Prelude to Cultural Software Agents:
Cultural Backgrounds in Agent Simulation

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"We often fail to realize how little we know about a thing until we attempt to simulate it on a computer" Donald Knuth, 1968

Abstract

The aim is to glean appropriate theories and pragmatic findings on human culture and explore ways in which they can be embedded on the decision making of advanced software agents. For this purpose, bases for fuzzy computational agents to represent cultural background and cultural biases of individuals are presented. Some definitions of culture and dimensions, layers and descriptions of differences among cultures are reviewed. Culture models of Hofstede and Schwartz are reviewed and a special questionnaire to specify cultural values is explained. A preliminary model for cultural agents is described briefly and simulation of a cultural agent in Fuzzy Clips environment is reported.

1. INTRODUCTION

Some aspects of human cognitive and affective characteristics are taken into account in advanced agent simulation, i.e., simulation of systems represented as software agents. In Ören and Ghasem-Aghaee [2003] and Ghasem-Aghaee and Ören [2003] we elaborated on representation of human personality by fuzzy agents. Later, we started to elaborate on the representation of human emotions for agent simulation [Kazemifard, Ghasem-Aghaee, and Ören 2006]. It is well known that cultures also affect human decision making. Our research team aims to glean appropriate theories and pragmatic findings on human culture and explore ways in which

they can be embedded on the decision making of advanced software agents. Due to several challenges in achieving this aim, in this article, we provide a general introduction to human culture and its several layers. Especially two cultural models due to Hofstede [Hofstede 1980; Hofstede and Hofstede 2005] and Schwartz [2003] are elaborated on.

A culture is a way of life of a group of people that they accept, generally without thinking about them, and that are passed along by communication and imitation from one generation to the next [Hofstede and Hofstede 2005]. Different cultures have usually different standards for perceiving, believing, evaluating, communicating, and acting. Hence culture affects decision making and norm of behavior in different situations [Smith et al., 2007]. In negotiation, decision making and team-working simulations, using cultural intelligent agents with different norms of behavior and ways of communication can be useful for solving some problems such as conflict [Samarah et al., 2003]. Avruch [1998] explores the role of culture in conflict resolution.

In this paper, we present a fuzzy logic-based model of culture and simulate a preliminary intelligent cultural agent. In second part of this article, we present some definitions of culture, theories of dimensions of culture and describe differences among cultures. In part 3, we outline Hofstede's dimensions of culture. We discuss Schwartz's culture model in part 4. In part 5, a special questionnaire to specify cultural values based on Schwartz et al. [2001] is presented. A proposed model for cultural agents is outlined in part 6. Finally, we simulate a cultural agent in Fuzzy Clips environment and calculate fuzzy sets and write sample rules for one of culture

dimensions. In last part, research results and future works are outlined.

2. CULTURAL DIFFERENCE

Most of the people who study culture agree that culture is learned. It is not encoded in our DNA. Each culture has standards for acting and communicating that are passed down from one generation to the next. Culture is created by people and is embodied in both physical and social artifacts. For example, physical artifacts that differ across cultures are cloths, tools, music and architecture. Social artifacts include rules, roles, and relationships that implicitly or explicitly define what people can do [Smith et al., 2007].

"Studying differences in culture among groups and societies presupposes a neutral vantage point, a position of cultural relativism. A great French anthropologist, Claude Lévi-Strauss (born 1908), has expressed it as follows: 'Cultural relativism affirms that one culture has no absolute criteria for judging the activities of another culture as 'low' or 'noble.' However, every culture can and should apply such judgments to its own activities, because its members are actors as well as observers.'" [Hofstede and Hofstede 2005, p. 6].

To study culture, we first describe manifestations of culture. Cultural differences manifest themselves in different ways and differing levels of depth. Cultures consist of values, rituals, heroes, and symbols [Hofstede and Hofstede 2005, p. 7]. Symbols represent the most superficial and value the deepest manifestations of culture, with heroes and rituals in between.

Symbols are words, gestures, pictures, or objects that carry a particular meaning which is only recognized by those who share a particular culture. New symbols easily develop, old ones disappear.

Heroes are persons, past or present, real or fictitious, who possess characteristics that are highly prized in a culture. They also serve as models for behavior.

Rituals are collective activities, sometimes superfluous in reaching desired objectives, but are considered as socially essential.

Values: The core of a culture is formed by values. They are broad tendencies for preferences of certain state of affairs to others (good-evil, right-wrong, natural-unnatural) [Hofstede and Hofstede 2005].

Values form the core of a culture. That is why value transfer between cultures is a rare phenomenon. Thus, discussing the cultural differences is in fact highlighting the differences between cultural values. Values also form cultural dimensions of society. For example, American decision making style is more individual than that of Japanese people. Main features of values, as formulated by Schwartz in value theory are the following [Schwartz 1992, ANES-doc 2006, pp. 1-2]:

1. "*Values are beliefs* linked inextricably to affect. When they are activated, they become infused with feelings.

2. *Values refer to desirable goals* that motivate action.

3. *Values transcend specific actions and situations* (e.g., obedience, honesty, independence). This distinguishes values from narrower concepts like *norms* and *attitudes* that usually refer to specific actions, objects, or situations.

4. *Values serve as standards or criteria*. Values guide the selection or evaluation of actions, policies, people, and events. People decide what is good or bad, justified or illegitimate, worth doing or avoiding, based on possible consequences for their cherished values. The impact of values in everyday decisions is rarely conscious. Values enter awareness when the actions or judgments one is considering have conflicting implications for different values one cherishes.

5. *Values are ordered by importance*, relative to one another. People's values form an ordered system of value priorities that characterize them as individuals. This hierarchical feature also distinguishes values from *norms* and *attitudes*.

6. *The relative importance of multiple values guides action*. Any *attitude*, *opinion* or *behavior* typically has implications for more than one value. … The tradeoff among relevant, competing values is what guides attitudes and behaviors [Schwartz 1996]. Values contribute to action to the extend that they are relevant in the context (hence likely to be activated) and important to the actor"

Fink et.al. [2004] provide a framework for understanding managerial implications of multinational teams. In addition to context, four major categories of variables have a determining influence on multinational team performance: universal values, norms of behavior, perceptions of others and self, and personality traits. Size of teams, kind of task, learning opportunities, power and interests change the effects of these variables. Of particular importance is the team implementation process, which can neutralize adverse effects of

wrong perceptions, helps to establish team norms and, thus, contributes to success of multinational teams. G. Hofstede's cultural dimensions for many countries and their comparisons are available on Internet [Hofstede].

3. HOFSTEDE'S DIMENSIONS OF CULTURE MODEL

In 1980, organizational sociologist Geert Hofstede published his book Culture's Consequences which presented an impressively extensive study. He collected questionnaire responses from more than 100,000 individuals from around the world. All respondents worked in the marketing and service divisions of a multinational corporation (IBM). The questionnaires concerned various aspects of employees' work experience that could be tied to fundamental human values. From this material, Hofstede was able to make comparisons across countries. In his first analysis, 40 countries were compared. Hofstede [1980] managed to provide an empirical mapping of the world's major nations across four dimensions of culture. He also integrated these results with previous theory and data about national cultures [Bond 2002]. Later, several more were included in the study and together with other researchers' replications of Hofstede's study, the study now includes more than 60 nations [Hofstede and Hofstede 2005].

Based on the data collected at IBM sites around the world, Hofstede identified four different bipolar dimensions of cultural diversity: (1) power distance, (2) uncertainty avoidance, (3) individualism/collectivism, and (4) masculinity/femininity. Afterwards, he added a fifth dimension, i.e., long- and short-term orientation. Value characteristics of nations based on these five dimensions are elaborated on by Hofstede [1980] and Hofstede and Hofstede [2005].

Hofstede's analysis of cultural differences can be said to be valid for nations but not for any specific individual in a nation [Bond 2002; Hofstede 1980; Smith and Bond 1998]. Hofstede's dimensions are examples of group-level measures. However, Hofstede and Hofstede specify also several layers of culture which includes the national culture. According to Hofstede and Hofstede [2005, p. 11] layers (or levels) of culture an individual may belong to are the following:

1. *"National level*, according to one's country (or countries for people who migrated during their lifetime)

2. *Regional* and/or *ethnic* and/or *religious and/or linguistic level*, as most nations are composed of culturally dif-

ferent regional and/or ethnic and/or religious and/or language groups.

3. *Gender level*, according to a person was born as a girl or as a boy. [and also how later the person feels – emphasis added.]

4. *Generation level*, separating grandparents from parents from children.

5. *Social class level*, associated with educational opportunities and with a person's occupation or profession.

6. *(For those who are employed) Organizational, departmental and or corporate level*s, according to the way employees have been socialized by their work organization."

Hofstede has been criticized for some aspects of his study. First, he has been criticized for his selection of respondents. All participants worked for IBM, a company which is said to have a rather specific organizational culture [Smith and Bond, 1998] which the company most probably tries to instill in all offices, regardless of where in the world they are situated. In addition, all respondents worked within the marketing and servicing divisions and can hardly be seen as a representative sample of their cultures. Furthermore, the questionnaire items that lay the foundation for Hofstede's dimensions were a part of IBM's employee survey and were not designed for cross-cultural comparisons specifically. But, due to the matched groups of participants, he managed to keep the demographic diversity low and therefore managed to find differences based largely on the respondents' nationality [Smith and Bond 1998].

4. SCHWARTZ'S DIMENSIONS OF CULTURE MODEL

Psychologists have proposed several models of culture dimensions. The present paper will describe Schwartz's structure of core human values. "The value concept… [Is] able to unify the apparently diverse interests of all the sciences concerned with human behavior" [Rokeach 1973]. Schwartz represents a model based on 10 value types and four cultural dimensions. Each dimension consists of a subset of value types. Schwartz depicts this model by a circle (Figure 1):

Self-Enhancement

*Power* (PO): Social status and prestige, control or dominance over people and resources.

Achievement (AC): Personal success through demonstrating competence according to social standards.

Hedonism (HE): Pleasure and sensuous gratification for oneself.

Openness to Change

Stimulation (ST): Excitement, novelty, and challenge in life.

Self-Direction (SD): Independent thought and action-choosing, creating, exploring.
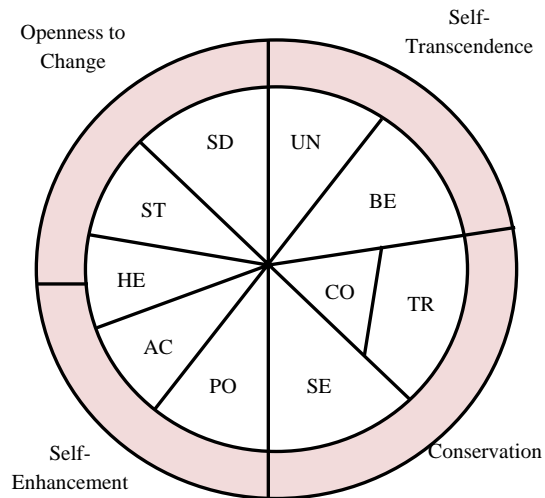
Figure 1. Schwartz's Cultural Model

[Schwartz 2006]

Self-Transcendence

Universalism (UN): Understanding, appreciation, tolerance and protection for the welfare of all people and for nature.

Benevolence (BE): Preservation and enhancement of the welfare of people with whom one is in frequent personal contact.

Conservation

Tradition (TR): Respect, commitment and acceptance of the customs and ideas that traditional culture or religion provide the self.

Conformity (CO): Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms.

Security (SE): Safety, harmony and stability of society, of relationships, and of self [Schwartz et al. 2001].

The conflicts and congruities among all ten basic values yield an integrated structure of values. This structure can be summarized with two orthogonal dimensions.

Self-enhancement vs. self-transcendence: On this dimension, both value types of self-enhancement emphasize *pursuit of self-interests*, whereas both value types of self-transcendence concern for the *welfare and interests of others*.

Openness to change vs. conservation: On this dimension, self-direction and stimulation values emphasize independent action, thought and feeling as well as *readiness for new experience*, on the other hand, security, conformity and tradition values emphasize self-restriction, order and *resistance to change*.

Hedonism shares elements of both openness and self-enhancement [Schwartz 2006]. In order to measure each value type, Schwartz used a special questionnaire which was based on measuring similarities of an individual's goals to his/her value types.

5. PORTRAIT VALUE QUESTIONNAIRE (PVQ)

The PVQ includes short verbal portraits of different people. Each portrait describes a person's goal or wishes which is important to him/her. For example "It is important to him to be rich. He wants to have a lot of money and expensive things" describes a person who cherishes power values [Schwartz et al. 2001]. For each portrait, respondents answer, "How much like you is this person?" They select one of these options: very much like me, like me, somewhat like me, a little like me, not like me, and not like me at all. Responses show value types of respondent that is important to him/her but he/she maybe does not necessarily exhibit the corresponding trait, for example, people may value creativity as a goal in life but may not be creative. And, some who are creative may attribute little importance to creativity as a value that guides them.

The original proposal to measure basic values in the American National Election Studies (ANES) Pilot study recommended adopting the 21-item instrument [ANES-doc 2006] that has now been included in three rounds of the European Social Survey (ESS). That instrument is a short version of a 40-item instrument that has been applied in 35countries. The ANES board decided that it would not be possible to include the full 21-item ESS instrument in the

Pilot Study. Instead, in collaboration with Schwartz, they selected 10 items, one to represent each of the 10 motivationally distinct basic values.

The ANES board also raised questions about the format of the proposed items. They suggested a more straightforward format than that of the items from the ESS. It was decided to run an experiment involving the value items. In the Pilot study, interviewers asked a randomly selected half of the sample ten value items in the ESS format and the other half of the sample ten items with parallel content in an alternate format. The alternate format included two additional items to obtain more detail about two types of success, financial success and success at getting people's respect for achievements. This report will compare the effectiveness of the two methods of measurement.

The ESS format drew on items from and on the methodology of the Schwartz Portrait Values Questionnaire. [Schwartz 2003] Each item presents a brief verbal portrait of a person, gender-matched to the respondent. Each portrait describes a person's goals, aspirations, or wishes that point implicitly to the importance of a single value. Each description includes two short sentences. By describing each person in terms of what is important to him or her the goals and wishes he or she pursues the portraits capture the person's values. This method does not identify values as the topic of study.

The PVQ method is developed after pretesting and interviewing small samples who responded to different formats. Table 1 lists the ten items in the alternate format, marked to indicate the values they measure. Two added item intended to measure additional components of the success value were included as numbers #11 and #12. In this format, a five point response scale was employed, rather than a six point scale as used in the PVQ format. [Schwartz 2007]

Schwartz identified seven value types to discriminate cultures [Schwartz 1994, Ng et al 2007]. In 1999, Schwartz extended his study to cover 35 000 respondents and "concluded that the seven value types 'efficiently captures the relations among national cultures' [Schwartz 1999, p. 38] [Ng et al. 2007, p. 170].

Table 1. Ten Value Items in the Alternate Format

The next few questions are about how important things are to you:

(Extremely important, Very important, Moderately important, Slightly important, or Not important)

1. Every person in the world has the same opportunities in life?	UN
2. You feel safe from harm?	SE
3. You take risks in life?	ST
4. You follow traditions?	TR
5. You have fun whenever you can?	HE
6. People always follow rules?	CO
7. That you are very successful?	AC
8. You help other people?	BE
9. You be in charge of others?	PO
10. You choose what you do in life?	SD
(Additional questions to discriminate two types of success):	
11. You be financially successful?	Financial Success
12. You be successful at getting other people's respect for your achievements?	Gaining Respect for Achievements

The seven *culture level value types* are as follows [Schwartz 1999, Ng et al 2007]:

1. *"**Conservatism**.* A society that emphasizes close-knit harmonious relations, the maintenance of status-quo and avoids actions that disturb traditional order.

2. *Intellectual autonomy*. A society that recognizes individuals as autonomous entities to pursue their own intellectual interests and desires.

3. *Affective autonomy*. A society that recognizes individuals as autonomous entities who are entitled to pursue their stimulation and hedonism interests and desires.

4. *Hierarchy*. A society that emphasizes the legitimacy of hierarchical roles and resource allocation.

5. *Mastery*. A society that emphasizes active mastery of the social environment and individual's rights to get ahead of other people.

6. *Egalitarian Commitment*. A society that emphasizes the transcendence of selfless interests.

7. *Harmony*. A society that emphasizes harmony with nature. "

6. PROPOSED MODEL

Modeling cultural agents can highly improve the process of simulation; this is due to the importance and function of software agents in simulating human behavior and also due to the great impact of culture on human thought patterns and decision-making. The cultural model for intelligent agents proposed in this paper enables us to explore new aspects of the behavior of these agents in various environments. This model is based on Schwartz's 10 value types. (Figure 2)
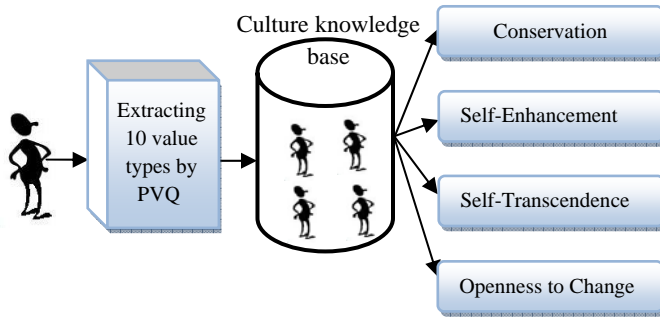

Figure 2. Proposed model

Extracting value types: in this module, we extract each of 10 value types using PVQ. We get all user responses and by numerical scales described in next session we determine fuzzy values.

Culture knowledge base: this module determines fuzzy values of each dimension of culture using induction rules and output of first module. In addition, each value type has several value items [Spini 2003] fuzzy value of these items can be indicated by the intensity of corresponding value types.

Initialization of agents: Agents can be initialized to different cultural values (1) by specifying a nationality, (2) by assigning values for the ten value type, or (3) by assigning values determined by using PVQ.

7. SIMULATION

In order to simulate a cultural intelligent agent, we use fuzzy logic and Fuzzy Clips environment. To use fuzzy logic, we have to define fuzzy set for each fuzzy variable. In this simulation, we define four fuzzy sets, one for each dimension. At first, we describe method of determining the fuzzy sets. When a user responds to PVQ we get his/her responses and convert them to fuzzy scales. We define an

interval for each fuzzy variable of user response. This interval should not be too big or too small. The following abbreviations are used for fuzzy intervals:

Extremely Important: EI

Very Important: VI

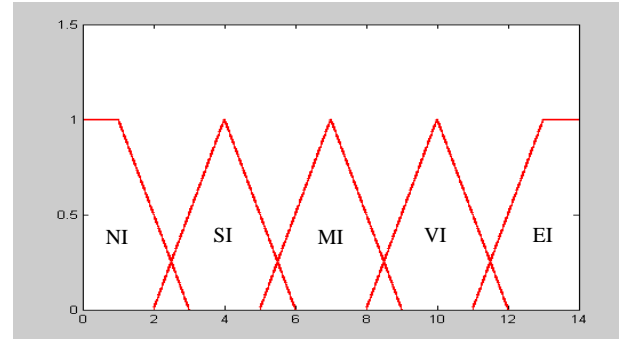Moderately Important: MI

Slightly Important: SI

Not Important: NI

Figure 3. Fuzzy Set for User Answer

We define fuzzy values based on this scale. We use the first value to determine fuzzy interval of Low, the middle three values for Medium and the last one value for High.

If we represent jth dimension by D_j, ith value type of jth dimension is represented by V_{ij}, and n is number of value types of each dimension, then the minimum amount of dimension is given by equation 1:

$$Min(D_j)=Min\{ V_{ij} \} \quad eq.1$$

And for maximum amount of dimension we will have equation 2:

$$Max(D_j)=Max\{ V_{ij} \} \quad eq.2$$

We suppose that there are three intervals for each dimension of culture denoted by Low, Medium and High. A sample of Fuzzy set for self-transcendence dimension is given in Figure 4.
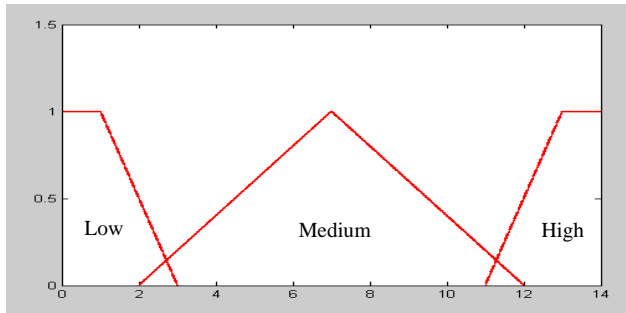
Figure 4. Fuzzy Set for Self-Transcendence Dimension

The following represents a few sample rules of culture knowledge base:

		Rule 1:			**D***
IF		UN	Is	NI	2
	And	BE	Is	SI	4
THEN		Self-Transcendence	Is	M*	4

		Rule 2:			
IF		SE	Is	MI	6
	And	TR	Is	EI	12
	And	CO	Is	SI	4
THEN		Conservation	Is	H*	12

		Rule 3:			
IF		SD	Is	SI	1
	And	ST	Is	SI	2
	And	HE	Is	VI	2
THEN		Openness to change	Is	L*	2

D*: degree, H: high, M: medium, L: low.

D is a descriptive symbol that we have implemented in Fuzzy Clips environment. This shows we have used maximum of membership to calculate membership degree of a dimension.

8. CONCLUSION AND FUTURE WORK

In this paper we presented some background conclusion for cultural software agents and introduced a preliminary model for intelligent cultural agents. In some real world cases as well as in respective simulations, differences between values of individuals can have strong implications on their relationships. For example, in multi-national team management and team-work performance, simulation styles of team-mate behavior, decision making and acting would affect team performance. On the other hand, conflicts among cultures are reported more frequently in these environments. Therefore, by analyzing interaction between cultural agents we can determine conflict points. We can also use this model for different virtual environments such as e-learning, constructing and managing virtual teams and extending negotiation algorithm for e-commerce. We plan to report more elaborated cultural software agents in the future.

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He has also contributed in *Ethics* in simulation –as the lead author of the Code of Professional Ethics for Simulationists–, M&S *Body of Knowledge*, and *multilingual M&S dictionaries*. He is the founding director of the *M&SNet* of SCS. He has over 350 **publications** (some translated in Chinese, German and Turkish) and has been active in over 370 **conferences** and seminars held in 30 countries. He received "Information Age **Award**" from the Turkish Ministry of Culture (1991), Distinguished Service Award from SCS (2006) and plaques and certificates of appreciation from organizations including ACM, AECL, AFCEA, and NATO; and is recognized by IBM Canada as a Pioneer of Computing in Canada (2005). http://www.site.uottawa.ca/~oren/