

5.6 Design and Evaluation of a Cross-Cultural Training System

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Cross-cultural competency, and the underlying communication and affective skills required to develop such expertise, is becoming increasingly important for a wide variety of domains. To address this need, we developed a blended learning platform which combines virtual role-play with tutorials, assessment and feedback. A Middle-Eastern Curriculum (MEC) exemplar for cross-cultural training U.S. military personnel was developed to guide the refinement of an existing game-based training platform. To complement this curriculum, we developed scenario authoring tools to enable end-users to define training objectives, link performance measures and feedback/remediation to these objectives, and deploy experiential scenarios within a game-based virtual environment (VE). Lessons learned from the design and development of this exemplar cross-cultural competency curriculum, as well as formative evaluation results, are discussed. Initial findings suggest that the underlying training technology promotes deep levels of semantic processing of the key information of relevant cultural and communication skills.

1.0 INTRODUCTION

Modern political confrontations involving the use of military force are being conducted by multinational coalition partners in multiple, concurrent foreign theaters. The parties to those arrangements, and the contexts in which those operations are conducted, have led military forces to be increasingly concerned with cross-cultural training as they pertain to the execution of warfare, counterinsurgency, peacekeeping and reconstruction efforts (see Field Manual (FM) 3-07 Stability and Support Operations; FM 3-24 Counterinsurgency Operations). For example, recent military operations in Afghanistan, Bosnia and Iraq have highlighted the centrality of cross-cultural acumen to securing and sustaining stability and strategic relationships.

The lessons learned from those global deployments are invaluable. Recent multinational, urban-based operations, however, have added a new layer of complexity; requiring soldiers to proactively anticipate, interpret and influence the thoughts, behaviors and affect of their coalition partners, host sponsors and heterogeneous populations [1]. Moreover, transformational changes such as network-centric warfare have also increased the complexity of operations; mandating increased inter-service and inter-agency coordination and thereby greater adaptation to fluid organizational cultures [21].

Recent attention has focused on the creation of military training systems utilizing gaming technologies. Many such systems have been developed to address domains such as Arabic language training, intelligence data collection, squad-level tactics, cultural familiarization, and leadership training [12, 3, 16]. An instructional trend in military game development has followed the paradigm of experiential learning [14] which emphasizes the role of experience in learning.

This has shaped the development of training games to be highly interactive and free-form, with trainees being allowed to explore the virtual environment, to gain experience through interactions with virtual characters and the performance of domain tasks, and to develop knowledge as the net effect of all interactions with the training system. Learning is largely opportunistic and no systematic approach has been applied to insure adequate exposure of trainees to all training objectives of a structured curriculum [20].

This problem is further compounded by the general lack or poor implementation of typical training mechanisms (e.g., articulation of training goals and performance standards, detailed feedback, performance remediation, performance appraisal, and explicit coaching prior to learning opportunities) within the current generation of military, game-based training

applications. These deficiencies within many contemporary VE-based training solutions are critical gaps as research suggests that if a scenario is linked with training objectives, then trainees are more likely to learn the underlying objectives [5]. These deficiencies were addressed in the development of the Middle-East Curriculum (MEC) discussed below.

2.0 BODY

The MEC design began with a training analysis of a number of sources in order to derive a set of knowledge/skill/abilities (KSAs). From those KSAs, a training objective taxonomy was derived. An underlying cultural training model was developed and a set of assessments and scenarios were created. This process is briefly described in the following sub-sections.

2.1 Knowledge/Skills/Abilities

A rich source of KSA candidates were identified in a Defense Equal Opportunity Management Institute (DEOMI) research report, entitled 'Toward An Operational Definition Of Cross-Cultural Competence From Interview Data' [18]. This data was derived from a corpus of interview data with Non-Commissioned Officers (NCOs) with recent Iraq deployment experience. The survey established a cross-cultural competency (CCC) definition and posits a number of factors impacting efficacy with respect to real-world CCC. These factors were validated through qualitative survey of subject participants. Ross' CCC-based KSA taxonomy included:

- Ethnocultural empathy
- Experience
- Flexibility
- Interpersonal and communication skills
- Mental-model/perspective taking
- Willingness to engage
- Low need for cognitive closure
- Relationship building
- Self-efficacy

- Self-regulation/emotion-regulation

These factors were subsumed within the MEC training design and used to identify important cross-cultural KSAs.

2.2 Training Objective Derivation

The Middle East curricular content was developed based on analyses of widely-available cultural training materials. This included the Defense Language Institute (DLI) cross-cultural training materials (see <http://www.dliflc.edu/products.html>) as well as other available sources of Middle Eastern reference content. The full set of sources for cross-cultural familiarization which were drawn upon included: TRADOC Culture Center Arab Cultural Training Curriculum, TRADOC DCSINT Handbook No. 2: Arab Cultural Awareness, TRADOC DCSINT Contemporary Operation Environment: Actors & Role, DLI Countries in Perspective (Iraq) and Iraqi Familiarization, Peacecorps Culture Matters workbook, State Department Iraq Fact Sheets, and the CIA World Fact Book (Iraq/Afghanistan).

A training analysis was conducted with these materials and a training objective hierarchy was created to guide the development of specific curricular content such as didactic materials, assessments, and VE-based scenarios. More importantly, this training objective analysis was used to develop a cultural training model, as described below.

2.3 Cultural Training Structure

There have been a number of initiatives conducted to better understand the nature of effective cross-cultural training for multinational operations. For example, the U.S. Army Training and Doctrine Command (TRADOC) requested the Director of Center for Army Leadership, Combined Arms Center and the Chief of the Leader Development Research Unit at ARI to host and conduct the Cultural Understanding and Language Proficiency (CULP) research initiative. A workshop supporting CULP was

conducted in July 2007 at Ft. Leavenworth, Kansas in order to provide a clearer understanding of the cultural and linguistic capabilities required by soldiers [2].

CULP participants were guided by a tri-component framework of cultural capability. The tenets of this framework suggest cultural capability consists of: (1) cross-cultural competence, and to a lesser extent: (2) culture-specific knowledge and (3) language proficiency. CULP participants were charged with defining cross-cultural competence, as it was deemed the most important factor to mission success, and identifying the knowledge, skills and attitudes required to achieve intercultural effectiveness. In response to this agenda, CULP participants posited that cross-cultural competence is the key aspect of this tri-component cultural training model because "Leaders will inevitably encounter situations in another culture that do not meet their expectations. Even if provided with highly accurate region- or culture-specific information in training, leaders will not be able to anticipate every impact of cultural differences" [2, p.5]. Moreover, multiple, concurrent engagements executed in widely diverse areas of operation, coupled with limited pre-deployment training time, often preclude soldiers from fully mastering any single national, regional or local language or dialect. Therefore, honing linguistic skills is increasingly less important relative to training time for the development of inter- or intra-cultural competence.

Based on these assumptions, coupled with the analysis of the identified KSAs and training objectives previously noted, a cultural training structure was created along three conceptual categories: Culture General, Culture Applied, and Culture Specific. Culture General includes a meta-cognitive-based overview of topics which introduce the learner to broad definitions of Culture, American Culture, and the importance of Religion. Each of these three categories was further sub-divided into

specific content themes based on the nature of each, as shown in Figure 1



Figure 1. MEC Structure

This design supports the MEC instructional design as each theme can have a variable number of elements (i.e., assessments, tutorials, and scenarios), incrementally moves from most-general (CG) through to most-specific (CS), and is granular enough to enable users to digest each given theme as an individual lesson within small periods of training time.

2.4 Cultural Assessments

Assessments were created based on the culture-assimilator concept [10, 15, 17]. The Culture Assimilators developed for the MEC were modeled after a set of Arab culture assimilators previously developed through the Defense Language Institute [11]. The DLI Arab culture assimilator content is divided into five specific books and organized around clustered themes. This includes hospitality and conversion, religious practices and history, behaviors toward food and women, greetings and nuances of thought, and traditions versus progress. The five-book culture assimilator was a rich source of material, as it contains more than sixty hypothetical cross-cultural narratives within four-hundred and fifty pages. This corpus was analyzed to derive topical sub-dimensions across the five books.

2.5 Scenario Definition

Scenarios were developed along a number of themes in support of the training objectives identified above. These scenario themes are briefly describe below. Negotiation of cooperation between Arab tribal leader and U.S. Forces regarding

humanitarian support for infrastructure rebuilding: This type of multi-party negotiation is quite common and stresses cross-cultural differences that can often impede or negate positive interactions and outcomes. In Arab cultures, decision making is typically not a diffuse "meeting of the minds"; on the contrary, decision-making typically is vested in the hands of a tribal leader. The determinant of negotiation outcomes is largely a function of the cultural competency of the U.S. negotiation party.

Negotiation of cooperation between Arab tribal leader and U.S. Forces diffusing rioting in the city after U.S. forces mistakenly fired on a wedding party after celebratory gun-fire: An important cultural practice within many Arab cultures is that of celebration of key life events (e.g., funeral, wedding etc.) is that of weapon-firing. This can create tensions and misinterpretation of the intent of such celebrations as they can be perceived as threatening rather than non-threatening events.

U.S. military personnel training indigenous security and military personnel: U.S. forces are commonly tasked with training indigenous populations' security and military forces to increase their tactical and military capabilities for self-protection. This scenario entails a U.S. Lt to interact with and train a small ten-person ISF squad. These contexts typically place an emphasis on cross-cultural interactions involving a small minority of U.S. military personnel in contact with a larger majority of indigenous personnel. Clashes between cultures are common including cultural differences related to authoritarianism, forced-compliance, tolerance, and protection of honor in a group setting.

Entry into a Mosque through demonstration of proper Mosque etiquette: Given that the Mosque is a ubiquitous part of Arab religious and cultural life, U.S. military personnel have a large degree of contact with, and need to enter, Mosques. U.S. military personnel are in the tenuous position of

having to balance the somewhat conflicting goal of performing MOUT-based patrols, sweeps, and apprehension of persons of interest, with the need to show great deference for required etiquette and practices associated with entry to, and prescribed and proscribed behaviors within, a Mosque. This scenario involves a U.S. Lt needing to gain entry into a Mosque, demonstrate appropriate cultural understanding to remain there, and elicit intelligence information from the Mosque religious leadership regarding a person-of-interest.

Gathering of intelligence indicators through interaction with local populace: Garnering the support of the local populace is key in many military operations but particularly so for intelligence operations in support of Commanders Critical Information Recruitments (CCIR). Respecting conventional cultural norms is a key determinant of success in this context. This scenario involves a U.S. Lt interacting with members of the local populace in order to elicit intelligence indicators regarding the presence of unknown individuals within the city, observed loitering (possible surveillance) near key infrastructure, reports of threats or intimidations toward local business, and perceptions of corruption of local law-enforcement.

3.0 DISCUSSION

We approached the task of instantiating the MEC content described above with a hypothesis that skills involving person-to-person communication, cross-cultural dynamics, an understanding of non-verbal behavior and other broad types of interpersonal skills, require extensive experiential practice before they can be reliably and independently applied by the learner in a broad range of everyday situations. However, providing only experiential training via a game-based virtual environment encounter is likely to be just as limiting and ineffective as providing only lecture-based presentation of abstracted information on cultural sensitivity

or on a specific (sub-)culture. This is because the game-based experiences address only one aspect of the skill- and knowledge-development process – that of experiential application or practice. While essential to learning, practice must be combined with three other broad functions to achieve effective training. Specifically, practice must be:

- Supplemented with didactic instruction such as demonstration, lecture or presentation;
- Guided with scaffolding to provide coaching and/or feedback that directly or indirectly promotes deliberative learning and introspection; and
- Managed through formative (pre) and summative (post) assessments that guide the learner’s progress toward the learning objectives.

The last function in the above list points to the explicit purposiveness of training, based on explicit learning objectives. In the MEC, the learning objectives drive not only the assessment process, but also the sequencing and management of the didactic instruction and practice process as well. The learner is systematically paced through a cyclic curriculum of instruction, practice, and assessment in a way that takes the trainee systematically toward the goal of achieving and demonstrating competence in the specific objectives of the training. Thus, the learning objectives strongly constrain the design of the practice environment (i.e., game—the two terms are used interchangeably here) to ensure that it provides clear opportunities for practice and assessment of the various actions and knowledge that the trainee must acquire. Whatever features are designed into the training game to make it interesting, challenging and engaging, they must be subordinated to these needs to provide opportunities to perform and be assessed in the performance of the target knowledge and actions. The impact of the objectives on the MEC practice environment flows into three separate aspects – the tutorials and

assessments outside the game, the scenarios and the dynamics in the game environment itself, and the behavior of the NPCs with whom the trainee interacts in the game. The curriculum is objectives-based and includes well integrated didactic instruction, game-based practice, coaching and feedback, and an ongoing assessment process that drive the cycle of learning forward on an individualized basis.

3.1 Instantiating Content

This Middle East curriculum was implemented using the game-based cultural training architecture VECTOR® [9] previously created by the research team because it provided a great degree of flexibility while requiring only incremental modifications. This includes a didactic learning component implemented using the commercial product Toolbook, a game-based practice component, a suite of authoring tools for creating and extending scenarios, and a data-base back-end for storing trainee performance results.

In the practice game, the trainee can progress through a series of scenarios, each of which involves interacting with a specific physical avatar or Non-Player Character (NPC) that possesses a specific set of cultural-behaviors and sensitivities. The interaction between the trainee and the NPCs in the scenario is organized into transactions, in which each party each say one thing in a turn-taking fashion. For the trainee, each turn is represented by a pre-defined set of utterances from which the trainee must select one. The progress through the scenario depends completely on the trainee’s choices and the NPCs react differently on each path based on their pre-defined cultural sensitivities. Figure 2 shows an example of the dialog choices available to the trainee during an initial-meeting encounter with a specific NPC named “Nabil”.



Figure 2. Interacting with an NPC

This fidelity required of the NPC avatars required a range of affect and expressivity using expressive non-verbal behaviors. The requirements for cross-cultural training dictated that the scenarios needed to include voice-acted speech coupled with avatars capable of a range of para-linguistic expressivity. Because these features were not required in the original creation of the VECTOR® system, this presented a technology gap. To address this gap we integrated a high-fidelity character-animation and lip-syncing tool, FaceFX [13], in order to provide highly interactive avatars capable of conveying subtle non-verbal cues. The use of FaceFX provides a smooth pipeline for processing voice-acted wav files against avatar speech (i.e., dialog) and produces character asset files which are then used to drive high-realistic game avatars.

During interactions with game NPCs, the trainee is expected to maintain trust with the avatars by communicating in ways that show deference for the modeled cultural norms and communication expectations. The NPC speaks via a voice-actor while the trainee selects responses via text presented on the screen. One of the forms of scaffolding and feedback provided dynamically to the trainee is a “trust meter” based on trainee responses (in the top left) and is an aggregate measure of NPC trust. Additional measures of performance are calculated and stored in the trainee

database for off-line use by an instructor or training administrator. Note that in the trust meter, Nabil’s trust of the trainee is average. As the trainee interacts with any given NPC, the trust-meter will increment or decrement as a result of choices the trainee makes while interacting as a function of success relative to underlying training objectives. Additionally, an after-action review (AAR) summarizes all learning objectives measured against trainee performance, per scenario, as seen in Figure 3.



Figure 3. After Action Review Example

3.2 Scenario Authoring

Despite successes in applying simulation and serious-games to interpersonal skills training, scenario content generation remains an obstacle to the cost-effective use of the technology. In fact, a common criticism of game-based training has been the lack of a systematic approach to linking learning objectives to scenario content.

To this end, an important capability was the inclusion of an authoring facility. Such a facility would provide three advantages in that it:

- Allows for systematic and repeatable manipulation of existing scenario to support experimentation;
- Provides the ability for third-party end-users to add content based on changes in cultural conditions
- Positions scenario creation in the context of training-objective articulation, performance measurement, feedback and assessment.

The existing VECTOR® scenario editor, depicted in Figure 4, enabled the efficient creation of the Middle East game-based scenarios. The integration of instructional design principles into the authoring process promoted effective training scenario instantiation [4].



Figure 4. Scenario Editor

To facilitate consistent scenario creation, a workflow model for scenario authoring was included within the existing scenario authoring tool. The overall approach to make scenario authoring more accessible to a wider audience (i.e., beyond “game” engineers), was to use a cinematic metaphor to create the design of the authoring tool interface. The use of cinematic metaphors has been successfully used in similar virtual environments [19, 7]]. Scenario authoring within VECTOR® encompasses a number of training aspects, including:

- Training objective specification: Includes a library of training objectives which can also be expanded using the objective editor.
- Scenario information: This includes specifying high-level scenario information such as authorship tracking (critical when scenarios are created and maintained by multiple authors), target trainee population details, and other aspects of the overall scenario learning goals.

- Environment specification: Includes the designation of specific environment/setting within which a scenario will take place to support the identified training requirements.
- Plot organization: Involves the creation and arrangement of an overall scenario “story” which supports the selected training objectives and conveys a complete, coherent scenario to the trainee.
- Vignette creation: Encompasses the process of creating detailed dialog-based interactions and trainee response options, linking those interactions to training objectives, specifying feedback and coaching, and other measurement details.
- Scenario generation: Process for reviewing and validating the scenario before export to the game-engine “player”.

3.3 Experimentation

As a continuation of on-going collaborations with the USMA at West point, a student-executed study using an earlier version of the VECTOR® system and Middle East content was conducted by Cadets at the USMA in 2008 [6]. The goal was to address the issue of how an interactive game-based training experience might influence the retention of training content in accordance with the “depth of processing” theory of Craik & Lockhart [8]. The findings of this field experiment regarding trainee reactions, knowledge acquisition and knowledge retention are presented in the three respective subsections below. All results reported are statistically significant at $p < .05$, one-tailed.

A multidimensional training effectiveness framework was leveraged to guide the planning and conduct of this field experiment to evidence the effects of VECTOR® relative to another cultural and negotiations training system, known as ELECT BiLAT, on trainee reactions, learning and knowledge retention. A between-subjects design was used to

document the differential effects of the two training simulator systems on trainee knowledge of cultural negotiation techniques.

Trainee procedural knowledge of cultural negotiations was measured after trainees completed a given simulator-delivered scenario-based training (SBT) event set (viz., VECTOR® v. ELECT BiLAT). Trainee reactions, operationalized herein in terms of affective, utility, engagement and difficulty reactions, were also measured post-training. Cadet retention of procedural cultural knowledge was also measured post-training.

3.3.1 Setting and Procedure

Trainees (N = 28) participating in the study were Second Class Cadets enrolled in the PL300 Military Leadership course at the United States Military Academy at West Point. The cultural training simulations, and trainee assessment tests and measures, were administered in a classroom setting as part of a project led by two Cadets attending West Point. Trainee participants ranged in age from 20-years to 22-years.

Cadets attending the leadership course were selected on a convenience basis by the researchers and randomly assigned to complete a simulator-delivered SBT event set. More specifically, trainees read and signed an informed consent form and were randomly assigned to leverage either the VECTOR® or Elect BiLAT cultural training simulation system to complete cultural negotiations training. Upon completion of the simulator-delivered SBT event set, trainees completed a post-training test of cultural knowledge and training reaction measures. After finishing training, trainees also completed a measure of cultural knowledge to index knowledge retention.

3.3.2 Trainee Reactions

In terms of trainee reactions to the simulator-delivered cultural training experience, trainees completing the VECTOR® SBT event set reported being

more engaged during training than those trainees exposed to ELECT BiLAT-based training. More specifically, relative to those Cadets exposed to ELECT BiLAT, those trainees exposed to VECTOR® reported more favorable engagement reactions to the simulator-delivered cultural training ($t(23) = -2.02, p \leq .05$). No statistically significant differences were observed between the two simulator system conditions in terms of trainee affective, utility and difficulty reactions to training.

3.3.3 Trainee Knowledge Acquisition

Trainees assigned to complete the VECTOR® SBT event set also acquired more procedural knowledge of cultural negotiation techniques than those trainees exposed to the ELECT BiLAT training system. More specifically, the results of an independent-samples t-test analysis suggest that relative to Cadets exposed to ELECT BiLAT, those trainees exposed to VECTOR® had greater knowledge of cultural negotiation techniques at the completion of the training session ($t(24) = -1.90, p \leq .05$).

3.3.4 Trainee Knowledge Retention

VECTOR® trainees also retained more knowledge of how to effectively negotiate in a multicultural context. The results of an independent-samples t-test analysis suggest trainees participating in VECTOR® delivered training maintained more procedural knowledge of cultural issues than those trainees subject to the ELECT BiLAT simulator system ($t(24) = -2.17, p \leq .05$). Moreover, a more fine-grained analysis of those items comprising the retention test which were designed to test trainee's culture-specific knowledge also evidenced a stronger impact of the VECTOR® system on Cadet learning. Relative to Cadets exposed to ELECT BiLAT, those Cadets exposed to VECTOR® retained more culture-specific procedural knowledge ($t(24) = -2.64, p \leq .01$).

4.0 CONCLUSIONS

The shift in DoD focus from high intensity conflicts to the preparation for Stability, Security, Transition, and Reconstruction (SSTR) operations has led to the desire to increase the availability of cultural familiarization training for U.S. forces. One approach that has generated interest is the use of game-based solutions. In theory the use of game-based VEs should permit game-based cultural-training to be practiced by a greater audience.

The work described here investigates the ability of a game-based solution to effectively utilize a VE for an effective cultural training experience. We have concluded that four key elements are responsible for an effective application of this technology towards this goal. These four elements include:

1. *Scalability* allows for an application created for an initial small group training framework to be enlarged to a much greater 'N' of trainees without concomitant increase in cost.
2. *Extensibility* provides for addition of new types of virtual cases within previously-designed VE's, allowing new and different forms of norms and culture to be imparted and assessed.
3. *Evaluability* allows for the direct application of comparative-effectiveness metrics to a system. Such a feature prevents the simplistic aspect of some training programs' "show-it-and-trust-it" approach to any domain knowledge.
4. *Authorability* gives tools to non-technical domain experts, such as clinicians, permitting them to populate cases without having to supply code or otherwise contend with excessively technically-constrained requirements:

The VECTOR® system has the potential to reduce the cost of developing interpersonal skills-based training applications, allow such applications to be easily disseminated to a

large numbers of trainees, and permit the applications to be executed on a wide variety of computer hardware. We expect that the Army and Marine Corps will obtain the greatest benefit from similar applications of cultural training because personnel in those services have the greatest need for direct interaction with the local populace in deployment areas. The VECTOR® platform will enable the development of training applications in other interpersonal skills domains and therefore will be a valuable training application for Government and private sector use.

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