

### 3.3 Using Agent Based Modeling (ABM) to Develop Cultural Interaction Simulations

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*Abstract:* Today, most cultural training is based on or built around “cultural engagements” or discrete interactions between the individual learner and one or more cultural “others”. Often, success in the engagement is the end or the objective. In reality, these interactions usually involve secondary and tertiary effects with potentially wide ranging consequences. The concern is that learning culture within a strict engagement context might lead to “checklist” cultural thinking that will not empower learners to understand the full consequence of their actions. We propose the use of agent based modeling (ABM) to collect, store, and, simulating the effects of social networks, promulgate engagement effects over time, distance, and consequence. The ABM development allows for rapid modification to re-create any number of population types, extending the applicability of the model to any requirement for social modeling.

### 1. INTRODUCTION

Most military thinkers agree that cultural competency is and will continue to be an essential skill on the part of our service men and women, a skill that has been lacking. The United States and its partners have worked hard to create the training capabilities to fill this gap. For many reasons, most of these current capabilities use training conditions defined by a “cultural engagement” or a discrete dealing between the individual learner and the cultural “other” or others. They are discrete because all trainee attention is focused on a determinate outcome tied to particular training objectives. In reality, however, cross-cultural interactions in the current operational environment involve secondary and tertiary effects with potentially wide ranging consequences. The concern is that learning culture within a strict engagement context leads to “checklist” cultural thinking that will not empower learners to understand the full

consequence of their actions nor tie their cross-cultural success to larger, more strategic aims.

The authors of this paper propose an evolved approach to culture training, one that is “campaign” based, with the potential to be an individual or collective and unit level training tool, and a method for its execution founded on agent based modeling (ABM). Such an approach would include multiple cross-cultural engagements and extend their consequences across distance and time. Such an approach would develop a broader, more strategic perspective on cross-cultural conditions while learning to achieve mission success in cross-cultural conditions.

As the authors have experimented with this new approach within serious games, the paper will use that modality for discussion, though the approach is not limited to game-based solutions.

## 2. ENGAGEMENT VS. CAMPAIGN

Today, military operational success must be achieved “amongst the people” [10] and cultural competency is essential to achieving that success [5]. One way of delivering culture training is through game-based training systems. Such systems provide an efficient and engaging learning environment and outcomes. Game-based training systems promote learning retention through engagement and require minimal overhead compared with systems dependent on instructor time, materials, and brick and mortar facilities.

There are already several efforts leveraging games for culture training. Some include BiLAT™, Tactical Iraqi™, and Virtual Cultural Awareness Trainer (VCAT™). These efforts share characteristics, a primary being that they are focused on or built around a “cultural engagement” or discrete interactions between the individual learner and one or more cultural “others”. Further, because simulated engagements tend to serve as merely a platform to demonstrate and teach aspects of cultural knowledge, they tend to be highly discrete with extremely limited consequences. In reality, however, cultural interactions are not ends by themselves but rather means to achieve military or other objectives. Additionally, these interactions cause secondary and tertiary effects with potentially wide ranging consequences. Therefore, individuals and groups who are effective in achieving goals under cross-cultural conditions are the focus of true operational objectives. The concern is that learning culture within a strict engagement context might lead to “checklist” cultural thinking that will not empower learners to understand the full consequence of their actions nor foster the initiative sought by the military [13].

The Department of Defense defines engagement as “A tactical conflict, usually between opposing lower echelon maneuver forces” [7]. Within the taxonomy of operations are, in order, engagements, battles, campaigns, and wars. The DoD defines a

campaign as “A series of related major operations aimed at achieving strategic and operational objectives within a given time and space” [7]. Because of the nature of current operations, the campaign is a better context for envisaging cross-cultural performance than the engagement. The Marine Corps Operating Concepts for a Changing Security Environment (2007) [15] identifies that our likely military opponents, unable to achieve decisive results against the United States, will likely leverage duration as a means to achieve their aims. This will result in “prolonged operations.” Further, the Operating Concept discusses the predominance of insurgencies in the past half century and into the future. These are wars among the people and for the support of the people. These same concepts are seen as a basis for current operational theater requirements, as the Commander of ISAF spells out in his Counterinsurgency Guidance (2010) [10]: secure and serve the population, live among the people, hold what is secured, foster lasting solutions, be a good guest, consult and build relationships, fight the information war, manage expectations, and maintain continuity through unit transitions. These are requirements to engage in a prolonged interaction with and for the people where cross-culture is a condition for long-term success.

It is well understood that training is best when it matches actual application: the “train as you fight” paradigm. Learning culture and language in a manner that enables one to apply what has been learned to a broad set of possible situations requires a new approach. Attempting to learn culture through discrete engagements will tend to limit training to heuristics that will be difficult to apply in the complexity of actual operations. Furthermore, it will miss the real target—achieving mission success under cross-cultural conditions.

The documentary Restrepo [12] illustrates the risks of training cultural interaction strictly within the “engagement” context. In the documentary, the American company commander conducts what appears to be a well-coordinated Shura (gathering of village



elder's in Afghanistan). However, in the Shura, the commander makes a point of negatively comparing his predecessor to himself. As the senior representative on the ground this could be perceived as disparaging the International Security Assistance Force (ISAF) or America in general. Had the company commander been trained to see cultural interaction as a campaign versus a series of discrete engagements, he would have better understood the linkages between his actions and those of his predecessor and possibly have had a more effective strategy.

Current virtual environment-based culture trainers tend to employ a single tier of consequence when interacting with cultural-other characters. This is not representative of the real world; in reality, consequences of one's actions will propagate along social networks throughout and beyond communities, having effects across a depth of time, distance, and consequence. These actions will affect future interactions with individuals a trainee has not yet met as well as affecting the interactions of "flanking" individuals and organizations.

What would be required to create a campaign-based approach to cross-cultural training? The authors propose changes to how we model individuals, the cultural others, and new methods to modeling the collective community.

### 3. MODELING INDIVIDUALS

Humans are inherently complex and difficult to accurately model. To deal with this complexity, or possibly to side-step it, many traditional systems have used intricate branching logic. This solution, unfortunately, leads to stilted models, unable to reflect the dynamics of the human condition.

At the individual level, a thorough framework must include the three domains of human existence: physical, cognitive, and emotional. Physical and cognitive modeling is relatively simple and exists in most first-person games. Emotional struc-

tures, such as the Global Structure of Emotion Types [9], have been developed and could be leveraged to develop computer frameworks that will allow response by AI-driven NPCs.

Sociology and philosophy are also underused disciplines for providing a framework that allows modeling of cross-cultural dynamics. Frame analysis, as introduced largely by Erving Goffman (1974) [6] has provided a basis for decoding how people understand and react to situations. The Social Theory of Practices is another approach for appreciating the natural behaviors of individuals [2] [3] [14] [11]. These theories, taken together, postulate the presence of context or environment to which individuals bring differing frames of reference and personal and cultural practices. The theories illuminate why an office worker acts differently in an office setting than in a social setting or why a local in a foreign community would respond differently than an American based upon a frame of self-identity or honor. These theories provide a means of modeling a much richer and more complete cultural-other, one who responds more complexly and realistically to changed context or predominant frame.

The next logical step is then to tie these more complete individual models to an accurate model of the collective community.

### 4. MODELING THE COLLECTIVE

The human community is comprised of complex systems. These include networks of people whose interactions result in observable and noteworthy behaviors. People live their lives based on rules (norms), interacting with one-another. Combining groups of people into observable groupings (i.e. a neighborhood, towns, provinces, etc.) provides insight into people composed systems-of-systems. Scaling the systems up creates larger cross sections of society that in turn provides insight on how that society functions. Observing massively

complex human systems requires a set of tools suited for recreating individual behavior based on a known set of rules. One tool is Agent Based Modeling (ABM). ABM is a method whereby experimenters construct complex systems consisting of numerous individual entities called agents [4]. These agents follow a set of rules and interact with each other as they mimic the inner workings of complex systems [8]. Using ABM, researchers re-create extremely complex social systems for study.

Researchers traditionally use ABM as a tool to examine and analyze complex societies. However, the authors propose using ABM as a societal model to capture, store, and propagate the results of cross-cultural engagements, or as the bond that links these engagements across space and time to enable a cross-cultural campaign.

ABM is traditionally used to observe emergent behaviors of groups of individuals. Emergent behaviors are the aggregate of the behavior of all the agents in the ABM system; behaviors which are unforeseen because we cannot normally observe them or notice them in the real world (i.e. one person dropping a rock in a lake will result in a small ripple, but 500 people performing the same act would result in a significant sized wave). Researchers model a targeted population to include means for individual agents to interact, create an initial state, and then run the system, observing the emergent behaviors of the modeled agents. Researchers can subsequently modify agent states and run additional tests, building a set of relevant results to gain insight on the targeted population.

In the approach offered by the authors, the targeted, cultural-other community is modeled within the ABM with several designated agents representing specific characters from the game environment. These characters are programmed to possess the same initial, attitudinal states as their game environment characters. The results of the trainee's engagement will modify the characters' attitudinal states and the system will relay this change to the ABM counterparts. The system cycles, allowing the initial

changes to propagate across the ABM population, changing the states of other individual agents. The system then transfers these subsequent changes back to the virtual environment in terms of changes to the attitudes, beliefs, and behaviors of the characters that trainees will subsequently engage. In a training application, these behaviors become the source of new information to the trainee.

These changes will modify future interactions at the local community level, thus creating a dynamic, consequence included environment for trainees; a trainee's actions will have future ramifications for themselves but also, because ABM social networks will span separate local communities, those actions will have ramifications for neighboring units. This unique expansion of impact over time, space, and consequence will create the conditions for a collective, campaign-based approach to culture training versus an engagement-based approach.

The ABM will also allow a management system that will capture trainee actions and resultant system reactions in a manner that will enable the learner to view the impacts of each interaction as it propagates through the broader social network. This will enable runtime or after action review of the impacts of actions serving as a feedback mechanism.

## 5. AGENT-BASED MODELING REQUIREMENTS

In order to create a system where cultural-other agents in the ABM can pass changes to the rest of the population, it is important to model accurate social networks within the ABM. Social networks are complex groups of individuals socially connected through some form of communication [1]. For example, a group of people who attend a church, temple, or mosque together are independent of one another, yet they routinely gather to worship together, and in this way share information. This social network is, in turn, part of a larger



network of social networks. ABM is highly suited to modeling these networks to duplicate information transfer, or to accurately replicate the mechanisms of information transfer.

ABM, in this context, is proposed as a tool with which a training system can set and modify interactional / relationship parameters in real time to effect both immediate and extended dynamics between the learner and the virtual cultural-other community. In addition, game-based systems, which require the presentation of learning experiences tailored to the trainee, are more efficient if those experiences are tailored in real or near-real time through assessment of the trainee's responses.

## 6. CONCLUSION

Cultural competency for today's soldiers consists of prolonged interactions

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within a community. The training they receive may prepare them to understand some components of a foreign culture, but does not adequately prepare them and their units for mission success under cross-cultural conditions. The combination of ABM as a back end to game based cultural trainers presents a solution to the problem of developing training which encompasses the complex nature of societies. Until cultural trainers are able to address the prolonged nature of interactions there is a risk that trainee's will not fully grasp the scope of their actions. The risk is Soldier's who may understand the basic components of a foreign culture but do not fully grasp how mistakes or success will affect future interactions. Additionally, if Soldier's do not realize that their actions will impact other units located in the vicinity, and those that follow on; they run the risk of creating cultural issues which they were not trained to handle.

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