

# Virtual Environments for Cultural Learning

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**Abstract.** We review six virtual learning environments built to support the acquisition of cultural knowledge and communication skills: Croquelandia, ATL, Second China, TLCTS, BiLAT, and VECTOR. Each leverages modern 3D video game engine technology which allows high-fidelity simulation of new cultural settings. This includes representations of buildings, streets, art work, dress, voice, gestures, and more. To bring more realism to simulated cultural interactions, several of the systems include artificial intelligence (AI) models of culture, communication, and emotion. Additionally, several rely on narrative-based techniques to place the target culture in context and enhance motivation of those using the systems. We conclude with a discussion of the role virtual environments might play in broader intercultural education programs and suggest that new approaches for their evaluation are critical if they are to become more widespread in their adoption.

**Keywords.** intercultural education, virtual learning environments, educational games, narrative-based learning environments, cultural modeling

## Introduction

Immersive learning environments provide new and unique ways in which to acquire cultural knowledge and develop intercultural communication skills. High-fidelity graphics, sound, and animation make it possible to simulate many tangible aspects of a specific culture, such as buildings, streets, art, dress, speech, gestures, and more. This enables the provision of more authentic computer-based practice environments than may otherwise be feasible using traditional live role-play and media-based approaches. Further, recent advances in artificial intelligence (AI) and cognitive modeling now permit rich modeling of emotions, language, tasks, and more [21]. When built with cultural accuracy, these models – and the virtual humans who utilize them – open new avenues for teaching the cognitive and interpersonal aspects of other cultures.

In this paper, we review six immersive cultural learning environments and discuss them in the broader context of intercultural education. There is not only significant potential to use systems such as these to enhance intercultural education programs, but also to formatively track intercultural development and for summative learner evaluation. That said, far more empirical studies are still necessary to fully gauge the efficacy of virtual environments to promote cultural learning and intercultural development. We conclude with a discussion of the future of virtual learning environments in intercultural training and suggest several areas of possible interest.

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## 1. Cultural and intercultural learning

Cultural training programs have evolved substantially in the last six decades. The earliest examples began to surface after World War II when international travel and collaboration became more prevalent in business and government work. As the need for these programs became more evident, scientific interest in creating theories of intercultural growth, identifying underlying cognitive processes, and demonstrating their effectiveness also grew. The field of intercultural training has attracted researchers from a variety of disciplines, including anthropology, cognitive psychology, social science, business, and more. The usual structure of intercultural training programs includes a blend of didactic and experiential components, including methods such as lectures, discussion, film, case study, and role playing [13]. Typically, the goal is to induce changes in knowledge, skills, and/or attitudes. Evaluations of intercultural training programs also tend to focus on these three dimensions. A recent meta-analysis suggests that many training programs have been found to be effective at teaching cultural knowledge, but generally fall short in skill acquisition and attitude change [16].

There is widespread agreement among intercultural training researchers that intercultural growth occurs in stages. Whether it be a student studying abroad, or a business person starting a new branch in a foreign country, the assumption that people acclimatize gradually is both intuitive and generally supported by psychometric measures of cognitive, affective, and emotional change. One such model is Bennett's *Developmental Model of Intercultural Sensitivity* (DMIS) [3]. An underlying assumption of the DMIS is that as one's ability to construe cultural differences evolves, intercultural competence also increases. According to Bennett, "it is the construction of reality as increasingly capable of accommodating cultural difference that constitutes development" [3, p.24]. The DMIS posits two broad worldview orientations: *ethnocentrism* and *ethnorelativism*, and includes three sub-stages within each.

It is our contention that virtual learning environments may represent a significant leap for intercultural training programs. We believe that they could (1) promote positive movement through stage-based models, possibly helping learners achieve greater levels of intercultural competence than traditional methods alone, and (2) act as an assessment tool to gauge movement through these stages. There is a long list of historical successes of intelligent tutoring systems to teach cognitive skills [1], and such systems offer affordances for repeated practice opportunities, environmental control, and high-fidelity interaction. We disagree strongly with Fowler and Blohm who say: "...if the goal is intercultural effectiveness, performance in multicultural settings, sensitivity, and establishing cross-cultural relationships, these cannot be done by a computer." [7, p.40]. Recent research on virtual humans and how people interact with them suggest otherwise. It is certainly reasonable now to investigate whether virtual learning environments, with virtual characters from other cultures, combined with authentic intercultural situations, hold potential for intercultural training.

## 2. Virtual cultural learning environments

In this section we summarize six virtual cultural learning environments. We analyze them in terms of their focus on knowledge, skills, and/or attitudes, describe their interactions, learning activities, and underlying models, and finally report any empirical findings about their effectiveness.



Figure 1. Adaptive Thinking and Leadership System for intercultural communication and leadership training; developed at Sandia National Labs [19]

### 2.1. Adaptive Thinking and Leadership System (ATL)

The Adaptive Thinking and Leadership (ATL) system is a networked, first-person, 3D role-playing environment that focuses on teamwork, intercultural communication, and adaptive thinking [19]. The primary focus is on improving the players' abilities to make decisions under stress, balance lethal and nonlethal aspects of conflict, and apply communication skills. Learners play the role of a U.S. Army Special Forces Soldier, an indigenous Iraqi citizen, or an invisible evaluator. All players are given backstories and goals to achieve while role-playing in the virtual environment (observers are given information about both sides). A screenshot of characters communicating with one another in ATL appears in figure 1.

ATL enables higher fidelity role playing than would normally be possible in a typical classroom simulation. Like Tactical Language and Culture Training System (2.4), careful attention is paid to tangible cultural elements, such as appearance, buildings, dress, and so on. Players interact with one another via speech and can move around freely in the virtual world. An instructor station allows for control over the simulation, such as the triggering of story events and the introduction of "curveballs" that are useful for creating additional stress and surprise (such as an explosive device going off). Intercultural communication knowledge is derived primarily from scenarios and backstories that are given to the learners before they begin. As students interact with one another, they are expected to take the perspective of their character, adopt appropriate desires and attitudes, and act in ways that they believe the fictional character would. Perspective taking is a well-established approach in the field of intercultural communication [12].

The instructor is also responsible for assigning evaluation tasks to observers so that they can assess the performance of their peers' interactions within the virtual world. Typically, learners are rotated in and out of this role so that that after a session, they have both role played and evaluated the abilities of others in their class. A study has been conducted with 51 officers who completed self-report scales on the usability of the system and their perceived learning [19]. Raybourn et al. found that the officers felt the scenario was realistic and that they believed they learned about their own strengths and weaknesses by participating in the simulation.



Figure 2. BiLAT simulation for negotiation with cultural awareness; developed at the USC Institute for Creative Technologies [11]

## 2.2. BiLAT

BiLAT is a game-based immersive environment that teaches the preparation, execution, and understanding of bi-lateral meetings in a cultural context [11]. The focus is on both knowledge and skills in Arab culture, but with emphasis on the culture of business meetings and negotiation skills and no coverage of the Arabic language. BiLAT is supported by an hour-long video that demonstrates the principles being taught. Most scenarios in the simulation place the learner in the position of a high-ranking U.S. Army officer who must solve a problem in a small Iraqi community, although other scenarios have been authored, such as for military transition team training. A screenshot of the BiLAT meeting screen appears in figure 2.

Success in BiLAT requires the application of several different skills. First, learners must study the background story and select characters to visit who can help solve the problems. Second, learners must prepare for the meeting by collecting information and filling out a *preparation sheet* that identifies important pieces of information, goals for the meeting, potential impasses, and more. Finally, learners must conduct face-to-face meetings with the characters to achieve their objectives, such as convincing an Iraqi police captain to patrol a market. Meetings require adherence to Iraqi cultural and social interaction rules, as well as the application of integrative negotiation tactics.

An intelligent tutoring system provides guidance and feedback during face-to-face meetings in BiLAT [14,15]. The ITS supports reflection with an after-action review (AAR) for each meeting [14]. It also assesses all communicative actions taken in a meeting as having a positive, mixed, or negative impact on the character, then evaluates the actions as a group and walks the learner through the AAR. Evaluations of BiLAT have shown that:

- learners with minimal prior negotiation experience seem to benefit the most from using it [6]
- learners who spontaneously adopt social goals show the greatest gains in understanding Arab culture [17]
- feedback from the ITS during meetings is effective at helping learners be aware of culturally-relevant time periods in meetings and the Arabic business practice of “following the lead of your host” [15].

Studies of learning from BiLAT fit squarely into the broader movement to understand how people treat, react to, and learn from virtual humans.



Figure 3. Croquelandia for second language learning; developed at the University of Minnesota [22]

### 2.3. Croquelandia

Croquelandia is a 3D virtual environment designed specifically for learning Spanish pragmatics, defined as the various ways in which meaning is communicated and interpreted in interaction [23]. In particular, Croquelandia deals with making requests. It is intended to be used as part of an instructional sequence with college learners of Spanish. Learners collaborate and interact in three virtual spaces linked by an interactive map: their host family's house, a central plaza and marketplace, and a professor's office at the university. While in Croquelandia, players complete quests related to specific requesting contexts in these spaces (e.g., requesting an extension on a paper, asking a host father to have a party at the house).

Completing these quests successfully may require interaction with nonplayer characters (NPCs)—computer-generated avatars present in each of the spaces. NPC interactions were created from several role-play conversations with native speakers, varying the semantics of the requests to expose different pragmatic meanings. These conversations were then used as the basis for conversation trees that the learner chooses from as the main mode of interaction in the game. The NPCs then react to the learners' choices based on how the native speakers responded, resulting in various levels of success for quest completion. Additionally, learners are able to collaborate synchronously with NPCs using voice or written chat, as well as with others from their class. Beyond synchronous communication within Croquelandia, learners can also create their own game content to share, and can leave messages for classmates on a discussion board. Assistance is provided in the form of various tips and ideas that are hidden throughout the environment. These tips were designed to help learners self-monitor their progress and successfully complete each of the requests.

To evaluate the environment, a first study was completed with 53 participants, of which 25 completed a pre- and posttest [22]. The discourse completion task used as the assessment included six scenarios which varied in terms of the social distance between interlocutors. In addition to the data from the Croquelandia environment and the pre- and posttests, one-on-one interviews were also conducted with the subgroup of 25 participants. Sykes reports that the data from the request scenarios show little change from pre- to posttest. However, she reports that both the interview data and a set of lengthy in-class presentations indicate an improved awareness of pragmatic issues.

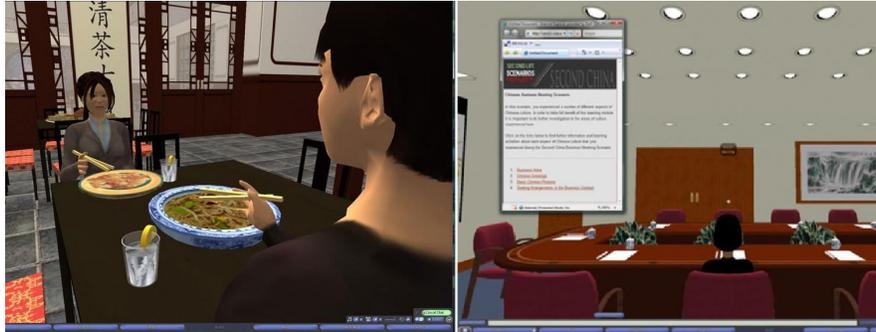


Figure 4. Second China, an island in Second Life for Chinese cultural learning; developed at the University of Florida [8]

#### 2.4. Second China

Second China is a project with two components: a web-based text and multimedia repository, and an island in Second Life which has been designed to mimic cultural and visual aspects of China. The project focuses on “preparing the learner to behave with a level of sophistication that communicates *respect and understanding* of the target culture” [8]. The target audience is government personnel who will be conducting operations in a foreign country. Students may choose to begin with the web-based or the 3D content, and links are provided throughout both to access relevant content in the other medium. A main pedagogical principle of the system is to let the learner determine a personally relevant path through the available content and activities.

When the learner arrives on the Second China island, he or she is met by a greeter named Jiang who offers to guide the avatar to different locations around the island. The learner may accept or may explore the environment independently. Exploration of the island may include observing or performing activities that are culturally significant (e.g., watching or doing taichi in the park), initiated using scripted animations. It may also include walking around noting architectural variations and other experiential aspects or participating in quests for information in a given locale. In addition to unguided exploration, there are embedded scenarios that deliver important cultural experiences. These scenarios are facilitated by a *bot* playing a culturally appropriate role. The *bot* detects the presence of the avatar and guides the avatar through a scenario that mirrors real life. To provide support, the learner receives questions throughout the guided learning experiences. Questions are delivered just-in-time where the particular concept being checked is necessary for the continuation of the scenario, or where it reinforces prior learning. While browsing, learners can access videos, or click on items linking to websites that provide a selection of references. If accessed from within the 2D web-based portal, each scenario or locale in the environment is introduced by outlining the target content areas and describing possible learning objectives.

Evaluation of the environment has begun in the form of a peer review committee comprised of experts in various related areas. In a first peer review activity, committee members were guided around Second China and participated in one of the planned learning scenarios. Henderson and colleagues report that initial feedback, while positive, highlights the need for continued research and attention to instructional design such as clearer objectives, and evaluation metrics.



Figure 5. Tactical Dari for Arabic language and culture learning; developed by Alelo, Inc. [9]

### 2.5. Tactical Language and Culture Training Systems

The goal of the Tactical Language and Culture Training System (TLCTS) is to teach functional skills in various foreign languages and cultures [9]. There are four versions of TLCTS currently: Iraqi, Dari, Pashto, and French. Each provides three kinds of interactive activities: part-task lessons that focus on core communication skills (called “skillbuilders”), “arcade” games that provide more opportunities for basic practice, and “mission” games that allow players to practice in realistic contexts. Mission games take place in a high-fidelity 3D virtual world with the learner in a third person perspective (but fully controlling their avatar). The emphasis is on spoken communication: learners must learn to speak the foreign language to complete the lessons and play the games. Two views of the mission game in Tactical Dari are shown in figure 5.

The three modes of interaction in TLCTS provide different kinds of learning opportunities. Skill builders focus on basic elements like vocabulary, pronunciation, grammar and nonverbal behaviors. For example, one skill builder teaches the learner an appropriate “goodbye” in several different contexts. Arcade games have a similar goal, but give the learner artificial goals to achieve, such as listening to directions in the target language and executing the steps to move out of a maze. The mission environment is the primary vehicle in TLCTS for experiential learning where the learner must engage in everyday activities, such as navigating a village and communicating in culturally appropriate ways. One example of an objective is to gain permission to search a home for a person of interest. Characters in the mission environment are autonomous and driven by AI models of speech, language, and emotions [9]. The speech recognizer is trained using novice data so errors can be better detected. Such errors are dealt with directly in the skill builder and arcade games, while they are integrated naturally into the mission game (i.e., characters don’t understand you). Further, using game performance and quiz results as evidence, TLCTS maintains a probabilistic student model that tracks learning throughout use of the system.

Several evaluations of TLCTS have been conducted. A broad study on the effectiveness of Tactical Iraqi on military participants reported significant gains in learning of Iraqi Arabic and cultural knowledge [20]. Tactical Iraqi was used to investigate the “politeness effect” [24]. It was found that feedback messages that helped the learner “save face” led to better learning and motivation. Finally, military participants with high motivation and time in service, as well as those who spent the most time with the Skill Builder tool, demonstrated the largest learning gains [10].



Figure 6. VECTOR for intercultural communication and peacekeeping training; developed by CHI Systems [5].

## 2.6. Virtual Environment Cultural Training for Operational Readiness

The Virtual Environment Cultural Training for Operational Readiness system (VECTOR) shares many similarities with Tactical Iraqi and BiLAT. The goals of the system are to improve learners' knowledge of Arabic culture and intercultural communication skills, but with a focus on peacekeeping [5]. It situates learners in a virtual foreign town and requires them to interact with locals, synthesize information, and take actions to solve problems. A first-person perspective is used and users have free movement around the 3D world. This enables specific categories of cultural errors to be made, such as addressing locals in an improper order. An example of a game goal in VECTOR is to find the identity of a bomber and stop him from attacking his next target. Characters in VECTOR are controlled by adjustable cognitive models that encode cultural rules, communicative action understanding, as well as emotional components. A screenshot of VECTOR appears in figure 6.

VECTOR scenarios can be created with a set of associated authoring tools that permit non-experts to create character models, user actions, training objectives, dialogue trees, and underlying narratives [2]. Character behaviors are derived from common superclasses that encode cultural norms, and can be tweaked such that they react differently according to personality differences. Learners communicate with characters through contextual, menu-based selections. VECTOR includes a "synthetic instructor" character that conducts an after-action review with the learner that highlights right and wrong answers. Correct answers are reinforced with explanations for why the actions had a positive effect on the characters, whereas mistakes are dealt with by informing the learner what actions would have been more appropriate. Feedback messages are created in the authoring tool and are associated with training objectives [2] and displayed on the screen for the user to see during meetings.

## 3. Discussion

We have described six systems for intercultural training that cover different cultures (Spanish, Chinese, Iraqi, Dari, Pashto, and French). They each utilize immersive technologies such as Second Life or the Unreal Tournament Engine, while some are integrated with other activities such as multimedia resources or skill building arcade-

style games. As mentioned earlier, Mendenhall's review of intercultural training programs suggests that behavior and attitudes are areas for improvement for intercultural training [16]. It is generally believed that games have the potential to exact changes in students' knowledge, skills, and attitudes; however, the main focus of games so far, including those we have reviewed here, has been on knowledge and skills. The immersive, affective power of games might go a long way towards enabling us to change students' attitudes towards other cultures. For example, dispositions like empathy, ethnorelativism, etc., are a critical part of intercultural competence, and narrative-based techniques are appearing more frequently in commercial video games to evoke these kinds of emotions in players (just as movies do to draw audiences in and keep their attention). These are fertile connections for future research.

Immersive cultural learning environments to date have focused primarily on culture-specific training; that is, in any given system, the goal is to learn one particular culture and a limited set of skills or knowledge within that culture. We perceive great potential to use these systems to encourage students to transfer knowledge from one culture to another – to develop a set of *culture-general skills*. Byram [4] describes such a set of skills, including *savoir comprendre*, learning how to interpret and explain cultural practices and compare them with aspects of one's own culture. Taking a culture-general approach to teaching in immersive environments might allow students to more easily transfer to new skills within the same culture, or even to new cultures.

One question that remains is whether these simulations, like any simulation that utilizes a necessarily simplified model of the world, present a valid representation of the culture. While it is impossible and perhaps undesirable to model a culture with complete accuracy, the cultural model might be deemed sufficient for learning goals if it enables the student to acquire knowledge and skills in the target culture. With respect to accuracy, it is still an open question how to validate such simulations. The models in the systems discussed in this paper were developed in various ways, from role-playing with native speakers, to expert interviews, to the use of photographs and artifacts. A future method of validation may be to return to independent natives of the culture to assess their reactions to the content, and perhaps their ability to proceed successfully through the simulation.

The systems described here are all relatively new, but are beginning to enter more widespread use, especially with military audiences. The next major step is to more rigorously evaluate their effectiveness against less expensive alternatives. Research with most of these systems has only just begun to look at fundamental questions of learning and acquiring intercultural competence. While evaluation of cultural skills (and language skills) is difficult, we can turn to the intercultural competence community who have developed a wide range of instruments to examine these questions [18]. These instruments range from self-report of attitudes to choosing cultural explanations. Determining which of these instruments is appropriate for the evaluation of immersive cultural learning environments is a first step, although this will often depend on the context of use of the systems and most likely involves the use of multiple methods to triangulate students' developmental trajectories. Once the effectiveness of these environments has been shown, they have the potential to be used as testbeds for research into what leads to successful learning in these ill-defined, interpersonal domains. The seeds for this type of research are appearing in studies of BiLAT and TLCTS, but many more will be necessary to bring the fields of intercultural training, language training, the learning sciences, and artificial intelligence closer together.

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## References

- [1] J.A. Anderson, A.T. Corbett, K. Koedinger, R. Pelletier, Cognitive tutors: Lessons learned. *The Journal of the Learning Sciences* 4,2 (1995), 167-207.
- [2] C.A. Barba, T.P. Santarelli, F.A. Glenn, D.C. Bogert, J. Belanich, Authoring tools of game-based training. *Proceedings of the Conference of the Society for Applied Learning Technologies* (2006).
- [3] M. J. Bennett. Towards ethnorelativism: A developmental model of intercultural sensitivity. In R. M. Paige, Ed., *Education for the Intercultural Experience*, 21-71. Intercultural Press, Yarmouth, ME, 1993.
- [4] Byram, M., *Teaching and Assessing Intercultural Communicative Competence*. Multilingual Matters, Clevedon, 1997.
- [5] J.E. Deaton, C. Barba, T. Santarelli, et al., Virtual environment cultural training for operational readiness (VECTOR). *Virtual Reality* 8, 3 (2005), 156-167.
- [6] P. Durlach, T. Wansbury, J. Wilkinson, Cultural awareness and negotiation skills training: Evaluation of a prototype semi-immersive system. *Proceedings of the Army Science Conference* (2008).
- [7] S.M. Fowler, J.M. Blohm, An analysis of methods for intercultural training, in Landis (2004), 37-84.
- [8] J. Henderson, P. Fishwick, E. Fresh, F. Futterknecht, & B.D. Hamilton, Immersive Learning Simulation Environment for Chinese Culture. *Proceedings of Interservice/Industry Training, Simulation, and Education Conference* (2008), paper 8334.
- [9] W.L. Johnson, A. Valente, Tactical Language and Culture Training Systems: Using artificial intelligence to teach foreign languages and cultures. *Proc of Innovative Applications of Artificial Intelligence* (2008).
- [10] W. L. Johnson, S. Wu, Assessing aptitude for learning with a serious game for foreign language and culture. *In Proceedings of Intelligent Tutoring Systems* (2008).
- [11] J. Kim, R.W. Hill, P. Durlach, et al., BiLAT: A game-based environment for practicing negotiation in a cultural context. *International Journal of Artificial Intelligence in Education* (in-press).
- [12] Kramsch, C., *Context and Culture in Language Teaching*, Oxford University Press, Oxford, 1993.
- [13] D.Landis, J.M. Bennett, M.J. Bennett (Eds.), *Hbk of Intercultural Training*. Sage, Thousand Oaks, 2004.
- [14] H.C. Lane, M.G. Core, D. Gomboc, A. Karnavat, & M. Rosenberg, Intelligent tutoring for interpersonal and intercultural skills. *Proceedings of Interservice/Industry Training, Simulation, and Education Conference* (2007), paper 1514.
- [15] H.C. Lane, M. J. Hays, M.G. Core, D. Gomboc, E. Forbell, D. Auerbach, & M. Rosenberg, Coaching intercultural communication in a serious game. *Proceedings of the 16<sup>th</sup> International Conference on Computers in Education* (2008), 35-42.
- [16] M.E. Mendenhall, G.K. Stahl, I. Ehnert, et al., Evaluation studies of cross-cultural training programs: A review of the literature from 1988 to 2000. In Landis (2004), 129-144.
- [17] A. Ogan, J. Kim, V. Alevan, C. Jones, Explicit social goals and learning in a game for cross-cultural negotiation, To appear in *Proceedings of the Intelligent Educational Games Workshop, Artificial Intelligence in Education 2009* (in-press).
- [18] R.M. Paige, Instrumentation in intercultural training, In Landis (2004), 85-128.
- [19] E.M. Raybourn, E. Deagle, K. Mendini, J. Heneghan, Adaptive Thinking & Leadership simulation game training for Special Forces Officers. *Proceedings, Interservice/ Industry Training, Simulation and Education Conference Proceedings* (2005).
- [20] E. Surface, E.Dierdorff, *Special Operations Language Training Software Measurement of Effectiveness Study: Tactical Iraqi Study Final Report*, Special Operations Forces Language Office, 2007.
- [21] W. Swartout, J. Gratch, R. Hill, et al., Toward virtual humans. *AI Magazine* 27, 2 (2006), 96-108.
- [22] J. Sykes. Learner requests in Spanish: Examining the potential of multiuser virtual environments for L2 pragmatic acquisition. *CALICO* (in preparation).
- [23] J. Sykes, A. Oskoz, A., S. Thorne, Web 2.0, synthetic immersive environments, and mobile resources for language education. *CALICO Journal*, 25 (2008), 528-546.
- [24] N. Wang, W.L. Johnson, The politeness effect in an intelligent foreign language tutoring system. *Proceedings of the International Conference on Intelligent Tutoring Systems* (2008).