that inhabit a specific culture. For example, an individual belonging to an individualistic culture will have high needs for uncertainty avoidance and competence and a lower need for affiliation. A similar needs setup can be observed in a feminine culture.

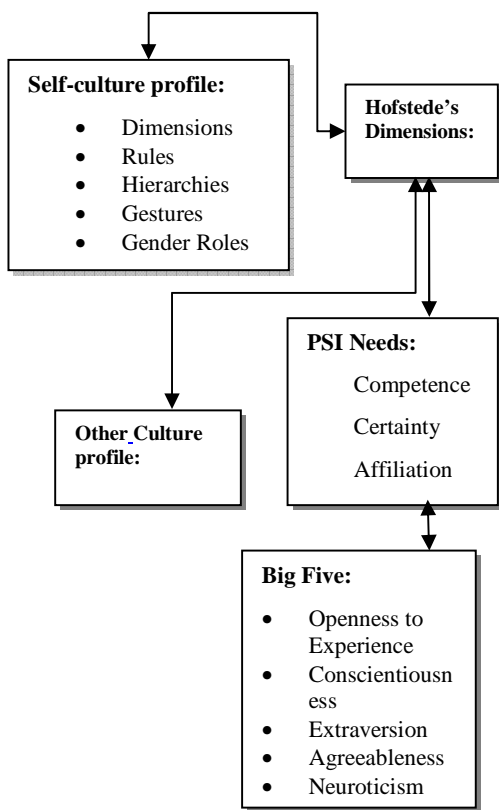


Figure 1: A cultural character model

The Big Five dimensions can also be interpreted in terms of PSI needs and modulators. The idea is that the overt behaviour that serves as a source of understanding others and explaining their behaviour (commonly described on the basis of personality characteristics or traits) can also – like

the cultural dimensions – be traced back to differences in need states and need importance in the individual.

An individual who scores high in openness will be someone who has a low need for certainty and high need for competence, eventually showing behaviour that can be characterized as daring, curious, even risky at times, because they want to gain new insights and experiences and are convinced that they can achieve what they want to achieve. A conscientious person on the other hand will be someone who has a high need for competence and certainty and will be showing rather cautious behaviour that is aimed at achieving something within a set context or environment where the person feels safe and secure. An extravert will be someone who is primarily characterized as someone with a high need for affiliation, someone who seeks social contacts and wants to get into contact with other people. Needs for an individual who scores high in agreeableness are generally not extremely activated or require a long time to exceed the activation threshold, resulting in a certain calmness and satisfaction. On the other hand, a person who is neurotic will be someone who has many needs that can be easily activated (or active at the same time) and a low selection threshold causing jumpy, unpredictable behaviour.

In the cultural agent model we propose, personality can be combined with culture. As we have shown, both Big Five personality parameters and cultural dimensions can be mapped onto PSI needs, so merging the two is simply a matter of defining their balance, i.e. to what percentage each of those two components contributes to the PSI needs. For example, an extravert who is in an individualistic culture will have a lower need for affiliation than one who is in a collectivistic culture. An open individual in a feminine culture will have a lower need for certainty than one who is in a masculine society.

4. EXAMPLE APPLICATION

As part of the EU FP6 project e-Circus, our research group is currently developing software called ORIENT with the goal to facilitate the user's awareness and appreciation of cultural differences and diversity. ORIENT is an ideal example for the application of our model of virtual agents that are aware of their own and other agent's virtual cultures. We design ORIENT as an interactive computer assisted role playing game. The players take the roles of foreign visitors to an unknown planet that is inhabited by several alien cultures. In order to save the planet from an imminent catastrophe, the users have to use the help of the planets inhabitants, which can only be achieved by integrating themselves into the cultures and helping the cultures reconcile with each other.

The alien inhabitants are represented by autonomous virtual agents. Existing agent architectures [e.g. Aylett, 2006] support the generation of autonomous behaviour, but outside of a cultural context. In order for ORIENT agents to

act in a way coherent with their culture and to represent cultural conflicts between the different virtual ORIENT cultures in a believable way, a cultural agent model like the one proposed in this paper is needed.

5. CONCLUSION

In this paper we have introduced a model for virtual cultural agents. It is based on the PSI architecture and combines agent personality according to the Big Five with the properties of an agent's culture according to Hofstede's cultural dimensions.

Future work includes the refinement and extension of the model to cover other parameters of cultural variability, and implementation of the model. A proof of concept demonstration is planned to illustrate difficulties in intercultural communication through simulated agents embodying different cultural personalities. Scenarios are also being defined which we hope will clarify communication difficulties and potential misunderstandings.

6. ACKNOWLEDGMENT

This paper is supported by the eCIRCUS (Contract no. IST-4-027656-STP) project carried out with the provision of the European Community in the Framework VI Programme.

7. REFERENCES

1. Aylett, R., Dias, J. & Paiva, A. (2006). *An affectively driven planner for synthetic characters*. In Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS). AAAI Press.
2. Bartl, C., & Dörner, D. (1998). Comparing the behaviour of psi with human behaviour in the biolab game. Bamberg: Lehrstuhl Psychologie II, Memorandum Nr. 32.
3. Berger, C. R., & Calabrese, R. (1975). Some explorations in initial interactions and beyond. *Human Communication Research, 1*, 99-112.
4. Brislin, R. W. (1993). *Understanding culture's influence on behaviour*. Fort Worth, TX: Harcourt Brace.
5. Cox, T. H. (1993). *Cultural Diversity in Organizations: Theory, Research, and Practice*. San Francisco: Berrett-Koehler.
6. Camera, L.A., et al. 1998. Production of emotional facial expressions in European American, Japanese, and Chinese infants. *Developmental Psychology* 34(July):616
7. Dörner, D. (2003). The mathematics of emotions. In F. Detje, D. Dörner, & H. Schaub, (Eds.), *Proceedings of the Fifth International Conference on Cognitive Modelling*, amberg, Germany (Apr, 10-12, 2003).
8. Ekman, P. (1972). *Universals and cultural differences in facial expressions of emotion*. In J. K. Cole (Ed.), *Nebraska Symposium on Motivation*, vol. 19 (pp. 207-283). Lincoln: University of Nebraska Press.
9. Ekman, P., & Friesen, W. (1969). The repertoire of nonverbal behaviour: Categories, origins, usage, and coding, *Semiotica, 1*, 49-98.
10. Elfenbein, H. A., & Ambady, N. (2003). *Cultural similarity's consequences: A distance perspective on cross-cultural differences in emotion recognition*. *Journal of Cross-Cultural Psychology, 34*, 92-110.
11. Goldberg, L. R. (1990). An alternative "description of personality": The Big Five Factor structure. *Journal of Personality and Social Psychology, 59*, 1216-1229.
12. Gudykunst, W. B., & Mody B. (2002). *Handbook of International and Intercultural Communication*. 2nd Edition. Thousand Oaks, CA: Sage.
13. Hall, E., & Hall, M. R. (1990). *Understanding Cultural Differences*. Yarmouth, Maine: Intercultural Press.
14. Hofstede G. (1991). *Cultures and Organisations*. London: McGraw-Hill.
15. Hofstede, G. J., Pedersen, P. B., & Hofstede, G. (2002). *Exploring Culture: Exercises, stories and Synthetic Cultures*. Yarmouth, Maine: Intercultural Press.
16. John, O. P. (1990). The "Big Five" factor taxonomy: Dimensions of personality in the natural language and in questionnaires. In L. Pervin (Ed.), *Handbook of personality theory and research* (pp. 66-100). New York: Guilford.
17. Harmon-Jones, E. (2000). Cognitive dissonance and experienced negative affect: Evidence that dissonance increases experienced negative affect even in the absence of aversive consequences. *Personality and Social Psychology Bulletin, 26*, 1490-1501
18. Hille, K.. (2001). A theory on emotion. http://web.uni-bamberg.de/ppp/insttheopsy/dokumente/Hille_A_theory_of_emotion.pdf
19. Khaslavsky, J. (1998). Integrating culture into interface design. In *CHI 98 conference summary on Human factors in computing systems*, (pp. 365-366). Los Angeles, California: ACM Press.
20. Lim, M. Y. (2007). Emotions, Behaviour and Belief Regulation in An Intelligent Guide with Attitude, PhD

thesis, School of Mathematical and Computer Sciences, Heriot-Watt University, Edinburgh.

21. Matsumoto, D., Yoo, S. H., Hirayama, S., & Petrova, G. (2005). Development and validation of a measure of display rule knowledge: The Display Rule Assessment Inventory. *Emotion, 5*, 23-40.

22. Matsumoto, D., & Kuppertsbusch, C. (2001). Idiocentric and allocentric in emotion expression, experience, and the coherence between expression and experience. *Asian Journal of Social Psychology, 4*, 113-131.

23. McCrae, R. R., & Costa, P. T., Jr. (1996). Toward a new generation of personality theories: Theoretical contexts for the five-factor model. In J. S. Wiggins (Ed.), *The five-factor model of personality: Theoretical perspectives* (pp. 51-87). New York: Guilford.

24. McCrae, R. R. & John, O. P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality, 60*, 175-215.

25. Oliveira, E., & Sarmiento, L. (2003). Emotional advantage for adaptability and autonomy. In AAMAS (pp. 305-312). Melbourne, Australia: ACM Press.

26. Ortony A., G. Clore, A. Collins (1998). *The cognitive structure of emotions*. Cambridge: University Press.

27. Picard, R. W. (1997). *Affective Computing*. Cambridge: MIT Press.

28. Seelye H. N. (Ed.) (2006). *Experiential Activities for Intercultural Learning*. Yarmouth, ME: Intercultural Press.

29. Triandis, H. C. (1994). *Theoretical and methodological approaches to the study of collectivism and individualism*. In U. Kim, H. C. Triandis, C. Kagitcibasi, S. Choi, G. Yoon (Eds), *Individualism and Collectivism* (pp. 41-51). Thousand Oaks, CA: Sage.

30. Trompenaars, F. (1993). *Riding the Waves of Culture: Understanding the Cultural Diversity in Business*. London: Nicholas Brealey.

31. Waxer, P.H. 1985. *Video ethnology: Television as a database for cross-cultural studies in non-verbal displays*. *Journal of Non-verbal behaviour, 9*, 111-120.