Virtual Learning Environments for Culture and Intercultural Competence

Amy Ogan
Human-Computer Interaction Institute, Carnegie-Mellon University, USA

H. Chad Lane
Institute for Creative Technologies, University of Southern California, USA

Abstract. We review six virtual learning environments built to support the acquisition of cultural knowledge and communication skills: ATL, BiLAT, Croquelandia, Second China, TLCTS, and VECTOR. Each leverages modern 3D video game engine technology which allows high-fidelity simulation of new cultural settings, including representations of buildings, streets, art work, dress, voice, gestures, and more. To bring more realism to simulated cultural interactions, several of the systems are driven by 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 reviewed environments and identify potential research directions that focus on (1) general intercultural competence, (2) learner assessment, and (3) cultural model building and validation.

INTRODUCTION

Many of the chapters in this volume focus on the problem of adapting computer systems to the culture of the user. In this chapter, we are concerned with the other direction: how to use computer-based learning environments to help the user learn to adapt to a new culture. The basic problem we address is how immersive learning environments can be used to teach cultural knowledge and provide experiential learning opportunities for intercultural communication. Virtual learning environments provide new and unique ways in which to convey cultural knowledge and develop intercultural communication skills. High-fidelity graphics, sound, and animation make it possible for them 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 (e.g., Swartout, Gratch, Hill, Hovy, Marsella, Rickel, & Traum, 2006; also see Rehm, 2009 in this volume for more information on cultural modeling for training and embodied conversational agents). 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.

Below, we begin with a brief summary of cultural learning theory and describe current teaching practices. We then 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 research areas of possible interest.

**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 is highly interdisciplinary, attracting researchers from a variety of disciplines, including anthropology, cognitive psychology, social science, business, and more. Surprisingly, very little of this work leverages state of the art computing technology.

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 (Landis, Bennett, & Bennett, 2004). Many of these methods are based on a classroom instruction model and seek to leverage peer interaction and debate to engage learners. Typically, the goal is to induce changes in knowledge, skills, and/or attitudes. Knowledge includes basic facts about a new culture, such as common values and beliefs, preferences for physical contact, and typical eating and drinking patterns. Skills usually refer to the learner’s ability to interact with someone from the new culture, including communicating their desires and interpreting the behaviors of others. Finally, attitudes have to do with basic beliefs a learner has about people of a different culture and whether a positive, neutral, or negative disposition exists towards them. Evaluations of intercultural training programs also tend to focus on these three dimensions.

Although intercultural training is often motivated by immediate need, such as international travel, researchers and educators are also interested on its longer term impact on cultural learning and development. There is widespread agreement that intercultural growth occurs in stages and can take many years (Savicki, 2008). Whether it be a student studying abroad, or a business executive starting a new branch in a foreign country, the assumption that people acclimate gradually is both intuitive and generally supported by psychometric measures of cognitive, affective, and emotional change (Paige, 2004). Decades of research in cognitive psychology also lends support, as it is reported that development of expertise can take up to 10 years of study and practice in many domains (Ericsson, Charness, Feltovich, & Hoffman, 2006).

In terms of long-term development of intercultural competence, one of the more studied models is Bennett’s Developmental Model of Intercultural Sensitivity (DMIS; Bennett, 1993). The DMIS rests on the assertion 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” (p.24). The DMIS posits two broad worldview orientations: ethnocentrism and ethnorelativism, which refers the positioning of one’s own culture in relation to others. An ethnocentric orientation implies that one views all other cultures relative to his or her own, whereas an ethnorelative perspective implies that one’s own culture is understood in the context of others. Three sub-stages are included within each orientation that describe common cognitive and affective states that evolve during development. For Bennett, the goal of intercultural training is to promote gradual movement through the stages and deliver appropriate training given the learner’s stage. If, for example, behavioral change is rushed, the learner may develop an impoverished understanding of the new culture. As with learning in most domains, it is important to avoid shallow learning and to develop an underlying conceptual understanding with better chances for retention and transfer.

Evaluation of intercultural training programs is essential to answer questions about the appropriateness and accuracy of fundamental models like the DMIS. A recent meta-analysis suggests
that many training programs have been found to be effective at teaching cultural knowledge and generating learner satisfaction, but generally fall short in skill acquisition and attitude change (Mendenhall, Stahl, Ehnert, Oddou, Osland, & Külmann, 2004). Although the authors criticize the general lack of rigor in the field and recommend a greater empirical focus, no specific suggestions regarding why skills and attitude effects are more difficult to achieve are made. We believe it may relate to a general lack of realistic practice opportunities in those training programs. Although many of the studies qualified in terms of rigor, most lacked a strong, experiential component – lectures, assimilators, discussion, and role-play are indicated as the top four types of programs (p. 134).

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 (e.g., Anderson, Corbett, Koedinger, & Pelletier, 1995), and such systems offer affordances for repeated practice opportunities, environmental control, and high-fidelity interaction. Complementary to this work, there has been some history of using technology to support intercultural interactions. An early example is text-based multi-user domains (MUDs), which allowed students to interact online in an imaginary world where they could use a foreign language and interact in culturally influenced ways (Bruckman, 1995, Falsetti & Schweitzer, 1995, etc.). Another step along the way towards today’s environments was A la rencontre de Philippe (Furstenberg, 1993), a game in which students could play as a French journalist using cultural knowledge to interact with his environment through branching storylines. Immersive virtual environments present the future of learning technologies. We disagree strongly with Fowler and Blohm (2004) 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.” (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.

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.

***INSERT FIGURE 1 ABOUT HERE***

*Figure 1. Adaptive Thinking and Leadership System for intercultural communication and leadership training (© 2006, Sandia National Laboratories. Used with permission.)*

**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 (Raybourn, Deagle, Mendini, & Heneghan, 2005). The goals of the system are to improve the players’ abilities to make decisions under stress, balance lethal and nonlethal aspects of conflict, and apply communication and intercultural 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 (evaluators are given information about both sides). A screenshot of characters communicating with one another in ATL appears on the left panel of figure 1. A related system, Ambush! NK (“non-kinetic”), was developed several years after ATL,
but with the addition of a few additional elements, such as simulated crowds and scenario authoring tools (Raybourn, Roberts, Diller, & Dubow, 2008). It shares many of the underlying principles described below, such as role-playing, scenario development, and real-time assessment (Raybourn, 2007).

ATL, as well as Ambush! NK, enables higher fidelity role playing than would normally be possible in a typical classroom simulation. Like Tactical Language and Culture Training System, BiLAT, and the other systems described below, 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). 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 after a session, they have both role played and evaluated the abilities of others in their class. The results are recorded by the system and used to drive an instructor-led group After-Action Review (AAR). Here, learners are able to watch the entire exercise, interpret the events, and discuss their decisions.

Intercultural communication knowledge in ATL 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. Here, ATL is applying a perspective taking approach, a well-established technique in the field of intercultural communication (Kramsch, 1993). In addition, the instructor-initiated peer assessments in ATL can be used to rate participants in their ability to role play in this fashion. A preliminary study was conducted with 85 officers who completed self-report scales on the usability of the system and their perceived learning (Raybourn, et al., 2005). The results suggested 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.

***INSERT FIGURE 2 ABOUT HERE***

Figure 2. BiLAT simulation for negotiation with cultural awareness. (© 2009, University of Southern California)

**BiLAT**

BiLAT is a game-based immersive environment that teaches the preparation, execution, and understanding of bi-lateral meetings in a cultural context (Kim, Hill, Durlach, Lane, Forbell, Core, et al., in press). The focus is on both knowledge and skills in Arab culture, but with emphasis on the culture of business meetings and negotiation skills. There is no coverage of the Arabic language. BiLAT is supported by an hour-long video that depicts good and bad examples of intercultural meetings, and provides a summary of the learning objectives addressed by BiLAT. 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 training Iraqi recruits and getting to know a local school teacher.

Success in BiLAT requires the application of several different skills. First, learners must study the background story, review their objectives, and select a character with whom to meet who can provide important information and assist in solving the problem. Next, learners then conduct background research on those characters to learn about their likes, dislikes, needs, and desires. Information is stored in a meeting preparation sheet that identifies these important pieces of information, and
includes goals for the meeting, potential impasses, and more. Meeting objectives are pre-assigned
during preparation, such as convincing an Iraqi police captain to patrol a market with Iraqi policemen.

Once complete, the learner is sent to meet with the character that was researched. BiLAT uses
menu-based interactions for communication with the virtual human characters. Adherence to Iraqi
cultural and social interaction rules is necessary, as well as the application of integrative negotiation
tactics. The set of available actions depends in part on the quality of the background research
conducted by the learner for each character. During the meeting, the character’s responses to user
communications are posted in a dialogue window and played back through a speech synthesizer. Non-
verbal behaviors are animated during the response and correspond to the content of the character
utterances. BiLAT also maintains a “trust meter” that is updated after each turn – this allows users to
monitor progress and learn what actions may hurt and help achieve their objectives. A screenshot of
the BiLAT meeting screen appears in the left of figure 2.

Cultural knowledge is encoded in several forms in BiLAT. First, the characters each have meeting
phases encodings that define typical Iraqi business meeting etiquette. Second, user actions and
character responses each contain cultural elements that have defined effects on trust, power, and other
character attributes. Finally, all meeting content is linked to a detailed representation of learning
objectives which is managed by an intelligent tutoring system (Lane, Core, Gomboc, Karnavat, &
Rosenberg, 2007). The ITS coaching component provides guidance and feedback during face-to-face
meetings in BiLAT (Lane, Hays, Core, Gomboc, Forbell, et al., 2008) and provides an after-action
review (AAR) for each meeting driven by an intelligent reflective tutoring system (Lane et al., 2007).
The overarching aim is to help the learner understand the relevant underlying cultural considerations
behind events in the meeting. All communicative actions taken in a meeting are assessed based on the
meeting context, the related learning objectives, and the trust changes they induce. This process
categorizes actions as having a positive, mixed, or negative impact on the character. The coach uses
these to decide whether to give prescriptive feedback (i.e., hints) and/or reactive feedback (i.e.,
about an action just taken). The reflective tutor evaluates the actions as a group and walks the learner
through the AAR using playback of certain meeting events, more elaborated feedback, and multiple
choice questions to test understanding (the AAR screen is shown in the right side of figure 2).

Several evaluations of BiLAT have been conducted that focus on:

- **Whether BiLAT produced learning gains and for which kinds of learners:** Durlach, Wansbury, &
  Wilkinson (2008) ran a study with U.S. Army officers and found that learners with minimal
  prior negotiation experience did demonstrate learning gains, while those with prior experience
did not. The authors note that it was possible not enough time was devoted to training,
suggesting that users with prior experience may have just needed more time to use the system
in order to see a benefit. In addition, it was also reported that learners benefited regardless of
their self-reported video game-playing habits.

- **The adoption of social goals in interactions with virtual characters:** In this study, Ogan, Kim,
  Aleven, & Jones (2009) hypothesized that students who were given explicit social goals (e.g.
  “Come to understand your partner’s point of view”) would be more successful learning from
  BiLAT than students who were given task-only goals. In a randomized controlled experiment,
  30 students played the game as designed, with negotiation task goals, while 29 were
  additionally given a social goal. Students who reported having social goals in a manipulation
  check, regardless of condition, showed the greatest gains in understanding Arab culture.

- **The effect of coaching during meetings in BiLAT:** In one experiment, feedback from the ITS
during meetings was found to be effective at helping learners understand Arab business
meeting expectations as they relate to time and “following the lead of your host” (Lane, Hays,
Core, Gomboc, Forbell, et al., 2008). Specifically, feedback that focused on the expectations
of their meeting partner (e.g., "You should not be talking about business topics now.")
translated into better in-game performance on later meetings with characters with no
coaching, as well as on related questions on a written test. A subsequent study compared conceptual feedback with very concrete feedback, and this again produced better in-game transfer (Hays, Lane, Auerbach, Core, Gomboc, & Rosenberg, 2009).

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

***INSERT FIGURE 3 ABOUT HERE***

Figure 3. Croquelandia for second language learning. (© 2009, University of Minnesota. Used with permission.)

**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 (Sykes, Oskoz, & Thorne, 2008). In particular, the main learning objectives of Croquelandia are the skills to make culturally appropriate requests. Politeness in requests varies based on the social distance between participants, the size of the request, and other circumstances. The environment is intended to be used as part of an instructional sequence with college learners of Spanish. In it, learners collaborate and interact in three virtual spaces linked by an interactive map: their host family’s house, a central plaza and marketplace, and the office of a professor at the university. The models for these scenes were created from photographs taken throughout the Spanish-speaking world.

While in Croquelandia, players are given a series of five quests related to specific requests that might arise in context in these three spaces, such as requesting an extension on a paper, or asking the host father to hold a party at the house. Completing these quests successfully may require interaction with one or more non-player characters (NPCs) — computer-generated avatars who are present in each of the spaces. NPC interactions were created from several role-play conversations with native speakers. To achieve a variety of responses, semantics of the requests were varied while role-playing to expose different pragmatic meanings. These conversations were then used as the basis for conversation trees from which the learner chooses as the main mode of interaction in the game. Throughout the conversation, the NPCs react to the learners’ choices based on how the native speakers responded in the role-play, resulting in various levels of success as students complete their quests. 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. All of these interactions are recorded and archived for future use by teachers or researchers. In the game, 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 their quests.

To evaluate the environment, a first study was completed with 53 participants from an advanced Spanish course, of whom 25 completed a pre- and posttest (Sykes, in preparation). All participants received identical instruction on pragmatics both within the course as well as through the use of Croquelandia. The discourse completion task used as the assessment (Cohen, Paige, Shively, Emert, & Hoff, 2005) 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. These interviews were coded for instances of participants’ perception of learning. Sykes reports that the data from the request scenarios show little change from pre- to posttest. Unsurprisingly, most participants showed a preference for communicative strategies from their native language. However, she reports that both the interview data and a set of in-class presentations indicate an improved awareness of pragmatic
issues. In this context, participants demonstrated meta-linguistic knowledge that might eventually transfer to production skills.

***INSERT FIGURE 4 ABOUT HERE***

Figure 4. Second China for Chinese cultural learning. (© 2009, University of Florida. Used with permission.)

**Second China**

The Second China project focuses on “preparing the learner to behave with a level of sophistication that communicates respect and understanding of the target culture” (Henderson, Fishwick, Fresh, Futterknecht, & Hamilton, 2008). This is accomplished through two components: information in the form of a web-based text and multimedia repository, and experience which is provided through an island in Second Life that is designed to mimic cultural and visual aspects of China. These two components can be accessed independently but are designed to work in tandem. From a central web portal, students may choose to begin with either the web-based or the 3D content. Links from the web content go to relevant locations and scenarios in the Second Life island, while scattered throughout the 3D environment are links to web-based readings, audio, and video that are related to the current activity. A main pedagogical principle of the system is to let the learner determine a personally relevant path through the content, while providing guidance on appropriate routes to take. The target audience is government personnel who will be conducting operations in a foreign country.

If the learner chooses to enter the traditional web-based component first, they encounter a set of modules that are the core curriculum of the project. These modules, which consist of multimedia materials, learning activities, and self-paced quizzes for learners to check their own understanding, were developed by assessing the critical aspects of culture that should be addressed to develop cultural competence. When this content is explored prior to entering the Second Life environment, students may acquire target culture knowledge that will help them more deeply experience and practice behaviors in the 3D environment. If the learner accesses the Second China island from within this 2D web-based portal, there is an introduction to the linked scenario or locale in the environment that outlines the target content areas and possible learning objectives for that area.

On the other hand, if the learner chooses to enter the Second China island first, he or she is met by a character named Jiang who offers to be a guide to different locations around the island. The learner may accept this offer or may continue on to explore the island independently. This exploration may take the form of observing or performing culturally significant activities (such as watching or even doing tai chi in a park), which are initiated using scripted animations. It may also include walking around examining the architecture and other experiential aspects of the 3D world, or participating in quests for information in a given locale. In addition to unguided exploration, there are embedded scenarios within the world that deliver important cultural experiences. These scenarios are facilitated by bots located in the appropriate environment that play culturally appropriate roles, such as a receptionist. When a bot detects the presence of a visitor, it initiates a scenario similar to one that may take place in real life. To provide support for learning, the learner receives questions throughout these guided experiences. Questions are delivered just-in-time where the main concept of the question either is necessary for the continuation of the scenario, or where it may reinforce prior knowledge gained from the web content. In this way, attention is drawn to critical moments in culture for those students who choose to take a more experiential route. Outside of these scripted interactions, learners can access videos from various locations in the 3D environment, or click on items that link to websites that provide a set of external references.

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 guided learning scenarios as described above. Henderson and colleagues report that initial feedback was positive, but highlighted the need for continued research and attention to instructional design (e.g., clearer objectives), and defining the role of a virtual world in education. The suggested role for Second Life was in “understanding how to participate in a culture” rather than simply learning about a culture. They recommended conducting a full evaluation study of the environment, which will first require identifying solid metrics for learning. Although Henderson et al. indicate that they have plans for controlled experiments comparing the web resources to the 3D environment of Second China, at the time of this writing no results have been reported.

***INSERT FIGURE 5 ABOUT HERE***

Figure 5. Tactical Dari for Arabic language and culture learning. (© 2009, Alelo, Inc. Used with permission.)

**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 (Johnson & Valente, 2008a). To date, four versions of TLCTS have been implemented: Iraqi, Dari, Pashto, and French. 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. Each instance of TLCTS provides three kinds of interactive activities:

1. **Skill Builders** provide part-task lessons that focus on core communication skills.
2. **Arcade games** provide opportunities for basic vocabulary practice, specifically with way-finding (both speaking and listening)
3. **Mission games** embody realistic practice and give the learner a chance to apply knowledge learned in the skill builders and arcade games.

Skill builders intentionally limit the context and allow the learner to 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. Here, feedback is immediate and learners have the opportunity to retry until skills are mastered. Arcade games also intentionally limit the context by giving the learner simple goals to achieve, such as directing a character out of a maze with Arabic directional words (or following spoken directions). Finally, these skills are put to the test in the mission game environment where the learner must navigate his or her way through a high-fidelity 3D virtual world, interact with characters, and achieve more realistic goals, such as finding out names of important people in the town.

The mission environment is the primary vehicle in TLCTS for experiential learning. To succeed in mission games, the learner must engage in everyday activities, such as asking for directions and ordering meals. In all interactions, the learner must communicate clearly in the target language and communicate in culturally appropriate ways (including through non-verbal behaviors, which are selected via a drop-down menu). Mission objectives span many categories depending on the scenario and system. These can include finding out the name of the mayor of a small village, gaining permission to search a home for a person of interest, and convincing a local Sheik to support a planned reconstruction project.

Characters in the mission environment are autonomous and driven by AI models of speech, language, and emotions (Johnson & Valente, 2008). 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 (e.g., characters will react with confusion when they 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. TLCTS also includes authoring tools that allow non-experts to create game content (Johnson & Valente, 2008b). These tools are collaborative due to the need to incorporate input from different kinds of experts (culture, language, programming, etc.). The most complex component is the dialogue authoring tool that enables conversations to occur in the mission environment. Here, an author has the ability to define graphs that define pathways through conversations, and to reuse previously defined sub-graphs when appropriate. It is necessary, of course, to author the utterances spoken by the non-player characters (NPCs) as well as variations of user utterances that the learner speaks.

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 (Surface & Dierdorff, 2007). Tactical Iraqi was also used to investigate the “politeness effect” (Wang & Johnson, 2008); 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 (Johnson & Wu, 2008).

**Figure 6. VECTOR for intercultural communication and peacekeeping training. (© 2008, CHI Systems, Inc. Used with permission.)**

**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 (specifically, the Kurdish sub-culture of West Asian Arabs), although the system is accompanied by an authoring system specifically designed to extend the system to new cultural contexts. Like Tactical Iraqi and BiLAT, the focus is on face-to-face intercultural communication skills, but with a focus on peacekeeping (Deaton, Barba, Santarelli, Rosenzweig, Souders, et al., 2005). A screenshot of a face-to-face encounter is shown on the left side of Figure 6. VECTOR situates learners in a virtual foreign town working as a Military Policeman or with Military Intelligence. Learners communicate with characters through contextual, menu-based selections and characters respond using synthesized speech. A first-person perspective is used and users have free movement around the 3D world (e.g., see the right side of Figure 6). To succeed in missions, the learner must navigate the count, interact with locals, synthesize information from multiple sources, and take actions to solve problems. An example of a game goal in VECTOR is to find the identity of a bomber and stop him from attacking his next target.

Success in meetings with locals depends on the learner’s ability to interact in culturally appropriate ways and ask the right questions. Emotional modeling plays an important role in VECTOR – the emotional state of NPCs changes based on what happens to them. Actions taken by the user are one of the primary influences on NPC emotions, as well as interactions that happen “off camera” with other NPCs (Barba, Deaton, Santarelli, Knerr, Singer, & Belanich, 2005). This means that a meeting with one character may negatively or positively influence a different character’s attitude towards the learner. Specific categories of cultural errors are represented in the dialogue scripts, such as addressing locals in an improper order.

VECTOR scenarios can be created with a set of associated authoring tools that are intended to permit non-experts to create game data (Barba, Santarelli, Glenn, Bogert, & Belanich, 2006). To create a new scenario, authors follow six steps: (1) scenario specification, (2) map selection, (3) training objective authoring, (4) plot organization, (5) vignette editing, and (6) scenario generation. The elements that relate most closely to cultural learning occur in steps 3 (training objective
authoring) and 5 (vignette authoring). Authors must create the overall plot structure which defines the events in the scenario. Connections are made between these narrative elements and dialogue networks, which in turn drive learner interactions. The training objective screen also enables the authoring of proactive (i.e., hints) and performance feedback which are delivered by the synthetic instructor (discussed below). Character behaviors (verbal and non-verbal) are defined in the vignette editor. Cultural rules are derived from common superclasses that encode cultural norms, and can be tweaked such that they react differently according to personality differences. In addition, “conditional nodes” can be created in the dialogue trees so that characters can act based on the world state and across plot points. This allows different character behaviors to emerge based on successes or failures from previous character encounters.

As mentioned, VECTOR includes a “synthetic instructor” character that can provide proactive guidance during the game and conduct 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. Actions are assessed by the synthetic instructor by inspecting their relative impact on the emotional states of the NPCs as defined during the vignette authoring stage.

In sum, VECTOR is a game-based learning environment that focuses on intercultural communication skills and provides a mature set of authoring tools. The authoring tools integrate pedagogical needs (such as assessment and feedback), narrative, and dialogue authoring. No empirical evaluation of VECTOR or its authoring system has been published at the time of this writing.

FUTURE DIRECTIONS
We have described six systems for intercultural training that cover different cultures (Spanish, Chinese, Iraqi, Dari, Pashto, and French). They each utilize an immersive technology such as Second Life or the Unreal Tournament Engine to build a simulated representation of another culture, and some integrate other learning activities, such as multimedia resources, quizzes, and part-task training exercises. Although many of these systems might be considered still in their early stages of development or deployment, several have grown rapidly for their target audience and are expanding to new ones. For example, the Virtual Cultural Awareness Training (VCAT) system provides a web-based interface with functionality similar to the full TCLTS systems (Camacho, Johnson, Valente, & Bushika, 2009). Furthermore, a recent descendent of VCAT focuses on teaching American culture for young visitors to the United States. These systems represent a growing trend recognizing the power of immersive virtual environments for teaching social, interpersonal, and cultural domains.

In this discussion, we draw from the reviewed systems and the intercultural training literature to suggest several areas of important overlap and future research. These are: intercultural skills, learner assessment, and model building and validation.

Immersive Skills
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. It can be quite costly to develop new content in these worlds, and there is no end to the cultural knowledge that could be represented within a system. We perceive great potential to use these systems to encourage students to transfer knowledge from one culture to another, or to generalize their knowledge to be able to produce appropriate behaviors within the same culture on which they did not receive instruction – i.e., to develop a set of culture-general skills. Byram (1997) has described five widely-cited savoirs of culturally competent people. For example, savoir-comprendre involves interpreting phenomena with a culturally appropriate perspective; practitioners consider how observed behaviors or practices might be indicative of different cultural values or customs, and can reflect on or explain how those values and customs compare to those in
their own culture. The rest of the saviors cover attitudes, intercultural communication skills, and more. 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. Such training might take the form of instructional materials or discussions that wrap around the immersive practice (Ogan, Jones, & Aleven, 2008), guidance throughout training that encourages students to view their actions with greater abstraction, or intelligent after-action reviews that relate culture-specific behaviors into a culture-general framework. A step that could be taken in the very near future would be to present learners with currently implemented virtual human characters from different cultures, and build a culture-general intelligent tutor that focused on Byram’s five savoirs.

As mentioned earlier, Mendenhall et al.’s (2004) review of intercultural training programs suggests that behavior and attitudes are areas for improvement for intercultural training. We suggest that modern simulation and games may be able to address this shortcoming. It is generally believed that interactive nature of games and computer-based simulations have the potential to exact changes in students’ knowledge, skills, and attitudes, and some empirical evidence exists to support these intuitions (e.g., Vogel et al., 2006). The systems we have reviewed here vary from a focus on a culture-specific negotiation domain, to pragmatics in language, to context-specific schemas such as hotel check-in. Going beyond skills, some have used games as persuasive technologies in pursuit of broad social change, such as to produce awareness of environmental, human rights, or other global issues (Ashton, 2007). An open question is whether similar techniques may be applicable for supporting the emotional and affective aspects of cultural learning and adjustment. For example, dispositions like empathy, ethnorelativism, and openness are a critical part of intercultural competence and integral to success for learners such as those who are moving to a foreign country. Is it possible to exercise these skills in a game-based environment? The use of narrative is now standard practice in commercial video games, which seek to evoke these kinds of emotions in players (just as film has done for decades). Because cultural learning and development seems to necessitate the perfect storm of cognitive, metacognitive, emotional, affective, and attitudinal development, these are fertile connections to make in future research.

**Learner Assessment**

The systems described here are all relatively new, but are beginning to enter more widespread use, especially with military audiences. The next major steps are to evaluate more rigorously their effects on students’ skills and attitudes to determine whether technology can provide the solution for the missing pieces, as well as to systematically compare 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. Experimental studies on these approaches suggest they have a general positive impact on knowledge: learners who take cross-cultural training are generally able to describe aspects of a different culture, accurately analyze behavior of someone from a different culture, and identify cultural differences (Ogan et al., 2009). Less of a general effect, but still some, has been found on behavior, which looks at the problem solving ability and communicative choices of learners in intercultural settings (Hays et al., 2009; Sykes, in preparation). User satisfaction outcomes, when checked, are also generally high (e.g., Raybourn et al., 2008), but this comes as no surprise given the current novelty of such systems. Johnson & Wu (2008) propose adoption-based research, which looks at the number of users and institutions choosing to use a system over time. Here, satisfaction is implied by a growing user base, which may be more meaningful evidence than self-report data.

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 (Paige, 2004). For example, the Intercultural Development Inventory focuses on determining one’s place on a cultural worldview spectrum (from ethnocentric to ethnorelative) and has been validated
extensively (Hammer, Bennett, & Wiseman, 2003). Others seek to hone in on specific perspectives and dimensions, such as whether they lean towards being more individualistic or collectivist in their daily living. In general, there is no universal measure that determines the effectiveness of training programs; rather, the field has produced a large library of tools that seek to provide insights on how learners acquire cultural knowledge and intercultural skills. These instruments range from self-report questionnaires such as the Cultural Intelligence Scale (Ang et al., 2007) to choosing culturally appropriate explanations for events as in the Culture Assimilator (Cushner & Brislin, 1995). 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.

Model-building and Validation

A somewhat looming question that remains for all of the systems reviewed in this chapter is whether they present valid representations of culture. Because of the layers of complexity of culture as a concept and individual differences in human behavior, all of the systems utilize simplified models. Are these models appropriate given the stated pedagogical goals? Do they leave learners with inappropriate stereotypical models rather than a deeper appreciation for individuals from a new culture? While it remains unclear whether a model of a culture with complete accuracy can be built or is desirable, the systems described here take the approach that the modeling is sufficient if it enables the student to acquire knowledge and skills in the target culture.

It is still an open question how to go about validating social and cultural 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 from the target culture. The systems that rely on AI models reviewed in this paper (i.e., TLCTS, BiLAT, and VECTOR) rely on informal domain expert reports of cultural accuracy. Future methods of validation should be more formal and systematic. Leveraging experts from specific cultures is a necessary piece of the solution, but finding a consistent and reliable method for their assessments of accuracy, and dealing with between-expert disagreement, should be a top priority for intercultural researchers interested in virtual environments.

CONCLUSION

There is certainly no shortage of voices promoting the potential of immersive environments for enhancing learning and education (e.g., Dede, 2009). Mixed evidence on the efficacy of standard intercultural training programs to induce deep learning suggests that the addition of virtual learning environments may be poised to change the landscape. We believe they add much-needed realistic and deliberate practice opportunities that many traditional programs lack. The virtual environments and AI models of culture described in this chapter are only the beginning of what is going to be possible in the next several decades. Virtual environments for cultural learning will only increase in their immersiveness and fidelity. For example, all of the systems here are PC based, but mixed-reality environments (e.g., rooms with props) and fully immersive environments are becoming increasingly more affordable. These advances suggest the difference between the real world and virtual worlds is shrinking, and that potential for using advanced learning technology to enhance cultural education through immersion seems great. However, significant open questions remain regarding the cognitive processes involved with learning in such environments, as well as how to evaluate their ability to
induce positive cognitive, affective, and attitudinal changes in learners. Fortunately, they also have the potential to serve as a tool and testbed for intercultural researchers to advance their understanding of how the learning of culture might best be guided. This possibility has profound implications for the future of social and cultural training.

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KEY TERMS & DEFINITIONS

**Cultural model.** A representation of a culture which is designed to be used by a computer to drive a simulation

**Culture.** The collective programming of the mind which distinguishes members of one group or category of people from another

**Experiential learning.** The acquisition of knowledge and skills through learning by doing, reflection, and repeated revision of internal mental models

**Intercultural competence.** The ability to successfully communicate with members of another culture

**Learner assessment.** The process of documenting a learner’s skills, knowledge, and attitudes

**Validation.** The process of inspecting, testing, and confirming the accuracy of a model used to drive a computer simulation

**Virtual immersive environment.** A computer-generated environment which simulates portions of the real world