Creating Virtual Synthetic Cultures for Intercultural Training

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Abstract. Currently, interactive virtual environments for inter-cultural training are mostly designed to train in a specific target culture, focusing on the communication aspects of that culture. We are currently pursuing a different approach, one where users learn to broadly cope with culture shock as they interact with virtual agents that can enact different synthetic cultures. To create such agents we propose an architecture that integrates cultural aspects in the way the agent feels and chooses its goals and actions, based on anthropological studies. This architecture was applied in an agent-based educational role-playing game that tries to promote inter-cultural empathy in young teenagers.

Key words: Virtual Agents, Cultural Behaviour, Educational Games

1 Introduction

Research in intelligent virtual environments designed for inter-cultural training is strongly emerging. Current technology offers the possibility to create 3D virtual environments in which the visual and auditory aspects of a culture (architecture, clothes, artefacts, language, gestures) can be simulated with a great deal of realism. Moreover, in virtual environments users can safely interact with autonomous embodied agents that can display human-like behaviour, in particular behaviour that is culture-specific. However, the creation of autonomous agents that are able to enact various socio-cultural contexts is still hard and so far the results are limited.

As reported in [13], most virtual environments for cultural training, such as TLCTS [10], CUBE-G [20], Elect BiLat [7], VECTOR [3], Second China [6] or Croquelandia [23], focus on training verbal and non-verbal communicative aspects of a culture. Although communicative aspects are a fundamental issue to consider in intercultural training it is also important that users learn skills on how to cope with other differences such as different value orientations. In this paper, we propose an agent architecture that aims to generate such differences, integrating cultural aspects in the way the agents behave, not only in their gestures or communication styles, but also in their goals, emotions, choices, ways of reacting to the environment, among others.

An important inspiration for this work comes from the work conducted in developing simulation games for inter-cultural training. Probably the best known example is the *BaFá BaFá* simulation [22], where participants are randomly assigned to two synthetic cultures (Alpha and Beta) that differ in their core values. One is a more collectivist and hierarchical culture that stresses socialising and touching, and the other, uses a different language, is more individualistic and task-oriented. In the first phase of the simulation, each group is sent into separate rooms in which they are instructed to learn and rehearse their assigned culture. Afterwards, the participants take turns in visiting the other culture, try to gain an understanding of it, and then come back to their own culture to brief the other members about their experience. During the simulation, participants become aware of having a natural tendency towards ethnocentrism as they normally judge the other culture as "weird" compared to their own, despite the fictional nature of both cultures. As in a real cultural shock experience, the simulation often evokes feelings of bewilderment, disorientation, and exclusion.

The concept of synthetic cultures was also proposed as an inter-cultural training tool in [9]. In this work, synthetic cultures were also defined as a simplification of real cultures, emphasising differences in values. After years of experience with simulation role-playing games using these synthetic cultures, it was concluded they were a useful tool for learning about cross-cultural communication [9]. In a comprehensive review of various inter-cultural training techniques [12], some of the advantages described for simulation games are that they eliminate the gap between learning and applying, they provide an opportunity to practice new behaviours in a safe haven, are highly versatile and experience stays with trainees. Their disadvantages are that simulations normally require a large number of human participants, consume a lot of time and some people may be too shy to fully participate in these type of activities. Interactive virtual environments can help ameliorate these issues by allowing users to safely interact with virtual agents and thus eliminating the dependency on other human participants. Hence, we argue that by creating an agent architecture that facilitates the creation of various virtual synthetic cultures that can capture the essence of value differences in real cultures, it is possible to develop new fruitful and enjoyable ways of inter-cultural training.

The structure of this paper is described as follows. In the next section, the culture theory used to ground our approach is presented. In section 3, the integration of the cultural elements into an agent architecture is discussed. In section 4, an agent-based educational game designed with this architecture is presented along with a more simple scenario used to evaluate the architecture. Finally, we draw some conclusions and present some future work.

2 Background

Edward B. Tylor, often considered to be the founder of anthropology, defined culture in 1871 as "that complex whole which includes knowledge, belief, art, law, morals, custom, and any other capabilities and habits acquired by man as

a member of society" [25]. Since then, several other definitions for culture have been proposed. In 1952, a list containing 164 possible definitions of culture was compiled. [11]. Still, no consensus has yet been reached.

The particular notion of culture adopted in this work is grounded on the dimensional theory of culture proposed by Geert Hofstede [8]. In this theory, culture is defined as "the collective programming of the mind that distinguishes the members of one group or category of people from another" [8]. These "mental programs" refer to patterns of thinking, feeling, and potential acting that are shared and learnt by members of the same culture. The foundation of Hofstede's cultural theory is a large empirical study conducted in more than 70 countries. From this study, he was able to derive a set of five bipolar dimensions: Individualism-Collectivism, Power Distance, Uncertainty Avoidance, Masculinity-Femininity, and Long Term Orientation-Short Term Orientation. Each of these dimensions represent fundamental differences in cultural values across nations.

Generally, values can be defined as a "broad tendency to prefer a certain state of affairs over others" [8]. They transcend specific situations, guide selection or evaluation of behaviour and events, and are ordered by relative importance [21]. Another particular aspect of values is that they are often unconscious to those who hold them and so they cannot be directly observable. Instead, they have to be inferred from the way people act under various circumstances. However, besides values there are also other types of cultural manifestations [8] that, unlike values, are explicit and more clearly observable: (1) Rituals - essential social activities that are carried out in a predetermined fashion; (2) Heroes - real or even imaginary persons that serve as models for the cultural values; and (3) Symbols - words, gestures, pictures, or objects with a special particular meaning.

For the moment, our cultural model includes rituals, symbols and two of the five dimensions: Individualism-Collectivism and Power Distance. We chose to start with these two dimensions because they seemed to be the ones more easily recognisable in a short-term interaction and they also seem to be the ones most agreed upon in the literature. In particular, several studies that independently measure Individualism-Collectivism show a reasonable correspondence to Hofstede's findings [21, 2, 24]. The Individualism-Collectivism dimension indicates the extent to which individuals see themselves integrated into groups. The more individualistic a culture is the more people stress the importance of personal achievements and individual rights, and everyone is more expected to be responsible only for themselves and their immediate family. Conversely, in highly collectivistic cultures, everyone looks out for one another in exchange for unquestioning loyalty. As for the Power Distance dimension, it indicates the degree to which less powerful members of the group expect and accept that power is distributed unequally. In low power distance cultures, people tend to regard others as equals despite their formal status, while in high power distance cultures powerful people have more privileges and like to wear symbols that reflect their status. Note that these behavioural tendencies indicated by the cultural

dimensions should never be considered deterministic, since other factors such as personality also play an important role on determining behaviour.

The main advantage of using Hofstede's culture theory is that it was based on a large empirical study of national cultures and it gives a clear and detailed notion of differences in values between them. Even though the theory has received some criticisms [17] such as being based on the supposition that within each nation there is a uniform national culture that remains static, it still serves our purposes, which is to characterise important cultural differences and not to replicate real cultures in a dynamic and exact way.

3 Cultural Architecture

The agent architecture developed so far for creating agents with different cultural profiles is shown in Figure 1. It was implemented by extending FAtiMA, an emotional agent architecture [4, 14] that follows the OCC model of emotions [19] for creating believable virtual characters. In the resulting architecture, there are three kinds of cultural parameters that influence the agents' behaviour: *Symbols*, *Dimensions* and *Rituals*.

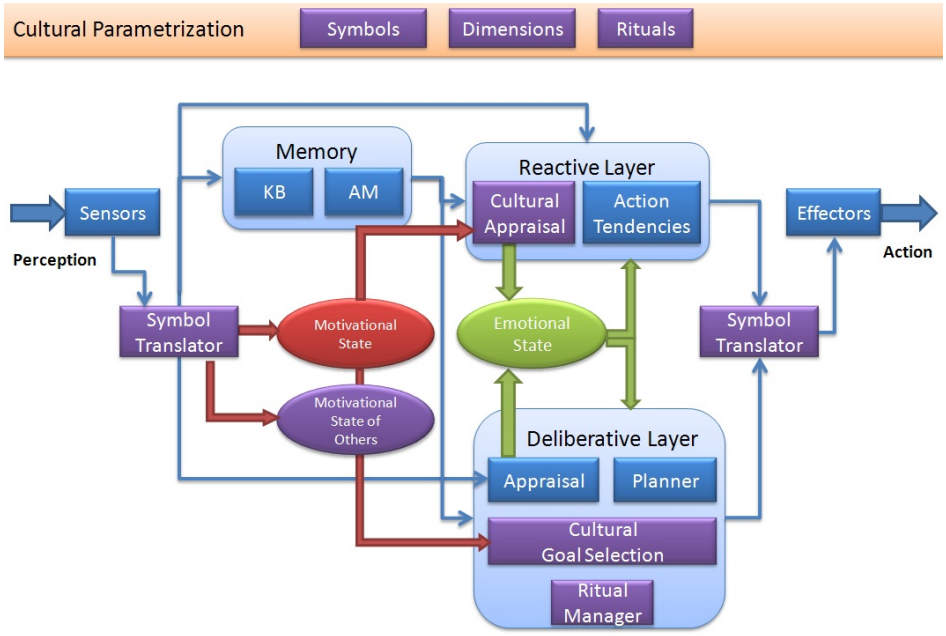

Fig. 1. Cultural Agent Architecture

The architecture works in the following manner. When an event is perceived, it passes through a *Symbol Translator* that translates the meaning of the event according to the culture's predefined symbols, using a simple association mechanism. For instance, when an agent performs a "thumbs-up" gesture, in one culture it can be associated to an "approval" meaning, while in another culture, it can be associated to an "insult" meaning. To avoid ambiguity, the mapping between physical actions and meanings is a one-to-one relationship, i.e. a particular action has only one meaning and vice versa. This is an assumed simplification of the real world, where in fact the same physical action can have different meanings in the same culture due to different contexts (e.g. a bow can be a form of greeting but also a sign to acknowledge the applause for performing a play).

After the event is translated, it is then used to update the *Knowledge Base* (KB) and *Autobiographic Memory* (AM). These are the main memory components of the agent. The first one is responsible for storing semantic knowledge such as properties about the world and relations, while the second one stores information concerning past events and the agent's personal experience. At the same time the memory components are updated, the event is used to update the agent's *Motivational State*. Agents have five different motivational needs that are represented by five continuous drives: Energy, Integrity, Affiliation, Certainty and Competence. These general drives are grounded on a psychological model of human action regulation called PSI [5]. To determine how events affect needs, the actions that agents can perform in the environment are authored with positive and/or negative effects on the motivational drives. To determine if other agents have their needs satisfied or not each agent also builds and updates a *Motivational State of Others* according to the events perceived. This information is inferred from the agent's perception of the other agents' actions and of their initial motivational states.

After updating the motivational states, the event is appraised in order to determine the emotional response of the agent. There are two main appraisal processes, the *Deliberative Appraisal* handles emotions related to the achievement of goals (e.g. satisfaction, disappointment), and the *Cultural Reactive Appraisal* associates appraisal values to the event perceived and then generates the corresponding emotions. The *Individualism* score, defined in the agent's cultural profile greatly affects the *Cultural Reactive Appraisal*. If the culture is defined with a very low *Individualism* score the more an event that is undesirable for others but is beneficial for the responsible agent will be blameworthy (e.g. stealing something), which will likely make the agent to feel ashamed. Also, the more an event that is good for others but is bad for the responsible agent (e.g. giving food) will be highly praiseworthy, making the agent feel proud of himself. In other words, the more collectivistic an agent is the more it considers self-sacrifice for the well-being of the group as highly admirable and selfish acts as highly reproachable. For more information on how the *Individualism* dimension affects the agent's appraisal, please refer to [16].

In the deliberative layer, the event perceived can activate predefined goals, and the agent will have to select between competing alternative goals. In this

layer, the *Cultural Goal Selection* is the process responsible for calculating the expected utility for each active goal, considering the *Individualism* and *Power Distance* dimensions, and the expected impact the goal has on the agent's motivational needs and on the needs of others. The exact equations are described in [16], but the general idea is the more *Individualism* and *Power Distance* the culture has, the more agents prefer goals that benefit their own needs or the needs of agents with higher status. Conversely, the less *Individualism* and *Power Distance* a culture has, the more the agents will care for the needs of other agents, regardless of their social statuses. To illustrate these differences consider a situation where an agent asks for help to paint his house. If the culture is defined as collectivistic and has a low power distance, all the other agents will likely offer their help. On the other hand, if the culture is highly individualistic with a high power distance, agents will tend to help only if the other agent has an important social status.

After the goal with the highest expected utility is chosen, the agent forms an intention of achieving that goal and uses the *Planner* component to develop and execute a plan. The architecture has also a *Ritual Manager* for dealing with the activation and execution of cultural *Rituals*. The model for *Rituals* was inspired by plan recipes used in traditional BDI architectures with a fundamental difference: traditional plans are based on technical activities (the focus is in the end result), whilst rituals are based on ritual activities (the focus is in the sequence of steps). As such, a ritual has a set of roles associated with it and each role has one or more steps that must be performed following any specified ordering constraints. For more details on how *Rituals* were implemented, please refer to [15].

4 Case Study

The implemented cultural architecture was used for the development of a *serious game* called ORIENT (Overcoming Refugee with Empathic Novel Tecnhology) [1]. The game is an agent-based educational role-play, developed in the context of an EU-funded project called eCIRCUS[1]. The main purpose of the game is to promote inter-cultural empathy for young teenagers. In this game (see Figure 2), players (assuming the role of space travellers), must interact with an unfamiliar fictional foreign culture whose planet is about to be destroyed by a large meteor. The main objective for the players is to gain the trust of the culture to then save them from annihilation. To gain their trust, players have to become familiar with the culture's strange customs and gestures. For instance, they must understand that the culture is strongly hierarchical and everyone is highly compassionate and loyal to each other. In order to create this culturally specific behaviour, we applied our architecture to define the culture's gestures and rituals. Moreover, their culture was parametrised as highly collectivistic and with a high power distance score.

[1] www.e-circus.org

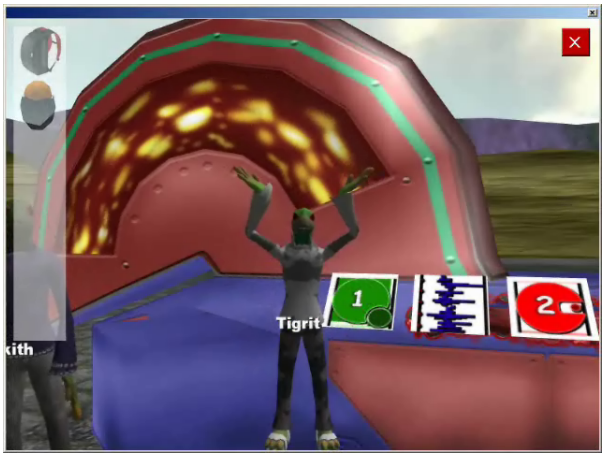

Fig. 2. Screenshot of the game.

ORIENT also has an innovative approach in terms of user interaction. It allows three users to interact simultaneously, each one controlling one of the following devices: a Dance Mat, a mobile phone and a WiiMote. Each device has a different but essential function: (1) the Dance Mat is used for navigation purposes; (2) the mobile phone is used for verbal communication and object recognition; and finally (3) the WiiMote is used to perform important cultural gestures that are used for instance, in the greeting rituals of the culture. The rationale for allowing a group of users to interact simultaneously was to promote social collaboration. A second objective was to encourage discussion between players about the cultural differences found in the synthetic culture. Also, the use of novel interaction devices was to incite players' curiosity to play the game and to provide a more engaging experience.

After conducting two pilot studies [1], users found the Sprytes to be a very different culture from their own and most users were interested in the storyline, even though it was considered to be too short and too simple. One key issue that emerged from the pilot study was that even though users identified Sprytes to have a very different and strange culture, users felt at ease during the interaction with Sprytes, considering them to be a friendly, peaceful, trusting, happy, relaxed, natural and social culture. As such, unlike simulation games for inter cultural training such as *Bafá Bafá* [22], ORIENT did not provide a strong cultural shock experience, which would consist in users experiencing some feelings of disorientation, uncertainty and confusion during the interaction. This can be explained by the fact that Sprytes were authored in a way that encouraged the user to like them so the user would become motivated in his mission to save the culture.

Furthermore, due to time constraints, we were unable to add other cultures in ORIENT's story for users to interact with. Hence, we were unable to use it to measure the power of our architecture in creating distinct virtual synthetic cultures. For that reason, we developed a smaller non-interactive scenario, specifically designed for this purpose. The scenario consisted of a dinner party with a simple plot: five virtual agents with different social status arrive at a party location, greet each other, socialise for a while, and then sit together at a dinner table and start to eat.

Using our architecture we defined different cultural profiles which were then associated to the same group of agents that enacted the same dinner party situation. The objective was to assess if users could perceive cultural differences between two groups of agents just by exclusively changing their cultural parametrization. Two separate experiments were conducted. In the first one, discussed in [15], two cultures were created that only differed in their rituals (and associated symbols), inspired on the opposite extremes of the Power Distance dimension. For example, a dinner ritual was defined for both cultures with the following differences: in the low power distance culture everyone rushed to the table immediately, not even waiting for the host to finish the announcement saying the dinner was about to start, while in the high power distance culture everyone waited first for the elder to sit before they could sit, and then waited for the elder to start eating before they could eat. In the second experiment, described in [16], the two created cultures only differed in the parametrization of the Individualism-Collectivism dimension. In both cultures the agents had the same available goals to choose from. To exemplify the differences between the cultures, consider the following situation in the scenario. After the characters greeted each other, one of the characters who is sick, reports about his sickness to the other characters. One of the other characters has medicine but is not a friend of the sick character. In the highly collectivistic culture, the character who has medicine will promptly offer it in order to help, feeling pride afterwards. Conversely, in the highly individualistic culture, the sick character is not given any medicine. This particular situation reflects the fact that, as stated in [8], in collectivistic cultures people tend to always look out for one another while in the individualistic cultures people assume that they are only responsible for those they share a close bond.

Both experiments had approximately 40 participants (the majority was Portuguese) and both shared a similar methodology . Users observed the two different cultures enacting the dinner party scenario and then were asked to choose from a list of possible values and adjectives the ones they saw as more fitting to describe the behaviour of each group. In the end, users were asked if they found differences between the groups and if so, if those differences were due to the character's personality or due to the character's culture. Both experiments gave significant yet different results. We found that the dimensional model was capable of differentiating cultures in terms of their inferred values, yet the differences were not interpreted as cultural. On the other hand, the rituals component was capable of leading to the perception of different cultures, yet few value dif-

ferences were identified. These results were somewhat expected because as Hofstede's theory points out, the values associated to the cultural dimensions are often unconscious to those who hold them and thereby are harder to interpret as cultural by the average person than rituals or symbols.

5 Conclusion and Future Work

In this paper we presented an ongoing work for designing an agent architecture that integrates cultural phenomena not only related to communication aspects such as gestures, but also to more high level behaviour, such as decision-making and emotional appraisal processes. The aim of the architecture is to facilitate the creation of different cultures of virtual agents that are able to enact general cultural differences and can be used in a similar manner as synthetic cultures are used in simulation games for inter-cultural training. The proposed architecture was used to drive the behaviour of an alien culture with strange customs and beliefs, which users learn to cope within a game designed to promote inter-cultural empathy. Additionally, a smaller non-interactive scenario with different cultures was also built for evaluating the architecture. Two experiments were conducted that showed the architecture was powerful enough to create cultures that were perceived and characterised significantly different by users.

As future work, we would like to integrate other important cultural aspects in the architecture as well as improve the existing ones. For instance, as described in [18], there are several other relations between culture and emotions which would be interesting to include. One example is the notion of cultural display rules (how should one act when experiencing certain emotions). Also, we would like to use the architecture in richer interactive scenarios designed for inter-cultural training. In particular, we are interested in applying the architecture in a scenario where users need to interact with more than one virtual culture, learning to adapt to their different values.

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References

1. Ruth Aylett, Ana Paiva, Natalie Vannini, Sybille Enz, Elisabeth Andre, and Lynne Hall. But that was in another country: agents and intercultural empathy. In *Proceedings of AAMAS 2009)*, Budapest, Hungary, 2009. IFAMAAS/ACM DL.

2. S. Bochner. Cross-cultural differences in the self concept: a test of hofstede's individualism/collectivism distinction. *Journal of Cross-cultural Psychology*, 25:273–283, 1994.
3. J.E. Deaton, C. Barba, T. Santarelli, Larry Rosenzweig an Vance Souders, Chris McCollum, Jason Seip, Bruce Knerr, and Michael Singer. Virtual environment cultural training for operational readiness (vector). *Virtual Reality*, 8(3):156–167, 2005.
4. J. Dias and A. Paiva. Feeling and reasoning: a computational model for emotional agents. In *Proceedings of 12th Portuguese Conference on Artificial Intelligence, EPIA 2005*, pages 127–140. Springer, 2005.
5. Dietrich Dorner. The mathematics of emotions. In *Prooceedings of the Fifth International Conference on Cognitive Modeling*, pages 75–79, Bamberg, Germany, 2003. Bamberg, Germany.
6. J. Henderson, P. Fishwick, E. Fresh, F. Futterknecht, and B.D. Hamilton. Immersive learning simulation environment for chinese culture. In *In Proceedings of Interservice/Industry Training, Simulation, and Education Conference*, 2008.
7. Randall W. Hill, James Belanich, H. Chad Lane, and Mark Core. Pedagogically structured game-based training: Development of the elect bilat simulation. In *In Proceedings of the 25th Army Science Conference*, 2006.
8. G. Hofstede. *Culture Consequences: Comparing Values, Behaviors, Intitutions, and Organizations Across Nations.* Sage Publications, Thousand Oaks, 2001.
9. G.J. Hofstede. Role playing with synthetic cultures: the evasive rules of the game. In *Proceedings of the 9th International workshop of the IFIP*, pages 49–56. Helsinky University of Technology, SimLab Report no 10, 2005.
10. W. Lewis Johnson, Hannes Högni Vilhjálmsson, and Stacy Marsella. Serious games for language learning: How much game, how much ai? In Chee-Kit Looi, Gordon I. McCalla, Bert Bredeweg, and Joost Breuker, editors, *AIED*, volume 125 of *Frontiers in Artificial Intelligence and Applications*, pages 306–313. IOS Press, 2005.
11. A.L. Kroeber and C. Kluckhohn. *Culture: A Critical Review of Concepts and Definitions.* MA: Peabody Museum, Cambridge, 1952.
12. Daniel Landis, Jannet M. Bennet, and Milton J. Bennet. *Handbook of Intercultural Training.* Sage Publications, Inc, 2003.
13. H. Lane and Amy Ogan. Virtual environments for cultural learning. In *Second Workshop on Culturally-Aware Tutoring Systems in AIED 2009 Workshops Proceedings*, pages 25–34, 2009.
14. Mei Yii Lim, João Dias, Ruth Aylett, and Ana Paiva. Improving adaptiveness in autonomous characters. In Helmut Prendinger, James C. Lester, and Mitsuru Ishizuka, editors, *IVA*, volume 5208 of *Lecture Notes in Computer Science*, pages 348–355. Springer, 2008.
15. S. Mascarenhas, J. Dias, N. Afonso, S. Enz, and A. Paiva. Using rituals to express cultural differences in synthetic characters. In *Proceedings of AAMAS 2009*, Budapest, Hungary, May 2009. IFAMAAS/ACM DL.
16. S. Mascarenhas, J. Dias, R. Prada, and A. Paiva. A dimensional model for cultural behaviour in virtual agents. *International Journal of Applied Artificial Intelligence: Special Issue on Virtual Agents*, 2010.
17. Brendan McSweeney. Hofstede's model of national cultural differences and their consequences: A triumph of faith - a failure of analysis. *Human Relations*, 55(1):89–118, 2002.
18. Batja Mesquita and Nico Frijda. Cultural variation in emotions: A review. *Psychological Bulletin*, 112:179–204, 1992.

19. A. Ortony, G. Clore, and A. Collins. *The Cognitive Structure of Emotions.* Cambridge University Press, UK, 1988.
20. Matthias Rehm, Nikolaus Bee, Birgit Endrass, Michael Wissner, and Elisabeth André. Too close for comfort?: Adapting to the user's cultural background. In *HCM '07: Proceedings of the international workshop on Human-centered multimedia*, pages 85–94, New York, NY, USA, 2007. ACM.
21. S. H. Schwartz and W. Bilsky. Toward a theory of the universal content and structure of values: Extensions and cross-cultural replications. *Journal of Personality and Social Psychology*, 58:878–891, 1990.
22. R.G Shirts. Beyond ethnocentrism: Promoting cross-cultural understanding with bafa bafa. In S. M. Fowler and M. G. Mumford, editors, *Intercultural Sourcebook: Cross-cultural training methods*, pages 93–100. Yarmouth, Intercultural Press, 1995.
23. Julie Sykes. Learner requests in spanish: Examining the potential of multiuser virtual environments for l2 pragmatic acquisition. *Computer Assisted Language Instruction Consortium*, 2009.
24. H. Triandis, C. McCusker, and C. H. Hui. Multimethod probes of individualism and collectivism. *Journal of Personality and Social Psychology*, 21:1006–1020, 1990.
25. E.B. Tylor. *Primitive culture: researches into the development of mythology, philosophy, religion, art, and custom.* New York Gordon Press, 1871.