

# WORKSHOPS

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**Intelligent Tutoring Systems : PAST AND FUTURE**

## Culturally-Aware Tutoring Systems (CATS'2008)

**Montreal, Canada, June 23-27, 2008**

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**CATS 2008: Workshop on Culturally-Aware Tutoring  
Systems**

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## Preface

Intelligent Tutoring Systems (ITS) have within their breadth of application the possibility of being used for distance education. As such, they can be included in the vaster field of eLearning. Knowledge, skills, techniques and even workers themselves have become global, a process to which ITS and eLearning are contributing. This process is not without certain pitfalls. Research in education has shown that teaching methodologies and instructional design cannot always be universally applied as their impact can greatly vary from one culture to another.

This first workshop on Culturally-Aware Tutoring Systems aims to foster reflection on the way culture can be represented within the overall goal of imparting knowledge via ITS and eLearning. In this process, it hopes to stimulate thought as to the impact of culture on the conception and application of ITS and eLearning and reflect on those emerging technologies that need to be developed to more fully integrate cultural considerations. It is also meant as a forum for sharing and expanding the very knowledge we have about culture. To this effect, seven full and two short papers, spanning a variety of research initiatives, have been accepted.

We are very grateful to the many individuals who have made this workshop possible. We thank the Committee of the International Conference on Intelligent Tutoring Systems 2008, especially its workshop chairs Roger Azevedo and Tak-Wai Chan, as well as conference chair Roger Nkambou, for their advice and collaboration in the planning of the workshop. We wholeheartedly thank the members of the program committee for having dedicated time to thoroughly evaluate workshop submissions within a limited time frame. Finally, we thank Dr. W. Lewis Johnson for having graciously accepted to give the opening keynote presentation.

We are pleased that this first workshop on Culturally-Aware Tutoring Systems has been well-received by the ITS/AIED community as well as by researchers exploring related eLearning issues. We believe that ITS can propose viable solutions to help deal with various intercultural challenges and we hope that this workshop will be a stepping stone towards anchoring this theme as a recognized field of research.

Welcome to CATS 2008, the first workshop on Culturally-Aware Tutoring Systems.

May 2008

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## Table of Contents

### Opening Keynote

- The Politeness Effect in an Intelligent Foreign Language Tutoring System 7  
*W. Lewis Johnson*

### Full Papers

- Towards Modeling Knowledge of Cultural Differences and Cross-Linguistic Influence in Computer-Assisted Language Learning 11  
*Danièle Allard, Jacqueline Bourdeau, Riichiro Mizoguchi*
- Designing Culturally-Aware Tutoring Systems: Towards an Upper Ontology of Culture 23  
*Emmanuel G. Blanchard, Riichiro Mizoguchi*
- Getting Down to Business: Teaching Cross-Cultural Social Interaction Skills in a Serious Game 35  
*H. Chad Lane, Matthew J. Hays*
- How the Piléface System, Dealing with Pragmatics, Takes Cultural Factors into Account 47  
*Ruddy Lelouche*
- Using Culture to Motivate Learning in a Digital Game Based Learning Environment 59  
*Phaedra Mohammed, Permanand Mohan*
- Using a Peer Moderator to Support Collaborative Cultural Discussion 71  
*Amy Ogan, Erin Walker, Vincent Aleven, Chris Jones*
- Cultural Variables in the Building of Pedagogical Scenarios 83  
*Isabelle Savard, Jacqueline Bourdeau, Gilbert Paquette*

### Short Papers

- Socio-Cultural Interfaces for e-Learning 95  
*Marine T. S. Bello Flores, Aude Dufresne, Ghislain Lévesque*
- Extending ITS Authoring Tools to be Culturally Aware 101  
*Manasi P. Vartak, Shane F. Almeida, and Neil T. Heffernan*



# Opening Keynote



# The Politeness Effect in an Intelligent Foreign Language Tutoring System

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**Abstract.** This talk describes the Situated Culture approach to teaching foreign language and culture, employed in Alelo's language and culture training learning environments. To support this work we have developed a framework for structuring cultural knowledge and implementing it in interactive learning experiences. This work has broader implications for modeling cultural differences in intelligent tutoring systems.

**Keywords:** Culture learning, language learning, cross-cultural communication, politeness effect.

Alelo has developed a number of intelligent learning environments aimed at promoting cross-cultural communication skills. Learners develop communication skills through a combination of interactive lessons focused on specific communication skills and interactive games in which learners practice these skills. We have developed learning environments for Arabic, French, Pashto, and Dari, and are developing additional ones for Chinese, Cherokee, and other languages. We are also developing interactive cultural awareness courses, which focus primarily on cultural awareness and secondarily on language.

All of these learning environments teach cultural competence as well as language skills, so that learners can apply them effectively in common tasks and situations, such as accepting an invitation and visiting a counterpart in his or her home. To focus the culture curriculum in these learning environments, we have developed a framework for modeling culture, called the Situated Culture framework, which focus on the cultural knowledge that applies in specific situations. We also try to promote awareness of culture, by providing learners with a conceptual framework that they can use to analyze the differences between their culture and the target culture. We also embed cultural models in the game environments that learners practice in, in the form of non-player characters that interact with learners in culturally appropriate ways.

The cultural modeling techniques employed in this work have implications for cross-cultural intelligent tutoring systems in general. After all, tutorial interaction is a type of situated interaction, and so is amenable to Situated Culture analysis. For example, we have found Brown and Levinson's Politeness Theory to be useful both to model situated cross-cultural interaction and tutorial interaction. Our studies have shown that intelligent tutoring systems can be more effective if they employ tutorial tactics that mitigate face threat. In collaboration with Elisabeth André we have compared politeness ratings of tutorial tactics by learners in different cultures.



## **Full Papers**



# Towards Modeling Knowledge of Cultural Differences and Cross-Linguistic Influence in Computer-Assisted Language Learning (CALL)

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**Abstract:** This paper describes a work in progress. The goal of the research is to map knowledge of cultural differences and cross-linguistic influence in a domain ontology, so as to lay a foundation for future CALL applications in this respect. We give a brief outline of culture in relation to foreign language learning, of the theories used to explain cultural differences, explain domain ontology, cross-linguistic influence, and illustrate with a relatively detailed example. We end with a basic simulation of how a CALL system based on the ontology could potentially work.

**Keywords:** Culture (CALL), cross-linguistic influence, interference (language), learner errors (language), ontological engineering

## 1. Introduction

Language is imbued with culture. When people communicate, they do so in relation to one another, as well as in relation to prior experience. In other words, their voice is not only individual, but collective: they regularly express the knowledge and social patterns accepted within their native community [1].

This article discusses a research project in progress. We address cultural differences in the context of computer-assisted language learning (CALL), more specifically, the issue of cross-linguistic influence with cultural underpinnings. Cross-linguistic influence can be observed when speakers use skills that can be traced to their native language in a second or foreign language. When this is expressed in the form of errors, it is called interference. Though interference may appear linguistic in nature, we have found that cultural differences often underlie the phenomenon. We seek to identify interferences in terms of cultural differences and map knowledge to

this effect in a domain ontology, which can then serve as a foundation for creating CALL applications.

We begin by giving a brief history of culture within language education, an overview of our cultural framework, currently based on the work of Hofstede and Schwartz, and explain our research project in more detail while providing information on the nature of cross-linguistic influence. We describe our methodology in terms of ontological engineering, and illustrate interference with a relatively detailed example that is followed by a basic simulation of how a CALL system based on a domain ontology could potentially work.

## **2. Culture**

### **2.1 Culture in second/foreign language teaching/learning**

The following definition seems to capture the current outlook on learning culture in the language classroom (actual or virtual) [2]: “Culture learning is the process of acquiring the culture-specific and culture-general knowledge, skills, and attitudes required for effective communication and interaction with individuals and other cultures. It is a dynamic, developmental, and ongoing process which engages the learner cognitively, behaviorally, and affectively” [3]. Here, culture-specific refers to a particular culture (for example, French and francophone culture) and culture-general refers to learning about any culture that is not the learner’s native culture. More specifically, according to the *National Standards for Language Learning* published by the American Council on the Teaching of Foreign Languages [4], cultural knowledge can be gained through examining cultural practices, products and perspectives. Practices refer to daily-life behaviors and patterns of social interactions, products refer to various cultural achievements, and perspectives refer to meanings, values and ideas.

The crucial importance of culture in relation to language learning is thus acknowledged in the field. With the advent of technology, which has allowed for unprecedented contact with other cultures, namely through different means of computer-mediated communication, the various resulting forms of human interaction and discourse are actively being explored in Computer-Assisted Language Learning (CALL) in relation to culture [5]. This said, while it is recognized that that a vast amount of discussion going on, that standards exist, that experiments are conducted and system prototypes built, that language and culture are intrinsically related, the fact remains that there is a lack of clarity as to what is actually meant by teaching/learning language in conjunction with culture. Consequently, the inclusion of culture in the curriculum as well as the manner in how to do so is an issue that is still largely unresolved [2] [5] [6].

### **2.2 Cross-Linguistic Influence and Culture**

In FL education, “the act of knowing the other and the other’s culture is inextricably linked to language competence. Both the ability to communicate by the appropriate use of language and by the awareness of the specific meanings, along with the values and connotations of language are involved in this act” [5]. As

Lomicka further explains, awareness of meanings, values and connotations can be approached through a cyclical process that Liddicoat [7] describes in terms of input, noticing, reflection and output, with “noticing” being especially important to intercultural learning, in conjunction with reflection and discussion.

“Input” and “output” can take a wide variety of forms. Our current research narrows the focus. It concentrates on what is known as language interferences, in an attempt to help learners overcome this particular kind of difficulty. Simply put, interferences are “errors in the learner’s use of the foreign language that can be traced back to the mother tongue” [8]. They are the result of the influence of one’s native language (L1) (or another previously acquired language) on a language currently being acquired (L2). This influence can be termed “positive,” such as when it facilitates the learning of a skill given similarities between L1 and L2, or “negative,” which takes place when a L1 skill transferred in L2 is different from what is actually used in the target language [9]. Negative transfer can then potentially impede learning and create misunderstanding. This reflects the fact that “the learner tends to assume that the system of L2 is more or less the same as in his L1 until he has discovered that it is not” [10]. In other words, interferences can be hurdles in language acquisition. Positive and negative transfer, for their part, are related to what is known as cross-linguistic influence.

Recent language research tends to show that overall patterns of errors tend to be language specific. This explains why English, for example, might sometimes be called “Thai English” or “Greek English” [11]. The patterns stem from differences in language, of course, and they can be explained, for instance, in terms of syntax and morphology. At the same time, close scrutiny also reveals that in several cases, cultural underpinnings can be identified. A specific example to this effect will be described in section 4.

Ferris explains, in the context of English acquisition, that FL instructors may find it beneficial to investigate similarities and differences between the L1 and English (in terms of syntax and morphology) and use such knowledge to assess students’ particular strengths and weaknesses to design feedback and instruction to address these specific areas of need [12]. We choose to take this a step further, by adding a cultural component, when applicable.

More specifically, we have been working at identifying and classifying cross-linguistic influence that can be related to cultural differences. We have found that a large part of this is related to vocabulary (meaning and connotation of words) as well as various functions, which are communication acts that include, for example, greetings, making requests, invitations, congratulations, asking/giving advice, etc. We have been focusing on the passage from Japanese to English, and more recently, that of English to French. These make for interesting and challenging comparisons. Generally speaking, if L1 and L2 are related, it will be easier for the student to acquire proficiency. If they are unrelated, the process, especially in the earlier stages of acquisition, will prove more difficult and time-consuming [10]. Conversely, it appears that if the L1 and L2 culture are less related, they seem to carry a greater potential for what we could term “cultural interference,” which not only becomes translated in the course of language acts and functions, but also in the very use of the language itself, namely in the choice of terminology, tense, pronouns, syntactic structure, and so on.

### 2.3 Cultural framework

Geert Hofstede's vastly comprehensive study of how values in the workplace are influenced by culture provides a valuable framework with which to ground a number of the cultural interferences related to the cross-linguistic hurdles we have been focusing on. Hofstede identifies five main dimensions along which dominant value systems in over fifty countries can not only be ordered, but also reflect how human thinking, feeling and acting may, to some degree, be predicted. The dimensions mirror basic problems that any society has to cope with, and further show how solutions to these problems will differ.

The five dimensions are: power distance, uncertainty avoidance, individualism, masculinity and long-term/short-term orientation. Essentially, power distance is concerned with the degree of human inequality underlying the functioning of each particular society. Uncertainty avoidance is concerned with the degree to which a society tries to control the uncontrollable. Individualism, as opposed to collectivism, is the degree to which individuals should look after themselves or remain integrated into groups, usually the family. Masculinity, as opposed to femininity, refers to the distribution of emotional roles between genders. Long term versus short-term orientation refers to the extent a culture programs its members to accept delayed gratification of material, social and emotional needs. The dimensions were empirically verified, and each country was positioned somewhere between their poles on the basis of specific scores [13].

The comprehensiveness of the study and the convenience of comparative scores between many countries makes Hofstede study an attractive and very useful tool to work with – which we do. At the same time, since it is rooted in a study of organization, we also find the need to consider the work of other researchers.

Another major study and classification of universal values in terms of culture was conducted by Shalom Schwartz, the results of which were published in the 1990's. Schwartz identifies cultural values that "represent the implicitly or explicitly shared abstract ideas about what is good, right and desirable in a society [14]. He divides the values in seven categories along three dimensions that reflect these categories: conservatism versus intellectual and affective autonomy, hierarchy versus egalitarianism, and mastery versus harmony. He draws comparisons between forty-nine national cultures, the result of interviewing teachers and students in each of these nations. Though he recognizes that no single occupational group represents a given culture, he explains that the benefit of interviewing teachers lies in the fact that teachers play an explicit role in value socialization, presumably are key carriers of culture, and probably reflect the mid-range of prevailing value priorities in most societies [15].

Schwartz's research is of interest because he circumscribes fifty-six specific values, which, after careful analysis by his research group, appear to stand the test of universality. That is to say, they cover the full range of human experience. Furthermore, the values can also be categorized according to types of human beings, and reflect individual differences, not only cultural differences. While this may not be necessarily relevant to our current research, it could be useful in other culture-related CALL research. For example, when analyzing correspondence between

keypals engaging in a virtual international exchange, it can be a tool to distinguish cultural from individual traits using a common vocabulary.

In addition to Hofstede's and Schwartz's comprehensive studies, we would like to take into consideration research on cultural stereotypes, which are gradually being explored in CALL [16] [17] [18]. We cannot talk about culture without making generalizations. When discussing culture, we are making statements of likelihood and potential, and not of certainty. We can address how people from a particular culture may behave in a given situation, but not how they will in fact behave [19]. Generalizations, as well as limited exposure to another culture can lead to stereotyping, which, in our attempt to help language students understand cultural underpinnings in various language acts, we wish to avoid.

### **3 Research Goals and Methodology**

#### **3.1 Research Goals:**

Our research has been focusing on identifying learner errors that are a result of L1 interference with underlying cultural underpinnings. We call them cross-linguistic hurdles in the hope that they can be overcome. The reality, however, is that they often are not. They can potentially become part of what is called language "fossilization." Broadly put, fossilization is, despite continuous exposure to input, motivation to learn, opportunity to practice, a state of non-progression in learning. More specifically, for our purposes, it has to do with how incorrect linguistic features can potentially become a permanent part of how a person speaks or writes a language [20]. Research in the field tends to point to the fact that language fossilization has at its roots several factors, the two main ones appearing to be transfer from L1, and the critical learning period -- simply put, whether a language is learned as a child (high potential of acquiring native-like proficiency in L2) or an adult [21].

This said, understanding what renders linguistic features fossilizable might help educators better sequence and present instructional materials, and guide them to find compensatory strategies to maximize learning. Some such factors, among others, are the absence of corrective feedback, the quality of input, the automatization of faulty knowledge, a lack of understanding and sensitivity to input [21].

In the course of our research, we have spent considerable time identifying instances of language interference. Though several of them may appear to be strictly the result of linguistic differences, close scrutiny shows that beyond differences in linguistic features between L1 and L2, there are underlying cultural differences. Understanding this can at times result in deriving teaching strategies that depart from "standard" strategies for given language structures, in addition to altering curriculum sequence. In other words, these are steps towards weeding interferences at their root, early on in the acquisition process. To this effect, we have conducted small experiments in the classroom which seem to indeed demonstrate that revised teaching strategies in view of interferences with cultural underpinnings seem to yield positive results, in that learners appear to overcome such interferences more than is the case if no particular attention is given them. In other words, we have sought to increase the quality of input, providing linguistic and cultural explanations, as well as corrective

feedback, thereby trying to promote adequate L2 usage before errors run the risk of becoming automatic.

We have thus been working at identifying key points of interference that have cultural underpinnings, namely in the study of English by Japanese learners, and more recently, French for English Canadian learners. The context is thus one of homogenous groups of learners, who share a common L1. We have been analyzing the cultural factors underlying the sources of difficulty. We have been working at mapping this information for future use in a CALL authoring system that could, initially, be queried by language instructors preparing course curriculum. The system would alert them not only to areas of possible interference, but also explanations as to the underlying cultural differences; it would also provide instructional strategies that may assist in overcoming these. Such information could also be eventually made available to students working directly with the system. The task is complex, and is a work in progress. In order to bring together the knowledge we need to build such a CALL system, we have been working with an ontological engineering methodology, as set forth by Mizoguchi Laboratory at Osaka University, Japan.

### **3.2 Methodology**

Ontological engineering, as it is practiced by Mizoguchi Laboratory, is used for knowledge management. It focuses on the specifications of concepts, the relations between concepts, and their attributes. In so doing, it enables to articulate seemingly chaotic situations in a principled manner and thus provide a concrete reference tool in the form of an ontology, which, simply put, is akin to a sophisticated road map representing the world of knowledge at hand, that can be read both by computers and humans (who are not necessarily computer experts).

In knowledge-based systems, ontologies can be used for problem solving (task ontology), and they can also be used to describe a domain in which a task is performed (domain ontology). Our research is concerned with producing a domain ontology, which seeks to represent a world of interest, making explicit the conceptualization of its structure. The objects perceived to exist in this world are made explicit, as are the relations and constraints between them. In other words, the domain ontology is a declarative description of the fundamental understanding of a given world of interest.

Domain ontologies, upon which computer systems and applications are subsequently based, are shareable and reusable. They can also be considered a repository of knowledge, which can be expanded and adapted as knowledge and understanding increases. In building an ontology, rigorous attention is paid to the meaning of the concepts, their hierarchical organization, as well as the relations governing them. Ontologies are meant to be used and shared by a community, and as such, designed collaboratively. They reflect a consensus of knowledge. Since they can be read not only by computers, but also humans, they thus provide a powerful tool to allow experts in the domain to come to a common understanding and agreement of the fundamentals of the world of interest they are working within, making this world explicit. Essentially, a domain ontology allows for the systematization of knowledge and its accumulation, using a common vocabulary.

Domain ontologies should also be conceived as use-neutral, in the sense that they are meant to serve as a foundation. Building on this foundation, different problems can be tackled, various applications derived, knowledge bases built. Consequently, domain ontologies should be relatively stable and aim to be a long-lasting conceptual structure. Furthermore, as a sophisticated data structure, they provide the building blocks and design rationale for the computer systems, models and applications built to serve the domain [22]. A good illustration of a domain ontology is the OMNIBUS ontology, whose domain is education. It is a work in progress, yet it is also serving as the basis upon which different software are currently being built [24].

Our own research seeks to describe, via ontology, a world in which, very broadly speaking, language and culture can be related to one another. More specifically, we are striving to articulate the understanding we have of culture and cultural differences primarily based, at this point in time, on the work of Hofstede and Schwartz. We try to make explicit language acquisition requirements that can be paralleled with what is known concerning interference, errors and learning difficulties. These not only occur in terms of “linguistic” requirements (simply put, appropriate use of phonology, syntax, morphology, grammar, vocabulary) but also language functions and acts, which all need to be systematized in a comprehensible and comprehensive fashion.

Though we are trying to do this in terms of cross-linguistic hurdles with cultural underpinnings, we are constantly confronted with the fundamental question as to whether language and culture can actually be separated, or if they are sides of the same coin. That is to say, something that may at first appear to be a “linguistic” difficulty can often times be related to inherent cultural practices. The example we give in the following section should illustrate this. We further try to provide information as to how errors manifest and their potential compensation strategies.

Other problems we face are distinguishing errors that are L1-dependent and independent. In other words, what can we identify as transfer from L1, and what is actually related to complexities in L2, independent of L1 and cultural practices. The divide can be vague, and has given rise to much criticism and debate. Furthermore, we need to be aware that nations sharing a common language do not necessarily share the same culture. For example, expectations concerning language functions and delivery may vary according to the area of the world – French in Quebec (Canada) in comparison to France, in similar contexts, can certainly vary. Consequently, when teaching L2, we need to acknowledge that we also make cultural choices.

We are currently working within the framework of three languages. We believe that ontological engineering methodology will help us clarify the various complex issues at stake in terms of cross-linguistic hurdles and cultural interferences in terms of these languages, all the while acknowledging the complexity of the task. We hope to build a stable foundation of current knowledge in this respect in the form of an ontology, which could eventually provide building blocks for considering interference in different sets L1 and L2. In addition, we hope that articulating culture and cultural differences in relation to language can potentially support other CALL research projects, for example those concerned with computer-mediated communication, or acquisition of cultural competence through the analysis of various forms of discourse produced in L2. We now provide an example of cross-linguistic influence followed by a simulation of a potential CALL system whose programming could be based on the ontology we are working on, which is still in its preliminary stages.

#### 4. Example of cross-linguistic influence<sup>1</sup>

Suggestions and advice made by Japanese people in English are prone to transfer and interference stemming from L1. One of the points of concern, among others, is the usage of the English modal *had better*.

Consider the following statements: (1) You had better take your umbrella. (2) You had better go to Osaka Castle to see the beautiful cherry blossoms. (3) You had better read this book. (4) You had better take this medicine. Though these are not uncommon in English used by Japanese native speakers, they have sometimes struck English native hearers to whom they were addressed as somewhat odd, inappropriate, or cause for concern (more than the statement intended). The Japanese speaker who reported example (1) was eventually told by his foreign visitor that this type of advice was not completely appropriate: the visitor was able to decide for himself whether or not he needed to take an umbrella – to the surprise of the Japanese speaker. Similarly, though comments were not voiced, (2) and (3) elicited reactions from native English speakers to the effect of: “What if I don’t go to the castle – or read this book? Do I need to worry about something?” Example (4) can give reason for concern, especially when the statement is made by a physician. This being said, depending on the context, usage of *had better* may not necessarily bring about such reactions, but the fact that it can, we believe, needs to be addressed.

The context, tone of voice and relationship of speaker and hearer when expressing and receiving advice further to be taken into consideration. Depending on these, *had better* can take on different connotations. To this effect, a Japanese speaker may consciously articulate *had + better* when uttering a statement, rather than use the (pronoun)’d *better* abbreviation more common to everyday English. This, along with a non-native rhythm/inflection/pronunciation may make the advice sound stronger/more threatening than it is actually intended to be.

It appears that *had better* is essentially perceived by learners as an equivalent for the Japanese expression *hou ga ii*. This is confirmed when looking up possible translations in various dictionaries. Makino and Tsutsui in their dictionary of Japanese grammar explain *hou ga ii* it in the following way: “it is strongly suggested that someone do something.”[25] In *Practical English Usage*, Swan explains *had better* in terms of strong advice, or telling people what to do (including ourselves) [26]. What is the difference between a strong suggestion and advice? To many, the nuance is not clear. *Hou ga ii* and *had better* may therefore be understood to be equivalent expressions. And yet, as the examples above have shown, they are not always so. How can an English teacher approach the topic so that usage of *had better* be clearly understood?

Modals of advice in the L2 classroom can be taught by initially contrasting them in relation to one another in terms of strength [27]. This means explaining for example that *had better* is stronger than *might*, *could*, *should*, but weaker than *have to*, and *must*; it is in the middle. When Makino and Tsutsui place Japanese expressions of advice on a scale of relative strength, *hou ga ii* is ranked as one of the

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<sup>1</sup> This example has previously been explained in [24]

weakest expressions in terms of impact [25]. How strong then is strong? Cultural perspectives, it appears, vary in this respect.

In an attempt to clarify the situation for Japanese students, several textbooks point out that the usage of *had better* can imply that if the advice given is not followed, there is the possibility of a problem or a danger [28] [29] [30]. Bearing this in mind, it might then be explained to students that in example (2) for instance, usage of “had better” is not the best choice since there is not any particular problem or danger in view of not seeing cherry blossoms at Osaka Castle.

When examining the issue more closely, however, it seems that this is not enough to clarify usage. Informal discussions with Japanese speakers have revealed that *hou ga ii* also carries the implication of negative consequences. This is actually the reason for giving the advice, and demonstrates concern for the hearer’s welfare, or at least for the possibility of missed opportunities. As such, it is commonly used among friends. Furthermore, it is used by doctors giving advice to patients, and by mothers telling children how to behave. In both languages, each respective expression can thus imply the possibility of negative consequences, or a possible problem.

In fact, the use of suggestion and advice expressions vary according to the content of the advice (*what* is being suggested), the relationship of the speaker and hearer to one another (status, situation of expertise, authority, hierarchy, friendship, etc.), and the context. In addition, the range of use of one expression in one language may be greater or lesser than its potential translation in the other. That is to say – *hou ga ii* can be used in situations similar to *had better* in English, and sometimes not. Such points need to be stressed when teaching Japanese students and many various examples used to illustrate. Furthermore, the cultural issue of sensitivity to advice, which varies according to culture and in this case affects usage, needs to be addressed.

To this effect, let us return to the example of the native English hearer who reacted negatively to the suggestion of bringing an umbrella. Westerners, who tend to value individualism and the capacity to decide for oneself, may react negatively to advice, especially if it is perceived as unsolicited. On the other hand, Japanese people are generally receptive to advice, even viewing it as normal, if not desirable. This is perhaps linked to the Japanese proclivity towards maintaining group harmony which rests upon a series of socially accepted rules. These serve as guidance towards maintaining harmony, and as such, are necessary and useful. They in turn contribute to generating a strong sense of duty, as well as, generally speaking, a sense of ease with respecting and following rules, and an openness towards various forms of advice from other group members with a similar concern for harmony. In other words, whereas “strong” advice using *hou ga ii* would likely not ruffle a Japanese hearer, “strong” advice using *had better* may in some cases not be well received by a native English-speaking hearer.

We acknowledge that this explanation is, to a certain extent, made of generalizations. Yet, it is not possible to talk about culture, about groups of people, without making generalizations. As these do contain a kernel of truth, used with discrimination, generalizations can at least pave a way towards clearer mutual understanding. As such, they can be useful [19].

How then does an English teacher deal with explaining *had better* to Japanese students? Teaching strategies based on the cultural differences can be devised and

stored into a CALL system. The cultural differences themselves in relation to this particular form of interference can be listed and explained.

In trying to culturally explain the phenomena, we might call upon concepts such as “range of meaning,” “speaker / hearer perspective,” “sensitivity to / ease with advice,” “under-use / overuse,” “attention to social hierarchy,” “need for politeness,” etc. Such concepts provide handles with which to give explanations, and a collection of different concepts that are systematically organized can provide a framework for comparing different language acts or functions in view of cross-linguistic influence. This can further lead to establishing links between language acts or functions that may not otherwise be initially apparent, and for example lead to teaching elements in targeted sequence, so as to reinforce understanding.

## 5. Basic system simulation

When preparing a language course or a given lesson, a teacher could receive guidance, and be able to query the system in relation to L1 interferences. The system could provide suggestions as to potential topic ordering, explanations concerning the cross-linguistic phenomena, in addition to instructional strategies, targeted activities and drills to help overcome potential difficulties. A student working on an activity, for his part, might be prompted by the system concerning an area of difficulty, and directed to specific explanations and activities for further practice. The programming rules would be directly based on an ontology. Following is a basic simulation pertaining to teacher access to the system:

```
IF Japanese is L1 and English is L2
And IF Learning Topic is: Modals of Advice
THEN : - Cross-linguistic difficulty
        - Provide students with targeted explanation
        - Provide targeted exercises
REASON : - Combination of cultural and linguistic difference
RELATED TOPIC : Imperatives2
RETRIEVE TARGETED EXPLANATION (in text form)
RETRIEVE INSTRUCTIONAL STRATEGY (in text form)
RETRIEVE EXERCISES AND TARGETED DRILLS (stored in
the computer)
```

The system could also display “aware” behavior. It could reproduce, in essential form, information contained in the ontology. For example:

```
Topic : Suggestions / Advice
      Related to broader topic of: Language functions
L1-related difficulty: yes
      Manifestation 1: Modals
Subclass: Had better3
```

---

<sup>2</sup> In trying to overcome difficulties in the use of *had better*, Japanese students may overuse “Please + imperative,” which we don’t discuss in this paper.

<sup>3</sup> We have explained the example of *had better* in detail, but there is other cross-linguistic influence at work, for instance with avoidance of *should*.

Manifestation 2: *Imperatives*  
 Language-related difficulty: *Yes*  
   Manifestation - *Had better*: Range of meaning varies between L1 and L2  
   Manifestation - *Had better*: Differences in usage between L1 and L2  
   Manifestation - *Imperatives*: Overuse of *please*  
 Culture-related difficulty: *Yes*  
   Manifestation – *Had better*: Differences in speaker / hearer perspective  
     (retrieve generic explanation in text form)  
   Manifestation – *Had better*: Content / Context issues  
     (retrieve generic explanation in text form)  
   Manifestation – *Had better*: Sensitivity to advice  
     (retrieve generic explanation in text form)  
     (Japan: rather low – North America: rather high)  
   Manifestation – *Imperatives*: Attention to social hierarchy  
     (Japan: rather high – North America: rather low)  
 RETRIEVE explanation of this cross-linguistic difficulty (in text form).

We acknowledge that the above represents an approximation. And yet, it is a starting point towards trying to bridge usage problems and communication gaps that are very real. The computer can point to the root of the problem, in other words show “intelligence,” and a more detailed explanation in text form can be retrieved. Such an explanation is further linked to examples of instructional strategies, targeted explanations and practice. Ultimately, the teacher can decide what to incorporate, or not.

We have noticed that with Japanese students, explaining that native English speakers (for example Americans) have a tendency to be sensitive to advice is usually enough for them to understand that there is reason to be careful in how to communicate in this respect. Practice of targeted exercises with accompanying discussion of possible impact of one form of statement in comparison to another has also shown to be efficient. In other words, a detailed explanation of the cross-linguistic phenomena may not always be needed for students, even though the system has information to this effect in store. Suggestions as to what explanations are especially efficient are provided in the instructional strategies. Our system can leave the teacher with the flexibility of learning about what underlies the cross-linguistic influence at hand, to adapt, adjust, borrow, if need be – and make it all or in part available to students.

## 6. Conclusion

The process of acquiring L2, especially in the earlier stages, is not without challenges, many stemming from L1 influence. In this paper, we have explained cross-linguistic influence and the impact cultural differences can have, illustrating with a specific example. We have described how we are working at mapping knowledge in this respect in a domain ontology, so that future CALL applications delving on cross-linguistic influence, as well as cultural differences, can rest on a solid foundation of knowledge. We hope to further elaborate on the results of our research in the future.

## References

1. Krashen, S.: *Context and Culture in Language Teaching*. Oxford University Press, New York (1993).
2. Dubreil, S.: *Culture through CALL*. In: Ducate, L., Arnold, N. (eds) *Calling on CALL: From Theory and Research to New Directions in Foreign Language Teaching*, pp 237-268. CALICO Monograph Series Volume 5, Texas State U. (2006).
3. Paige, R.M., Jorstad, H.L., Siaya, L., Klein, F., & Colby, J. *Culture learning in language education: A review of the literature*. In: Paige R.M., Lange, D.L. & Yershova, Y.A. Eds.). *Culture as the core: Integrating culture into the language curriculum*. pp 47-113. Center for Advanced Research on Language Acquisition, Minneapolis, MN (2000).
4. *National Standards in Foreign Language Education Project: Standards for foreign language learning in the 21<sup>st</sup> century*. Author, Yonkers NY (1999).
5. Lomicka, L.: *Understanding the Other: Intercultural Exchange and CMC*. In: Ducate, L., Arnold, N. (eds) *Calling on CALL: From Theory and Research to New Directions in Foreign Language Teaching*. pp. 211-236. Monograph Series Volume 5, Texas State U. (2006).
6. O'Dowd, R.: *Understanding the "other side": Intercultural learning in a Spanish-English email exchange*. *Language Learning and Technology* 7 (2), pp. 118-144 (2003).
7. Liddicoat, A.: *Teaching languages for intercultural communication*. Berkeley Language Center Newsletter 19, pp. 1-4, 7 (2003).
8. Lott, D.: *Analysing and counteracting interference errors*. *ELT Journal* 37 (3), pp. 256-261 (1983).
9. Noor, H.: *Some implications of the role of the mother tongue in second language acquisition*. *Linguistica Communicatio* 6 (1-2), 97-106 (1994).
10. Ringbom, H.: *Transfer in relation to some other variables in L2 learning*. <http://eric.ed.gov>.
11. Swan, M., Smith, B. (eds): *Learner English: A teacher's guide to interference and other problems*. Cambridge UP, Cambridge (2001).
12. Ferris, D.: *Treatment of Error*. U of Michigan P, Michigan (2002).
13. Hofstede, G.: *Cultures consequences*, 2<sup>nd</sup> edition. Sage, Thousand Oaks CA (2001).
14. Williams, R.M. Jr.: *American society: A sociological interpretation*, 3<sup>rd</sup> ed. Knopf: New York (1970).
15. Schwartz, S.: *A theory of cultural values and some implications for work*. *Applied psychology: An international review*, 48 (1). pp. 23-47 (1999).
16. Gray, R., Stockwell, G.: *Using computer mediated communication for language and culture acquisition*. On-Call 12. (1998).
17. Itakura, H.: *Changing cultural stereotypes through e-mail assisted foreign language learning*. *System* 32 (1), pp. 37-51 (2004).
18. Hertel, T.J.: *Using and e-mail exchange to promote cultural learning*. *Foreign Language Annals* 36 (3), pp. 386-396 (2003).
19. Storti, C.: *Figuring foreigners out*. Intercultural Press, Yarmouth (US), (1999).
20. Richards, J., Platt, J. & Weber, H.: *Longman dictionary of applied linguistics*. Longman (1985).
21. ZhaoHong, H.: *Fossilization in adult second language acquisition*. *Multilingual Matters*, Clevedon (UK) (2004).
22. Mizoguchi, R.: *Tutorial on ontological engineering, part 1, Introduction to ontological engineering*. *New Generation Computing* 21, pp. 365-384. Ohmsha Ltd and Springer-Verlag (2003).
23. Bourdeau, J., Mizoguchi, R., Hayashi, Y., Psyche, V. & Nkambou, R.: *When the domain of the ontology is education*. Proc. of the 4th Conf. on Intelligent, Interactive Learning Objects Repository Networks (I2LOR'07), CD-ROM, Nov. 4-7 (2007).
24. Allard, D., Mizoguchi, R., Bourdeau, J. *Can Language and Culture Go Hand in Hand? Cross-Linguistic Influence in the L2 Acquisition Process*. Proceedings of the JALT Conference, October 2005. pp. 382-393. JALT, Tokyo (2005)
25. Makino, S., Tsutui M.: *A dictionary of intermediate Japanese grammar*. The Japan Times, Tokyo (1986).
26. Swan, M.: *Practical English Usage*, 3<sup>rd</sup> Ed. Oxford UP, Oxford (2005),
27. Celce-Murcia, M., Larson-Freeman, D.: *The grammar book, and ESL/EFL teacher's course*, 2<sup>nd</sup> edition. Heinle and Heinle (USA) (1999).
28. Barker, D.: *英語と仲直りできる本 (Coming to Terms with English: A Reference Book)*. ALC (アルク) Press, Tokyo (2003).
29. Murphy, R.: *English Grammar in Use*. Cambridge UP, Cambridge, (2004).
30. Azar, B. S. *Understanding and using English Grammar*. Longman, New York (2002).

# Designing Culturally-Aware Tutoring Systems: Towards an Upper Ontology of Culture

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**Abstract.** An upper ontology of culture could be helpful in addressing various cultural issues when designing Intelligent Tutoring Systems. In this paper, we describe preliminary work on such ontology. We then discuss important features of an ontology-based collaborative authoring tool aimed at eliciting cultural information that could be used in various Culturally-Aware Tutoring Systems.

**Keywords.** Culture, Ontology Engineering, Intelligent Tutoring Systems.

## 1 Introduction

### 1.1 Intelligent Tutoring Systems and intercultural education

Every individual is a cultured agent in the sense that being raised in a cultural environment influences that individual's self-construction and patterns of interaction. Intelligent Tutoring Systems (ITS) need to take this into consideration, for some of the following reasons:

- First, many ITS-related topics are obviously culturally-sensitive, for example: human emotions [39], human motivation [9, 26, 38], pedagogical strategies [2], test perception [8], rewards allocation [15] and interface design [27].
- In a world where interaction between people of differing cultures is steadily increasing, developing efficient methods for cultural knowledge acquisition appears to be a promising domain of applications for ITS.

These reasons reflect the recently proposed UNESCO guidelines on intercultural education [44]. Intercultural education should:

- Respect "*the cultural identity of the learner through the provision of culturally appropriate and responsive quality education for all*",

- Provide “*every learner with the cultural knowledge, attitudes and skills necessary to achieve active and full participation in society*”,
- Provide “*all learners with cultural knowledge, attitudes and skills that enable them to contribute to respect, understanding and solidarity among individuals, ethnic, social, cultural and religious groups and nations*”.

There are therefore many reasons to take culture and learners’ cultural differences into consideration within ITS, and discuss the development of Culturally-Aware Tutoring Systems (CATS) aimed at providing intercultural education.

## 1.2 Current Objectives

This paper presents the state of our research in building an upper ontology of culture. By working at the meta-level of culture, this work aims at identifying major constituents to be considered when dealing with any kind of cultural issue without having to endorse a particular culture’s representational framework. By providing objective formalism for cultural representation, this approach will allow us to deal with many CATS-related issues such as terminological misunderstanding in culture-related communication and development, culturally-related automatic reasoning, cultural data elicitation and diffusion, interoperability between CATS, and so on. As our work is generic in nature, potential applications are not meant to be restrained to the educational domain.

This paper is organized into four sections. In the next section (section two), we summarize previous research related to *Acquisition-Oriented* and *Adaptation-Oriented CATS*, two alternative approaches to CATS that we have identified. Major issues related to CATS development are also discussed. In section three, after briefly explaining what ontology and upper ontology are, we describe the seminal work of Mizoguchi on a general upper ontology. This work is fundamental to our upper ontology of culture, which is then set forth. In section 4, we discuss how we could use our ontology to develop an authoring tool allowing culturally-different authors to collaboratively elicit cultural data to be used in various CATS. This is first proposal for an application built upon our upper ontology.

## 2 Culturally-Aware Tutoring Systems

In the last few years, many CATS-related projects have been initiated. Two varying approaches can be identified: *Acquisition-Oriented CATS* (systems trying to teach intercultural skills to learners) and *Adaptation-Oriented CATS* (systems trying to understand the cultural profile of learners and adapt to it). In the following subsections, we summarize important studies related to both these kinds of CATS.

### 2.1 Acquisition-Oriented CATS

The most prominent work on *Acquisition-Oriented CATS* should probably be attributed to Johnson and his team at Alelo [22] in view their Tactical Language and Culture Training System (TLCTS). The first version of this system was successfully used by the US army to teach soldiers some of the basics of Arabic language and

culture before they were sent to Iraq. TLCTS has been developed as a 3D serious game that provides situational learning to users by confronting them with embodied pedagogical agents that can both express cultural gestures and “understand” a specific foreign language within a cultural 3D environment. New versions of the game will enable training related to other areas of the world (Afghanistan, French-speaking Africa, etc.) and be adapted for use in business. Lane et al. are working on a somewhat similar system. Theirs teaches interpersonal and intercultural skills by focusing on narrative interaction within a 3D serious game [25]. Lane et al. rightfully point out that culture remains an ill-defined domain, which Ogan et al. also mention [33]. Ogan’s project objectives consist in helping students acquire cultural knowledge and intercultural competence by engaging them in activities of target-culture film viewing. Among other things, video clips in this online system can be paused when pre-selected culturally-interesting moments occur [34], at which point discussion related to cultural differences can begin.

## 2.2 Adaptation-Oriented CATS

Expressing some kind of cultural intelligence can be seen as the main objective of *Odaptation-Oriented CATS*. Cultural intelligence is defined in [14] as a “*seemingly natural ability to interpret someone’s unfamiliar and ambiguous gestures the way that a person’s compatriots would*”. Cultural intelligence is considered to have three facets:

- **A cognitive facet:** the ability to get knowledge about foreign cultures (*the head*),
- **A motivational/emotional facet:** the motivation and confidence to be able to adapt to foreign cultures (*the heart*),
- **A physical facet:** the ability to adapt actions, behaviors and demeanors according to foreign cultures (*the body*).

Based on these facets, Blanchard et al. [4, 5] have proposed a system architecture that adapts displayed multimedia content according to the cultural profile of a learner and to cultural rules extracted from cross-cultural studies [18, 19, 24].

Studies investigating potential variations in learners’ perceptions according to their socio-cultural profile within an ITS can be seen as a first step towards cultural intelligence. For instance, Johnson et al. [23] have discussed the cross-cultural interest of using the Politeness Theory [7] as a strategy of interaction between pedagogical agents and German or US students. Baylor and Kim [1] for their part have demonstrated that adding socio-cultural criteria (such as ethnicity) to pedagogical agents’ design had an effect on learners’ appreciation of those agents.

Much research related to Human-Computer Interaction could also be useful in providing cultural intelligence within ITS. For instance an affective model based on personality and culture-related data of users has been proposed in [32]. Huang and his colleagues are working on culturally-adaptive conversational agents [20], whereas Rehm and his colleagues are investigating cultural differences in non-verbal communication in order to enrich interface responses [37].

### 2.3 CATS development-related issues

Following are examples of the many issues related to the development of CATS.

**Culture is an ill-defined domain.** This issue is already considered in various CATS projects [25, 33]. As mentioned by Lane et al., “*ill-defined domains, in contrast to those that are well defined, are characterized by problems that tend to lack consistent, unambiguous, and generalizable solutions*” [25]. Indeed, culture is an easy-to-use concept in every day discussions. But it becomes much more difficult to deal with it when comes the time to describe it, to determine its constituents and to give it a proper definition. All domains addressing cultural issues (sociology, psychology, management, anthropology, statistics, etc.) have particular ways of dealing with such issues, which can cause a problem of information consistency within CATS. At the same time, it is obvious that a given culture is generally too complex to be fully modeled. What cultural data is sufficient to circumscribe a decent model of a given culture? How could acceptable results be obtained from this model? These are crucial questions for the development of CATS.

**Existing cultural data is not always reliable for educational use.** Preeminent cross-cultural studies have mainly been developed for and within the context of leadership or business researches [18, 19]. Legitimate concerns can be raised on how (and if) findings can be transferred and used within educational settings. Furthermore, there is no consensus on the reliability of these studies and their methodologies [13, 28, 44] even though many empirical studies discuss and “validate” their correctness and usefulness [24].

**Culture-related research/development may be biased by authors’ personal profile.** It is well-known in cultural research that analysis of a culture by a person foreign to that culture may be biased by interpretation based on that person’s cultural values even if methodologies such as *participant observation* [10] have been proposed to minimize such bias. As cultured agents, course authors and designers are prone to such cultural bias. In some cases, authors may simply not consider possible categories of behavior because they may not be aware of their existence. One solution is that authors be members of the culture being modeled, which still raises the problem of ensuring authors’ objectivity. Because CATS are dealing with critical information on how people perceive the world (and thus how they will interact with it), reliability of data has to be ensured. This means that stereotypes, interpretations and propaganda must be proscribed, to the extent that this is possible. Furthermore, teaching intercultural skills within *Acquisition-Oriented CATS* should be based on learners’ original perception of the targeted culture (i.e. the understanding of the targeted culture within the learner’s culture) in order to express how this differs from “reality.” To give a specific example, teaching about French culture should differ according to whether learners are German or Japanese.

**Cultural endorsement and influence is not uniformly distributed within a “cultural group.”** Culture is distributed within a group, but members of a cultural group aren’t necessarily alike nor do they express/endorse all the behaviors related to their culture in a similar manner [40]. In other words, culture doesn’t have a uniform impact on the individual members of an *associated cultural group*. This explains why one cannot use data describing behavioural tendencies within a cultural group in order to clearly predict what the reactions of each member of the particular group will be.

This is of great concern to the cross-cultural research community [13, 24, 42] and CATS need to follow suit to avoid falling into simplistic reasoning. This said, it is also recognized that such data remains valuable in many ways, such as when trying to consider the likeliness of endorsing given behaviours/cognition.

**Multiple cultural influences affect an individual.** The cultural profile of an individual can be seen as a patchwork of cultural influences resulting from his/her personal history and engagements [36]. Identifying those different and interconnected influences, evaluating their strength and how each of them affects the behaviour and cognition of an individual is far from a trivial task. By enumerating and describing the various kinds of cultural groups one can belong to, our upper ontology of culture will be useful in developing methodologies to better assess an individual's cultural profile.

**Ethical concerns have to be considered when dealing with cultural data.** The development of CATS should also raise ethical questions. Models of various systems of cultural values coexisting within a computer system have the potential of reflecting opposing conceptions of moral values, which needs to be addressed. In addition, there are, for example, legal issues concerning the use of cultural information. To illustrate, when hiring an individual in France, it is forbidden to require information concerning the individual's cultural profile (such as ethnicity), which is nevertheless common practice in the US.

### 3 Towards an Upper Ontology of Culture

#### 3.1 Ontology, upper ontology: definitions

Ontology is currently a hot topic in computer science research. According to the IEEE Standard Upper Ontology Working Group (SUOWG: <http://suo.ieee.org/>), **an ontology** “*is similar to a dictionary or glossary, but with greater detail and structure that enables computers to process its content. An ontology consists of a set of concepts, axioms, and relationships that describe a domain of interest*”. In our research, we are working at the conceptual level. By this we mean that the *identity* of a node (concept) is related to parts and properties that are associated with it and not especially to its semantic label (even if a correctly chosen label remains helpful).

An upper ontology is a specific type of ontology. According to SUOWG, **an upper ontology** “*is limited to concepts that are meta, generic, abstract and philosophical, and therefore are general enough to address (at a high level) a broad range of domain areas. Concepts specific to given domains will not be included; however, this standard will provide a structure and a set of general concepts upon which domain ontologies (e.g. medical, financial, engineering, etc.) could be constructed*”. Works on the nature of things done by philosophers such as Aristotle have inspired modern scientists who see the strong potential of such tools for computer science [17, 41]. Currently, there is no clear agreement on a Standard Upper Ontology (SUO) and some even suggest there should be more than one possible SUO.

Our work on an upper ontology of culture is grounded in Mizoguchi's SUO proposal [29, 30] that is itself influenced by research performed by Sowa [41] and Guarino [17], among others There are at least three other serious SUO candidates:

BFO (<http://www.ifomis.org/bfo>), DOLCE (<http://www.loa-cnr.it/DOLCE.html>) or SUMO (<http://www.ontologyportal.org/>). We don't consider Cyc (<http://www.cyc.com/>) as a possible option given the fact that it is based on common sense, and thus has little philosophical justification. We also believe that Cyc's use of multiple inheritance results in conceptualization errors. There are several, non-trivial reasons for choosing Mizoguchi's ontology instead of other SUO candidates:

- It is the sole initiative based on a model of roles [31], a paradigm that is growing in interest within the ontology engineering community,
- It is the only upper ontology in which difference between **process** and **event** is clearly modelled,
- Its theory of representation currently seems to be more sophisticated.

However choosing one SUO candidate among the four serious initiatives remains a matter of taste and there are probably good reasons advocating the use of either.

As previously mentioned, an upper ontology of culture will identify major constituents that have to be considered when dealing with any kind of cultural issues. One has to clearly understand that the goal of our approach is not to directly capture cultural differences within our upper ontology, but to capture the essence/structure of culture and culture-related elements, which in turn will be used to elicit/identify/collect cultural differences. Figure 1 describes a process leading to CATS development.

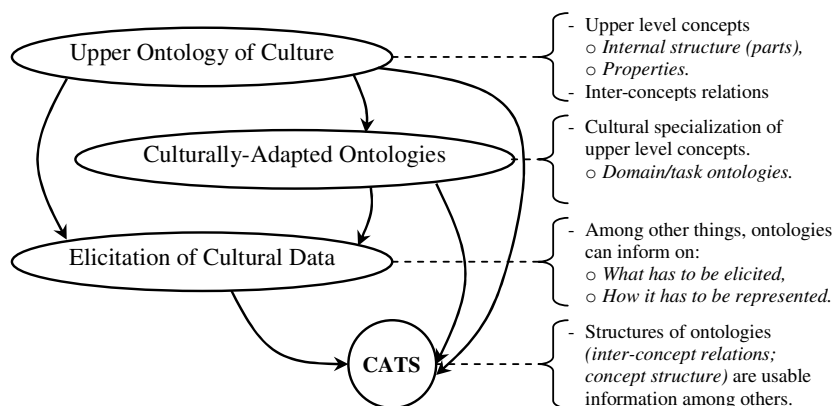


Fig. 1. The use of an upper ontology of culture for CATS development.

As shown in Figure 1, upper level concepts are identified, described and inter-connected within the upper ontology.

Some aspects of the resulting structure can then be specialized within classic domain or task ontologies. For instance, let us suppose that we have determined *non verbal communication* as an upper level concept in our ontology. This implies that we have identified its essential parts and properties as well as how it relates to other culture-related concepts. This helpful information will ground the development of culturally-specialized ontologies such as *French non-verbal communication* or *Japanese non-verbal communication*.

Even if structures of the upper ontology of culture or of culturally-adapted ontologies already hold valuable information to be used in CATS, they also could be used as formalisms to improve the elicitation of data related to cultural differences and specificities.

### 3.2 Overview of some of Mizoguchi's general upper ontology concepts

Mizoguchi's upper ontology is a very complex work made of hundreds of interconnected concepts. Here we chose to quickly present only a few of them (Figure 2) that are useful to understand our own upper ontology of culture. Readers can also find helpful information in [29, 30]. Most of this ontology reflects agreements within the ontology engineering community but some aspects still remain controversial.

Elements existing in the real world can be seen either as **abstract** (i.e. things that need neither 3D space nor time to exist such as **theorem**) or **physical** (called *concrete* in [41]). In the latter, one can distinguish between **occurrent** and **object**.

**Occurrent** has temporal parts (i.e. not the whole of an **occurrent** exists at a given time). **Event** is a kind of **occurrent** whose "start" or "end" are specified whereas this is not particularly the case for **process**. **State** and **situation** are kinds of **stative** whereas **action/behaviour/motion** or **phenomena** are referred to as **active**.

Unlike **occurrent**, all parts of **object** (sometimes called *continuant*) exist at any time. Mizoguchi describes two kinds of **object**: **semi-abstract** that only needs time to exist and **physical object** that needs both time and space. **Agent** (whose identity remains in its intention) and **functional** (whose identity is related to its function) are examples of **physical object**. **Artifact** is a specific kind of **functional** whose function is given inherently. **Mind** and **content** are examples of **semi-abstract**.

**Proposition** is the main body of the **content**: what is delivered by the representation independently of its form.

**Representation-primary** is a **proposition** for which a representation is necessary to determine the identity (like **rule**, whose structure informs when it is true or false). This is not the case for a **proposition** that is **representation-secondary** like **event\_content** (i.e. the content of something happening, its "essence" that can be explained by a person) or **thought**.

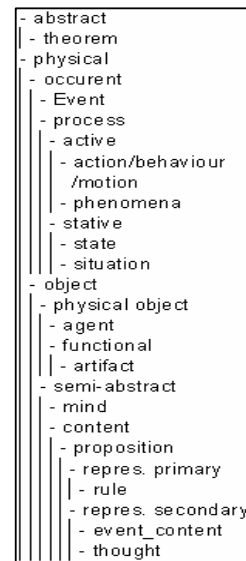


Fig. 2. Some concepts of Mizoguchi's upper ontology

### 3.3 Basic Concepts for an Upper Ontology of Culture

Most people agree that, in general, there is more than one correct ontology for a given problem. A correct upper ontology has to provide a consistent model to deal

with the problem, must try to avoid any kind of misinterpretation in order to identify the true nature of things. Hence, our upper ontology of culture must avoid relying on a unique cultural representation framework. However, considering inter-frameworks consensual aspects as suggested by Smith [42] is an interesting approach to identify upper level concepts.

We, as authors, are aware of the risk of interpretation related to our personal experiences (which includes our cultural profile). In order to minimize such a risk, our method consists of cross-reviewing references from various fields in order to identify core concepts related to culture. Furthermore and as was previously mentioned, our upper ontology of culture follows the same approach, and is grounded in, Mizoguchi's top ontology, which means we are using Mizoguchi's consistent model and its already defined concepts in order to define our own culture-related concepts. Our work can be seen as an extension of Mizoguchi's work to better deal with cultural issues.

Because it is multilingual and it frequently proposes various approaches to the same subject (various languages, various fields), Wikipedia appears to be an interesting starting point to identify potential concepts. Of course we are aware of criticisms regarding the Wikipedia project [45], and its reliability [46]. However we agree with the view of Dichev and his colleagues [11] that Wikipedia is an interesting source of consensual information that may be used to extract the identity of concepts (without forgetting critical thinking).

Other explored fields and useful resources include, but are not limited to: psychology and education [2, 38, 39, 44], philosophy [3, 35, 43], ontology engineering [6, 11], human-computer interaction [12, 16], business and management [13, 14, 18, 19, 24, 28, 42], cognitive science [35, 40]. The different cultural backgrounds of authors of this paper also help strengthen the modeling process. Figure 3 presents major concepts identified in the current version of our ontology.

Context-awareness is a hot topic in Human-Computer Interactions (see [12] and [16] for overviews of the related literature). Our conception of **context** refers to two ideas. First, Dourish stresses the interest of not only considering spatio-temporal dimensions but also other ones such as the social one or the cultural one. [12]. Second, Dichev and his colleagues insist on the fact that “*contexts have an infinite dimension hence they cannot be described completely*” [11]. Basically we see a **context** as a *subset (i.e. parts)* of a *related world* (3D world, social world, political world...) that surrounds a *context center*. Depending on the nature of the *related world* and of the **contextual relations** between its *center* and its *parts*, **primitive contexts** can be categorized as **abstract context** or **physical context**.

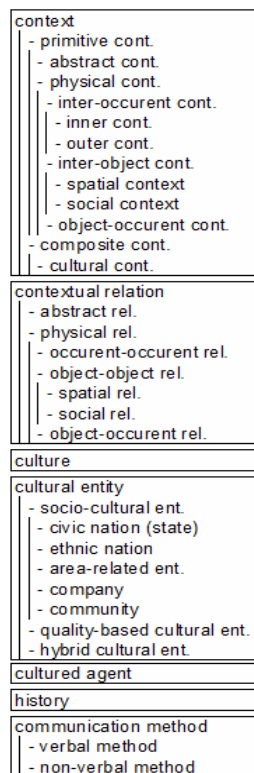


Fig. 3. Some concepts of the upper ontology of culture

Some **physical contexts** are based on relations between objects (such as **spatial** and **social contexts**). Others are based on relations between **occurents**. Relations between objects and occurent (such as an **agent actor-in an event** ) also exist and can be used to describe **object-occurent contexts**.

Regarding **occurent contexts** and according to Greenberg [16], it may sometime be important to be able to discuss inner-state evolution (**inner context**). **Composite contexts** (such as a **cultural context**) are an association of primitive and/or lower-level composite contexts. One has to notice that a **composite context** is a context that is more complex than the sum of its parts.

A **culture** consists of several elements: *norms, references, beliefs, behaviors, rituals, traditions, symbols, artifacts*. **Contexts** (such as the **cultural context**) can influence the interpretation of those elements. A **culture** is necessarily related to a *cultural group*: we associate them in what we have called a **cultural entity**. Members of a *cultural group* are **cultured agents** (that are influenced by one or more **cultures**). A **cultural entity** can have *sub-entities* (i.e. minorities with their own culture).

There are three kinds of **cultural entities**:

- **Socio-cultural entities** whose members are related to each other within a *social structure*, and whose **history** can be discussed. **History** is replete with important notions that help better understand a given culture. Thus some culture-related systems already propose to focus on the representation of historical events [21]. **Civic nations, ethnic nations, area-related entities** (for instance citizens of a specific city), **companies** and **communities** are examples of **socio-cultural entities**.
- **Quality-based cultural entities** are virtually-created cultural entities, based on some *shared qualities* of their members (for instance soccer players). Such an entity doesn't have a real **history**.
- **Hybrid cultural entities**, for instance "Afro-American": whereas at first sight they are based on a non-social criterion (afro), Afro-American have organized themselves in the course of **history** and developed a *social structure* (it is sometimes referred to as a **community**).

Finally, we also have to consider **communication methods** given the fact they are culturally sensitive and frequently related to cultural elements such as *cultural rituals* and *cultural behaviors*.

#### **4 Discussions on a collaborative authoring tool for cultural data elicitation**

Cultural data elicitation is the first task we want to address using our upper ontology because cultural data is an inherent and critical feature of any CATS: *Acquisition-Oriented CATS* need it to describe the intercultural skills to be learned and the culturally-related environments in which learning can take place (in cases of situational learning). *Adaptation-Oriented CATS, for their part*, need cultural data to nurture their adaptation processes. Following is a list of issues one has to consider in order to design a system that would correctly elicit cultural data.

**Distinguishing internal appreciations and external perceptions.** As it was mentioned in part 1.1, both these types of data may be useful in CATS but they

should not be used in a similar manner. Thus, authors' cultural profiles (including cultural memberships) are needed in such a system in order to help classify data.

**Ensuring data objectivity and honesty.** CATS have the responsibility of providing reliable and accurate information. We propose to achieve this by means of peer-reviewing processes like the ones developed in the Wikipedia project. Even though Wikipedia is not perfect [45, 46], it has demonstrated that collaborative authoring tools can lead to the creation of very useful knowledge bases. Wikipedia is using many features to promote data quality and author integrity: history of modifications, lists of senior members, labels related to completeness and quality of information are examples of such features. It is also possible to mention various perceptions of reality in wikis, which is suitable for ill-defined domains like culture.

**Using various criteria to determine the quality of cultural data.** As previously mentioned, problems in ill-defined domains lack in "*consistent, unambiguous, and generalizable solutions*" [25]. Thus, the evaluation of cultural data may vary from one author to another depending on that author's personal views. Certainly such an evaluation should not be reduced to a right/wrong axis. Many dimensions can be taken into consideration when assessing the quality of cultural data such as the strength of its endorsement within the target culture, the strength of its influence on cultural members, its frequency of occurrence, etc.

**Specifying the origins of cultural data.** Our project aims at being paradigm-independent, which doesn't mean that existing cultural data could not be referenced within a resulting cultural knowledge base. However, specifying the source of elicited cultural data (academic study, authors' proposals, etc) would allow CATS designers to decide which kind of data they want to rely on.

**Proposing intelligent suggestions to enrich the cultural database.** Cultural data is frequently defined within a specific context. Therefore the context of occurrence for a cultural feature has to be defined by an author. An authoring system for cultural data elicitation could use such a definition to ask authors with different cultural backgrounds to express what their behaviors/thought would be in a similar context. The interest and reliability of such a feature will depend upon the efficiency of the context modeling processes.

**Considering various kinds of cultural data and their specificities.** There are various types of cultural data (artifacts, beliefs, norms, behaviors, traditions, rituals, references) whose essence will be determined in our upper ontology. Data structure and mechanisms to correctly store them within a cultural database have to be discussed. Existing studies [37] can already give us hints on how to deal with some aspects of this issue.

## 5 Conclusion and Future Works

In this paper, we have explained our motivation to develop an upper ontology of culture. We have discussed some of the major concepts we identified thus far for such an ontology. However this remains a work in progress. Current concepts have to be validated and refined. New ones further need to be identified in order to provide a more coherent tool for culture modeling. As mentioned by one of the reviewers, HRAF database (<http://www.yale.edu/hraf>) hasn't been considered in the current

version of our upper ontology. We agree that this specific database could be of high interest in the process of determining a consistent model of culture and we plan to refer to it in future development.

This paper didn't explore the interest of CATS in the context of cross-cultural collaborative activities such as collaborative learning. CATS could be very useful to this effect given they would contribute to increasing the cultural intelligence of users or they would provide culturally-aware help and hints. We think our upper ontology can help to foster the development of such culturally-aware collaborative systems.

Finally we believe our work could be applied in any domain that implies human intercultural interactions. Culturally-aware systems could thus meet potential markets in business or tourism.

## References

1. Baylor, A. L., Kim, Y. (2004). Pedagogical agent design: the impact of agent realism, gender, ethnicity and instructional role. 7th International Conference on Intelligent Tutoring Systems (ITS2004), Maceio, Brasil, pp. 592-603.
2. Biggs, J. B. (2001). Teaching across cultures. In F. Salili, Chiu, C., and Hong, Y. (Eds.), *Student motivation: the culture and context of learning*. New York: Kluwer Academic/ Plenum Publisher, pp. 293-308.
3. Blay, M. (2007). *Dictionnaire des concepts philosophiques*. Larousse - CNRS Editions.
4. Blanchard, E., Frasson, C. (2007). Cross-cultural adaptation in eLearning. In T. Kidd and H. Song (Eds), *Handbook of Research on Instructional Systems & Technology*, Hershey, PA: Idea Group Publishing, Inc.
5. Blanchard, E., Razaki, R., Frasson, C. (2005). Cross-cultural adaptation of eLearning contents: a methodology. International Conference on e-Learning, Vancouver, Canada.
6. Bottazzi, E., Ferrario, R., Masolo, C., Trypuz, R. (2007). Designing organizations: towards a model. Normative Multi-agent Systems, Dagstuhl Seminar Proceedings, IBFI, Dagstuhl, Germany.
7. Brown, P., Levinson, S. (1987). *Politeness: some universals in language usage*. Cambridge: Cambridge University Press.
8. Cassady, J. C., Mohammed A., Mathieu L. (2004). Cross-cultural differences in test perceptions: women in Kuwait and the United States. *Journal of cross-cultural psychology*, 35(6), pp. 713-718.
9. Chirkov, V. I., Ryan, R. M., Kim, Y., Kaplan, U. (2003). Differentiating autonomy from individualism and independence: a self-determination theory perspective on internalization of cultural orientations and well-being. *Journal of Personality and Social Psychology*, 8(1), pp. 97-110.
10. DeWalt, K. M., DeWalt, B. R., Wayland, C. B. (1998). Participant observation. In H. R. Bernard (Ed.), *Handbook of methods in cultural anthropology*, pp: 259-299. Walnut Creek, CA: AltaMira Press.
11. Dichev, C., Dicheva, D., Fischer, J. (2007). Identity : How to name it, how to find it. 16th International World Wide Web Conference (WWW2007), Banff, Canada.
12. Dourish, P. (2001). Seeking a foundation for context-aware computing. *Human-Computer Interaction*, 16(2), pp. 229-241.
13. Earley, C. P. (2006). Leading cultural research in the future: a matter of paradigms and taste. *Journal of International Business Studies*, 37, pp. 922-931.
14. Earley, C. P., Mosakowski, E. (2004). Cultural intelligence. *Harvard Business Review*, October 2004, pp. 139-146.
15. Fischer, R., Smith P. (2003). Reward allocation and culture: a meta-analysis. *Journal of Cross-Cultural Psychology*, 34(3), pp. 251-268.
16. Greenberg, S. (2001). Context as a dynamic construct. *Human Computer Interaction*, 16(2), pp. 257-268.
17. Guarino, N. (1998). Some ontological principles for designing upper level lexical resources. First International Conference on Lexical Resources and Evaluation, Granada, Spain, pp. 28-30.
18. Hofstede, G. (2001). *Culture's consequences: comparing values, behaviors, institutions, and organizations across nations*, 2nd edition. London: Sage.
19. House, R.J., Hanges, P.J., Javidan, M., Dorfman, P., Gupta, V. (2004). *Culture, leadership and organizations: The Globe study of 62 societies*. Thousand Oaks, Ca: Sage Publications.

20. Huang, H., Nishida, T., Cerekovic, A., Pandzic I. S., Nakano, Y. (2008). Toward a culture adaptive conversational agent with a modularized approach. Workshop Enculturating Interfaces, held in conjunction with IUI2008, Canary Islands, Spain.
21. Hyvönen, E., Alm, O., Kuittinen, H. (2007). Using an ontology of historical events in semantic portals for cultural heritage. Workshop Cultural Heritage on the Semantic Web, held in conjunction with the 6<sup>th</sup> International Semantic Web Conference; Busan, Korea.
22. Johnson, W. L. (2007). Serious use of a serious game for language learning. International Conference on Artificial Intelligence in Education, Marina Del Rey, USA. pp. 67-74.
23. Johnson, W. L., Mayer, R. E., André, E., Rehm, M. (2005). Cross-cultural evaluation of politeness in tactics for pedagogical agents. International Conference on Artificial Intelligence in Education. Amsterdam, the Netherlands, pp. 298-305.
24. Kirkman, B. L., Lowe, K.B., Gibson, C. B. (2006). A quarter century of culture's consequences: a review of empirical research incorporating Hofstede's cultural values framework. *Journal of International Business Studies*, 37, pp. 285-320.
25. Lane, H. C., Gore, M. G., Gomboc, D., Karnavat, A., Rosenberg, M. (2007). Intelligent tutoring for interpersonal and intercultural skills. Interservice/Industry Training, Simulation, and Education Conference (IITSEC 2007), Orlando, FL.
26. Lim, D. H. (2004). Cross-cultural differences in online learning motivation. *Educational Media International*, 41(2), pp. 163-175.
27. Marcus, A., Gould, E. W. (2000). Cultural dimensions and global web user-interface design: What? So what? Now what? 6th Conference on Human Factors and the Web, Austin, Texas.
28. McSweeney B. (2002). Hofstede's model of national cultural differences and their consequences: a triumph of faith – a failure of analysis. *Journal of Human Relations*, 55(1), pp. 89-118.
29. Mizoguchi, R. (2003). Tutorial on ontological engineering - part 1: introduction to ontology engineering. *New Generation Computing*, 21(4), pp. 361-384.
30. Mizoguchi, R. (2004). Tutorial on ontological engineering - part 3: advanced course of ontological engineering. *New Generation Computing*, 22(2), pp. 198-220.
31. Mizoguchi, R., Sunagawa, E., Kozaki, K., Kitamura, Y. (2007). A model of roles within an ontology development tool: HOZO. *Journal of Applied Ontology*, 2 (2), pp. 159-179.
32. Nazir, A., Lim, M., Kriegel, M., Enz, S., Zoll, C. (2008). Culture-personality based affective model. Workshop Enculturating Interfaces, held in conjunction with IUI2008, Canary Islands, Spain.
33. Ogan, A., Jones, C., Aleven, V. (2006). Culture in the classroom: challenges for assessment in ill-defined domains. Workshop on Intelligent Tutoring Systems for Ill-Defined Domains, held in conjunction with ITS2006. Jonghli, Taiwan.
34. Ogan, A., Jones, C., Aleven, V. (2008). Pause, predict and ponder: use of narrative videos to improve cultural discussion and learning. CHI2008. Florence, Italy.
35. Pyysiäinen, I. (2002). Ontology of culture and the study of human behavior. *Journal of Cognition and Culture*, 2(3), pp 167-182.
36. Razaki, R., Blanchard, E., Frasson, C. (2006). On the definition and management of cultural groups of e-Learners. International Conference on Intelligent Tutoring System (ITS2006), Springer-Verlag LNCS 4053, Jonghli, Taiwan, pp. 804-807.
37. Rehm, M., Nakano, Y., Huang, H., Akhter Lipi, A., Yamaoka, Y., Grüneberg, F. (2008) Creating a standardized corpus of multimodal interactions for enculturating conversational interfaces. Workshop Enculturating Interfaces, held in conjunction with IUI2008, Canary Islands, Spain.
38. Salili, F., Chiu, C., Hong, Y. (2001). Student motivation: The culture and context of learning. New York: Plenum Press.
39. Scollon, C.N., Diener, E., Oishi, S., Biswas-Diener, R. (2004). Emotions across cultures and methods. *Journal of Cross-Cultural Psychology*, 35(3), pp. 304-326.
40. Sharifian, F. (2003). On cultural conceptualizations. *Journal of Cognition and Culture*, 3 (3), pp.187-207.
41. Sowa, J.F. (1995). Top-level ontological categories. *International Journal of Human-Computer Studies*, 43, pp. 669-685.
42. Smith, P. B. (2006). When elephants fight, the grass gets trampled: the GLOBE and Hofstede projects. *Journal of International Business Studies*, 37, pp. 915-921.
43. Stanford Encyclopedia of Philosophy. <http://plato.stanford.edu/> .
44. UNESCO (2007), UNESCO guidelines for intercultural education. Available online at: <http://unesdoc.unesco.org/images/0014/001478/147878e.pdf> (english version).
45. Wikipedia criticism. [http://en.wikipedia.org/wiki/Criticism\\_of\\_Wikipedia](http://en.wikipedia.org/wiki/Criticism_of_Wikipedia) .
46. Wikipedia reliability. [http://en.wikipedia.org/wiki/Wikipedia\\_reliability](http://en.wikipedia.org/wiki/Wikipedia_reliability) .

# Getting down to business: Teaching cross-cultural social interaction skills in a serious game

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**Abstract.** We consider the use of virtual humans and an intelligent tutoring system (ITS) for the teaching of cultural social conventions. Our learning environment is a serious game that requires the learner to establish trust and reach agreements with virtual characters of a different culture. An intelligent tutoring system provides culturally focused learning support during and after the meetings with these virtual characters. In a study intended to determine the effectiveness of the ITS, we found that guidance provided during meetings led to an improved understanding of culturally-related “phases” in meetings (e.g., when to talk about business) as well as greater success in an unsupported posttest meeting, but with no overall increase in cultural understanding when compared with learning in passive and unguided conditions.

**Keywords:** serious games, intelligent tutoring systems, cultural awareness, intercultural competence, intercultural communication, interpersonal skills

## 1 Introduction

Culture can play a significant role in the success or failure of face-to-face encounters. Many of the expectations we hold going into a conversation or meeting have cultural explanations, or at least are influenced by our cultural values and backgrounds. Similarly, meanings we infer from the communicative acts of others are influenced heavily by our own cultural “lenses.” So, when we enter into conversations with people from cultures other than our own, the differences can quickly become a source of confusion, misunderstanding, and at worst, conflict. Awareness of such differences – and a willingness to assume different cultural perspectives – is key for growth towards intercultural competence [2]. In this paper, we consider the use of virtual humans, serious games, and an intelligent tutoring system (ITS) for the learning of cultural social conventions. The aim is to teach trust-building strategies and how to reach agreements with virtual characters from another culture.

## 2 Immersive Environments for Cultural Learning

Immersive learning environments provide new and unique ways in which to learn about a new culture [7]. High-fidelity graphics, sound, and first-person perspectives make it possible to simulate the tangible aspects of a specific culture (e.g., dress, gestures) and provide more authentic practice environments than may otherwise be feasible with more traditional approaches like live role-play or media-based approaches. Further, recent advances in artificial intelligence (AI) and cognitive modeling now permit rich modeling of emotions, language, tasks, and more [13]. When built with cultural accuracy, these models (and the resulting virtual humans) may open new avenues for teaching the cognitive and interpersonal aspects of learning about different cultures.

A number of cultural learning systems exist that take advantage of these capabilities. The Tactical Language and Culture Training System provides a mission practice environment that allows learners to explore a virtual town while speaking to locals in Arabic, make culturally influenced gestures, and accomplish goals such as learning the names of contacts and getting directions [5]. VECTOR, another cultural learning system, also situates learners in a virtual foreign town to explore, but uses English utterances via menu selections for interaction with locals. An example of a goal in VECTOR is to find a bomber and stop him from attacking his next target [9]. Yet another immersive training environment, the Adaptive Thinking and Leadership system, is a team-training system that uses human role players in intercultural scenarios. Learners assume roles as people from different cultures and are given believable back-stories and goals [11].

We have conducted our research in another cultural learning system: ELECT BiLAT (Enhanced Learning Environments with Creative Technologies for Bi-lateral negotiations). BiLAT, a serious-game-based immersive learning environment, teaches the preparation, execution, and understanding of bi-lateral meetings in a cultural context [4]. The primary users of BiLAT have thus far been U.S. Soldiers who are learning about Middle Eastern culture. The full version of BiLAT requires the learner to work in the context of a complex narrative, select virtual characters with whom to meet, conduct background research on those characters and the situation facing the community, choose interpreters, pre-plan meetings, and more. Here, we focus only on the face-to-face aspect of BiLAT because (1) it represents the *practice* phase of learning (when feedback is most essential), and (2) it is most similar to live role-play-based training commonly used in classrooms and intercultural training.

A BiLAT meeting consists of two modes: dialogue and negotiation. A screenshot of the dialogue screen is shown in Figure 1. A menu of conversational actions is used to allow the learner to take communicative actions (e.g., ask questions and make statements – lower left in the screenshot) as well as physical actions (e.g., removing sunglasses, giving a gift). The character responds using a synthesized voice and physical gestures. The spoken utterances also appear as text in the dialogue window in the lower right corner. Although there are dozens of variables governing the actions of the character, the variable of primary importance is trust (it normally appears in upper left corner of the screen, but is blank for reasons of experimental control – this is described later). Although characters may say nice things or display anger in their responses, trust is the persistent record of how well players have used their

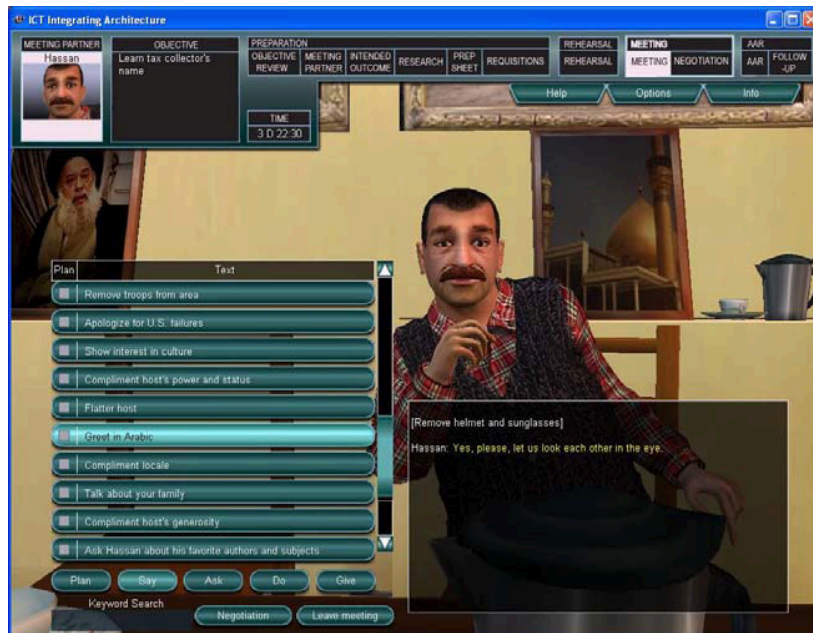


Figure 1. Screenshot of ELECT BiLAT

interpersonal and intercultural skills. We do not discuss the negotiation aspects here as our focus currently is interpersonal and intercultural skills, except to note that trust is a major factor in whether BiLAT characters will agree to negotiate and what deals they will accept. A mistrusting character will demand more, decline to negotiate, or at worst, kick the player out of a meeting without warning.

Characters each possess a model of how they expect a meetings to progress and the effects of actions are defined in ways that reinforce the cultural expectations. For example, attempting to give alcohol as a gift will have a negative impact on trust for Arabic characters. The dialogue models define actions, such as complimenting the host's culture, gift-giving, and making basic inquiries, that affect dialogue state. When the student takes an action, the dialogue state is updated and the character's response is determined. For the Middle Eastern culture model, trust is the primary variable being managed – actions taken in accordance with cultural expectations at appropriate phases tend to increase trust while cultural missteps decrease it.

The dialogue itself is governed by a state machine largely influenced by trust and time in accordance with typical Middle Eastern business meeting expectations: begin with proper greetings; follow with a social and relationship-building period; conduct actual business when a level of trust has been reached; conclude with more socializing. The trust “payoff” schedule for a given action is rooted in cultural and meeting topic appropriateness modified by meeting readiness, character state (power, wealth, belief, security), existing trust, meeting phase appropriateness (greeting, social, business), and a small random element.

BiLAT characters respond by selecting from a large collection of hand-authored utterances. These utterances were a result of a long process of analyzing transcripts from Iraqi-American role-playing scenarios involving negotiation and consultation of sources on Middle Eastern culture (e.g., [10]). Twelve possible responses exist for each available user action, along with a set of universal standard responses (e.g., to display confusion). The presence of randomness is intended to simulate the uncertainty of human behavior – more advanced AI, cognitive and emotional modeling techniques are able to simulate this uncertainty in a more principled way [13]. Each action entails a possible change to the trust variable of the character. All content – available actions, utterances, trust changes, etc. – are authored; since the characters behaviors and utterances are data, the BiLAT framework is fundamentally independent of culture. When given new behavior data and graphical assets, other cultures can be represented by the virtual characters (the problem of cross cultural knowledge representation is addressed in [12] where development of a German version of one of the BiLAT characters is discussed).

Because of variability between cultures with respect to how time is treated [10], BiLAT also represents distinct time spans corresponding to a business period and social periods before and after business. Authors are required to indicate the phases when actions are appropriate. If a learner chooses an action that is not appropriate for the current phase of a meeting, the character will respond negatively, which is revealed in the content of the response, through gestures, and with a likely decrement in trust. One of the learning objectives (LOs) underlying BiLAT for Middle Eastern culture is that the learner should follow the lead of his or her host – this is a particular focus of the of the ITS and is discussed in the next section.

### 3 Coaching for culture

In BiLAT, the learner must repeatedly select conversational actions that simultaneously achieve game objectives and respect the cultural norms observed by the virtual counterparts. This can be a significant challenge for a learner who does not understand the new culture or the differences between it and his or her own. Our ITS, an instance of the Intelligent Guided Experiential Learning (IGEL) framework [2], can provide learning support in two ways. *During* meetings, feedback and hints can be delivered by a *coach*. *After* meetings, an intelligent *reflective tutor* reviews the meeting with the learner, gives more detailed feedback, and asks reflection questions. In the present study, we focus on the details of the IGEL coach that deal with timing aspects of intercultural meetings. This is also the focus of the evaluation described in Section 4.

#### 3.1 Feedback and hinting

When the coach decides to provide some form of guidance, a message appears in the dialogue window of BiLAT (lower right hand corner of Figure 1). These messages are intended to promote learning and reduce frustration. For example, if an inappropriate

gift is given to the virtual character, the coach might explicitly state the gift is not an acceptable one for the virtual character's culture (e.g., "alcohol is not generally acceptable in Middle Eastern cultures."; [9]). Coaching messages are generally shorter given the context of a live meeting, while reflective tutoring sessions are used to get into the underlying cultural issues through interactive questioning and explanations.

The coach is capable of two levels of feedback: abstract and more specific. Further, at each of these levels, three categories of coaching actions are possible:

- **hints:** a suggestion pointing the learner to an appropriate next action
- **negative feedback:** statement that an action just taken was problematic and (possibly) a short explanation
- **positive feedback:** praise for a good action taken by the learner and (possibly) a short explanation

Since cultural rules vary across individuals and are ill-defined to begin with, actions often resist clear assessments as "right" or "wrong." Some BiLAT actions can therefore be "mixed," meaning that both negative and positive feedback may be possible (discussed in the next section). Feedback messages in these situations can be concatenated or delivered individually based on other factors, such as if related errors (or related "good" actions) were selected earlier in the meeting. These decisions depend on the configuration of the coaching algorithm. The content of the coaching messages – as well as the settings on how often and at what detail feedback is given – must be determined by a human author ahead of time. For the experiment described in Section 4, we implemented a model/scaffold/fade algorithm to control feedback timing (details are discussed in [6]).

### 3.2 Assessing actions

Of course, it is critical for the coach to assess actions to decide whether to give feedback and if so, what to say. In BiLAT, each time an action is taken in a meeting or the learner responds to a character's question, IGEL's expert model is called to judge the action's quality. Actions are classified as *correct*, *incorrect*, or *mixed* in two stages:

1. The action is checked to see if it is phase appropriate.
2. If no phase mismatch is found, the active LOs are determined along with their positive and negative association with them.

As discussed above, meeting phases are windows of time during a meeting that define when certain categories of actions are appropriate or not. They are culture dependent and the expert module dynamically assigns negative assessments when an inappropriate action is chosen. This is implemented via a link to the appropriate LO.

As discussed in section 2, BiLAT focuses on teaching Middle Eastern business culture. These rules (many are discussed in [10]) involve discussing the right topics at the right time. In addition, they involve respecting the cultural values in ways that indicate interest, understanding, and respect. Timing of actions is an important part of this process – e.g., jumping directly to business before gaining the trust of a negotiation partner can introduce new hurdles, even perhaps insurmountable ones. To

teach these critical skills, we currently use the following set of LOs to classify phase mismatch errors:

1. Don't discuss business during social periods.
2. Don't stray too far from business in a business period.
3. Regarding the opening of meetings:
  - a. Opening actions (e.g., greetings) are not appropriate later in the meeting.
  - b. The opening is too early for some social actions.
4. Regarding the closing of meetings:
  - a. Closing actions (e.g., leaving) are not appropriate earlier in the meeting.
  - b. Some social actions are not appropriate in the closing.

The expert model considers in which phases an action is permitted and in which phase it is actually performed. For example, if an action is permitted only in the opening phase (e.g., greeting in Arabic) but is performed in the pre-business phase, the expert model's algorithm will return negative evidence of recognizing LO 3a above. It will also find positive evidence of understanding the LO to greet in the language of your counterpart. The expert model's assessment will be therefore be *mixed*. Another example of a phase-related LO states that it is not ideal to rush into business [9, p.58], which implies conversational actions are needed early in meetings. When a business-phase action is taken in an opening phase, then, the expert model records an *incorrect* for that action (i.e., that the player does not understand that LO).

## 4 Evaluation

The LOs of BiLAT deal with effective negotiation strategy, trust building, and appropriate meeting behavior (i.e., actions relevant to the meeting phase and partner's culture). Together, practice in BiLAT and extrinsic feedback from IGEL (as opposed to intrinsic feedback from the characters' actions and responses) should allow the learner to gather a practical understanding of the LOs. In this section, we report on a study intended to examine the contributions of each component: BiLAT and IGEL.

### 4.1 Research questions: Interactivity and real-time feedback

Our first question was whether actually *playing* BiLAT would be pedagogically beneficial. A common notion is that maximum gains can be produced by *errorless learning*, wherein the conditions of instruction are such that it is impossible for learners to make errors [1]. In the present study, we used a *video-only* condition, in which participants watched videos of perfect gameplay. Because no incorrect choices are made, optimal behavior is modeled for these learners.

Nevertheless, we expected that the video-only condition would suffer because it would lose the benefit of interactivity. Participants who actually play BiLAT would select actions they believed to be correct. Perhaps of even more value: participants would also select *against* actions they believed to be *incorrect*. In this way, they would be evaluating *all* of the available actions – not just those selected by the player in the video of perfect gameplay. We expected that evaluating the actions would

produce general gains when meeting with new characters. We therefore expected interactive conditions to be superior to the video-only condition.

Our second question was whether the IGEL-driven coach adds any pedagogical value. A concern that accompanies any form of extrinsic support is dependence on the help. Such reliance might lead the player to neglect feedback from the meeting partner; if that support was removed, the player might flounder. Instead, we believed that the coach would produce significant learning gains because of its ability to identify incorrect actions and the reasons those actions are incorrect. Plainly, this type of feedback could generalize to other actions – and the learner’s ability to evaluate whether those actions would be advisable. To get at this question, we included two interactive conditions: one in which the coach was active (*yes-coach*) and one in which it was not (*no-coach*). In all three conditions, the reflective tutor was active to ensure that participants in all three conditions received extrinsic pedagogical support.

## 4.2 Method

**Participants.** Participants were thirty U.S. Citizens recruited by flyer from the campus of the University of Southern California. As compensation for their three hours of participation, they were paid \$60.

**Procedure.** All participants received an instructions packet, watched a video on how BiLAT worked, took the pretest, conducted meetings with three different BiLAT characters (including reading background information about each and reflective tutoring sessions), conducted a fourth meeting with no coaching or reflective tutor, and finally took the posttest.

**Design.** The manipulation between the three conditions – *video-only*, *no-coach*, and *yes-coach* – occurred in the three meetings. For *video-only*, participants observed expert play with coaching and reflective tutoring active. For *no-coach*, they held the meetings and received reflective tutoring. For *yes-coach*, they played with coaching and reflective tutoring. Otherwise, participants’ experiences were identical.

**Measures.** We made two comparisons of the three between-subjects conditions. The first was *success*, which was measured on the uncoached fourth meeting. This measurement was binary: whether the participant was able to achieve the mission objective in 25 minutes or less (as with all of their meetings, participants could repeatedly meet if prior meetings were unsuccessful – up until time expired). A successful meeting required achieving given objectives identified in the reading materials and by choosing actions that increased the meeting partner’s trust to the point where agreements were possible.

The second measurement was the pretest-posttest improvement. A *situational judgment test* (SJT) was used for the pre- and posttests, which present a series of small scenarios. For each scenario, the participant is asked to rate the quality of a small set of responses on a Likert scale [8]. Each action is rated between 0 (never take this action) up to 10 (definitely a good action). The test was given to three subject-

matter experts (SMEs) and the means of their answers were used as the gold standard. Two measurements were used to evaluate participants' mastery of the LOs. One is the *correlation* between participants' answers and SMEs'. The correlation represents the degree to which the two groups correspond in their overall assessment of the responses, but does not capture valence data. To illustrate: let us say that a SME rates an answer as 10 and that is the highest rating the SME gives. If a participant rates that answer as 4, but 4 is the highest rating that participant gives, the two may be perfectly correlated. To capture information about the valence of answers, we calculated what we have called a *ballpark* score. To illustrate: if an SME rates a response as 8, the participant would be said to be "in the ballpark" if the participant provides a rating of 7, 8, or 9. The change in each score was measured from pretest to posttest.

### 4.3 Results and Discussion

**Fourth meeting.** Three participants – one from each condition – were omitted from this analysis because of experimenter error. As a result, this analysis included a total of 27 participants (nine per condition). Figure 2

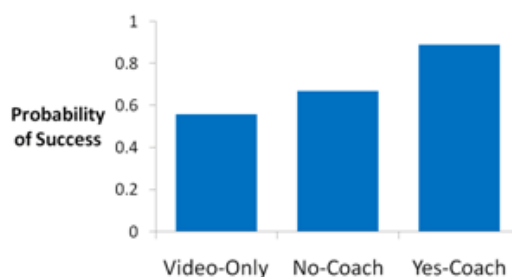


Figure 2. Probability of success (by condition)

presents the success data from our experiment. As can be seen, the combination of interactive gameplay and feedback from the coach helped players to be successful in the fourth meeting (in which both the coach and reflective tutor were deactivated). 56% of the participants in the video-only condition were successful. With the addition of interactivity – and the ability to make errors – 67% of the participants in the no-coach condition were successful. Finally, those who had coaching during practice had the highest rate of success in the fourth meeting at 89%. The number of participants per cell (nine) in this analysis was too small for a reliable statistical analysis to be run. Nevertheless, we view these results as encouraging.

**Situational Judgment Test.** The uncoached meeting suggested learners who interacted and were coached improved their ability to play BiLAT. To check for learning beyond the game, we used the SJT to determine whether participants were mastering the LOs. The SJT therefore served as a non-ELECT-BiLAT measure of learning from BiLAT (and IGEL). These data initially painted a different picture. We did not find that the conditions produced a differential increase in correlation with SMEs:  $F(2, 27) = .805, p = .457$ . Neither did we find a significant difference between the conditions on the ballpark measure:  $F(2, 27) = .111, p = .896$ .

Immediately, we wondered why there would be such a disparity between performance in the game and improvement on the SJT. One possibility is that the pretest SJT ratings affected posttest ratings (i.e., that learning occurred from the test itself). It is unlikely that participants were able to remember the exact numbers that they had provided hours before. Nevertheless, pretest ratings may have served as anchors for posttest responses. To the extent that this interference reduced variance in posttest responses, it reduced the ability for between-group differences to emerge.

Another, more likely possibility is that this particular experiment and the SJT were not perfectly aligned. The “correct” answers on the SJT were provided by subject matter experts, whose knowledge spans all of the elements of BiLAT, all of the LOs in IGEL, and much, much more. The SJT itself was not originally designed as a measure for this experiment. As a result, the SJT taps knowledge about many more issues of negotiation and culture than we could have expected to address in three hours with our participants. The SJT may be too broad in scope to examine gains in knowledge *in our participants* as a result of our experimental procedure.

We therefore ran a second analysis of learning gains in the SJT. In this secondary analysis, we culled data from questions that did not address LOs addressed by IGEL. For example, we omitted responses to prompts about the reliability of information during the meeting preparation phase (which was skipped in our experiment; participants were instead provided with a dossier). By removing these responses from our analysis, we increased our power to detect learning in two ways. First, to the extent that participants’ responses to culled answers remained fixed from pre-test to post-test, estimates of change would be deflated and would therefore underestimate the amount of learning in the subset of SME knowledge tapped by BiLAT and IGEL. Second, to the extent that participants’ responses to culled answers wandered randomly, pre- and posttest correlations would be attenuated and within-group variance in both of our measures would increase. This secondary analysis therefore reflected only changes in knowledge in domains addressed by BiLAT gameplay and the IGEL coach. The domain of meeting-phase-specific behavior was highlighted for this analysis. It draws on cultural understanding and appropriate use of negotiation strategies.

**Correlation data for phase-specific questions.** Figure 3 presents the correlation data for the three conditions in our experiment. As can be seen, interactive gameplay and the coach together produced significant gains in understanding of meeting-phase-specific information:  $F(2, 27) = 2.062, p = .147$ . Post-hoc tests revealed this result to be driven by the difference between the superior yes-coach and the inferior no-coach conditions:  $p = .054$ .

This finding is not surprising; an action's phase-appropriateness is the branching point from which the coach begins to decide to provide feedback. If the coach were to produce benefits in only one way, this would be it. Regardless of any other elements of the action chosen by the player, the phase-appropriateness is a primary determinant of coach intervention.

It should be noted that the no-coach condition is actually *worse* than the video-only condition (as shown in Figure 3). This pattern of results may reflect the inadequacy of discovery (i.e., trial-and-error) learning. Without guidance from the coach or a model of ideal gameplay (e.g., the video in the video-only condition), players in the no-coach condition are left to wander through actions. It appears that this unguided wandering is unproductive, perhaps even harmful.

**Ballpark scores on phase-specific questions.** Figure 4 presents the ballpark data for the three conditions in our experiment. Again, playing BiLAT and receiving real-time feedback from IGEL resulted in marginally superior comprehension and retention of the LOs related to meeting phase:  $F(2, 27) = 1.681, p = .205$ . Post-hoc tests revealed a marginally significant difference between the superior yes-coach and the inferior video-only conditions:  $p = .086$ . This finding provides additional (albeit preliminary) support for our conclusions from the correlation data.

On the other hand, the reversal of the video-only and no-coach relationship in the correlation and ballpark measures suggests some instability in our measures. This is likely due to the small number of participants and to the relatively small number of data points per participant; there were only five phase-specific prompts on the SJT. Nevertheless, in combination with the success data, we find these results encouraging, and will conduct a more comprehensive investigation of benefits from IGEL in BiLAT in the coming months.

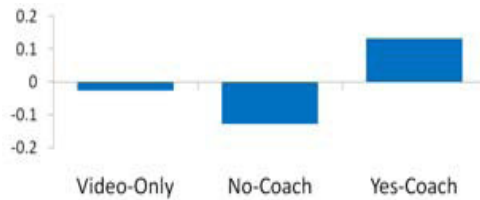


Figure 3. Changes in correlation with experts on meeting-phase-specific prompts (by condition)

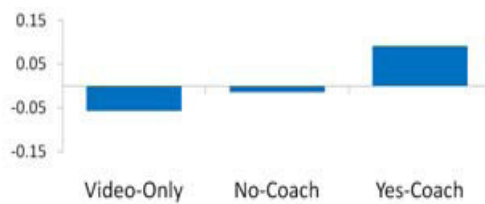


Figure 4. Changes in "ballpark" score on meeting-phase-specific prompts (by condition)

## 5 Conclusion

This paper described a serious-game-based approach to teaching intercultural communication skills with virtual human characters and with the support of an intelligent tutoring system. Our results suggest that learning occurs and is likely due to the interactivity of the game and from the intelligent tutoring support during face-to-face time with the virtual characters. We intend to continue experimentation to further explore these preliminary findings by considering different patterns of coach feedback, more advanced reflective tutoring tactics, and through adjusting character behaviors (this idea is developed further in [6]). We also intend to revise our pre- and posttests to better match the intended aims of the IGEL tutoring framework and its instantiation in BiLAT.

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## References

1. Anderson, N.D., Craik, F.I.M.: The mnemonic mechanisms of errorless learning. *Neuropsychologia*, 44, pp. 2806-2813 (2006)
2. Bennett, M.J.: Towards ethnorelativism: A developmental model of intercultural sensitivity. In: R.M. Paige (ed.) *Education for the Intercultural Experience*, pp. 27-71. Intercultural Press, Yarmouth (1993)
3. Gomboc, D., Lane, H.C., Core, M., Karnavat, A., Rosenberg, M.: Towards an ITS architecture for simulations. In: *Proceedings of the 21<sup>st</sup> International Florida Artificial Intelligence Research Society Conference (FLAIRS-21)*. AAAI Press (2008)
4. Hill, R.W., Belanich, J., Lane, H.C., Core, M.G., Dixon, M., Forbell, E., Kim, J., Hart, J.: Pedagogically structured game-based training: Development of the ELECT BiLat simulation. In: *Proceedings of the 25<sup>th</sup> Army Science Conference*. Orlando, FL (2006)
5. Johnson, W.L.: Serious use of a serious game for language learning. In: *The 13<sup>th</sup> International Conference on Artificial Intelligence in Education*, pp. 67-74. IOS Press (2007)
6. Lane, H.C., Core, M.G., Gomboc, D., Karnavat, A., Rosenberg, M.: Intelligent tutoring for interpersonal and intercultural skills. In: *Proceedings of Interservice/Industry Training, Simulation, and Education Conference (ITSEC 2007)*. Orlando, FL (2007)
7. Lane, H.C.: Metacognition and the development of intercultural competence. In: *Proceedings of the Workshop on Metacognition and Self-regulated Learning in Intelligent Tutoring Systems at the 13<sup>th</sup> International Conference on Artificial Intelligence and Education*, pp. 23-32. Marina del Rey, CA (2007)

8. Legree, P., Psotka, J. Refining situational judgment test methods. In: Proceedings of the 25<sup>th</sup> Army Science Conference (2006)
9. McCollum, C., Deaton, J., Barba, C., Santerelli, T., Singer, M.J., & Kerr, B.W.: Developing an immersive, cultural training system. In: Proceedings of I/ITSEC: Interservice/Industry Training, Simulation, and Education Conference (2004)
10. Nydall, M.K.: Understanding Arabs: A guide for modern times (4<sup>th</sup> ed.). Boston, Intercultural Press (2006)
11. Raybourn, E.M.: Applying simulation experience design methods to creating serious game-based adaptive training systems. *Interacting with Computers*, 19, pp. 206–214 (2007)
12. Solomon, S., van Lent, M., Core, M., Carpenter, P., & Rosenberg, M.: A language for modeling cultural norms, biases, and stereotypes. In: Proceedings of the 17<sup>th</sup> Conference on Behavior Representation in Modeling and Simulation (2008)
13. Swartout, W., Gratch, J., Hill, R., Hovy, E., Marsella, S., Rickel, J.: Toward virtual humans. *AI Magazine*, 27, 2, 96–108 (2006)

## How the PILÉFACE System, Dealing with Pragmatics, Takes Cultural Factors into Account

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**Abstract.** In the domain of language acquisition, PILÉFACE is a system that has been initially designed to take into account the pragmatic aspects of language, i.e. to provide the learner not only with a linguistic competence, but also with a communicative competence. That communicative competence implies that the language learner master certain pragmatic usage rules, which are mastered by the native speaker, but unspoken and unwritten, and therefore implicit. In that context, PILÉFACE is readily equipped to take into account many socio-cultural aspects of communication exchanges. In this paper, starting with culture-aware pedagogical dialogues, we show which types of cultural aspects may occur in such dialogues, how these cultural aspects are actually implemented in the data organization and system architecture of PILÉFACE, and how they could be extended using the same architecture.

**Keywords.** Intelligent tutoring systems, language learning, pragmatics, communicative situation, communication intention, linguistic realization, cultural factors, architecture, system design.

### Introduction

In language learning, the learner is expected not only to acquire a *linguistic competence*, i.e. to assimilate lexical and grammatical knowledge and correctly use that knowledge, but also to acquire a *communicative competence*, i.e. to adequately express her communicative goal in a given communicative setting (for a change, we use the feminine as our generic gender). To do so, she must be aware of the relevant parameters describing a given situation and to choose accordingly which linguistic production to use in order to express her goal. This can be done by using certain *pragmatic usage rules*. Indeed, the pragmatic aspect of language is defined as “those linguistic investigations that make necessary reference to aspects of the context, where the term *context* is understood to cover the identities of participants, the temporal and spatial parameters of the speech event, and [...] the beliefs, knowledge and intentions of the participants in that speech event, and no doubt much besides” [20, p. 5]. Pragmatics thus refers widely to *implicit knowledge*. And making implicit knowledge explicit is a difficult and challenging problem of artificial intelligence, in particular in conjunction with common sense representation and reasoning [9, p. 13].

Most pragmatic usage rules used in everyday communication are mastered by the native speaker, but unspoken and unwritten, and therefore implicit. Because of the importance of

these usage rules in the communicative approach [8], we were interested in a computer program that could take them into account in foreign language teaching, in our case French as a second language [18]. This endeavor to define implicit and explicit knowledge progressively led us to more fundamental research questions [7]. Since pragmatic knowledge is widely implicit and encompasses socio-cultural aspects, PILÉFACE is readily equipped to take into account many socio-cultural aspects of communication exchanges. The paper [15] describes what making something explicit means; here, we concentrate mainly on the cultural and pragmatics aspects of the PILÉFACE system.

First, section 1 recalls the initial objectives and motivations of PILÉFACE, and present similar more recent systems. Then section 2, using pedagogical examples, shows how cultural aspects come into play. Section 3 describes more formally which types of cultural aspects may occur in PILÉFACE, and section 4 shows how the capabilities to deal with them are implemented. Finally, section 5 shows how it could be possible to extend these culture-aware capabilities to account for other languages and cultures.

## 1. PILÉFACE rationale and similar systems

The PILÉFACE system (for “Programme Intelligent pour les Langues Étrangères Favorisant l’Approche Communicative de l’Enseignement”, i.e. Intelligent Program for Foreign Languages Fostering the Communicative Approach to Teaching) is primarily meant to establish and implement the relationships between, on the one hand, a *situation or context description* and a *communication intention* and, on the other hand, the *linguistic production(s)* adequately expressing that intention in that context.

### 1.1 Goals of PILÉFACE

PILÉFACE was designed with three goals in mind, more completely presented in [18]:

- a *short term linguistic goal*, which conceptually meets the initial needs: to have the computer program process the *language pragmatic aspects*; as a result, the student will use the keyboard and screen, and other artifacts, only to simulate linguistic realizations that are verbal exchanges (utterances); that is the problem-solving aspect or goal;
- a *medium term ergonomic goal* : the study of the *system interface “intelligence”*;
- a *longer term tutoring goal*, which every intelligent CALL system should tackle: an adequate *user-learner modeling*, and thus a strong adaptation of the system to the user.

As it turns out, the development of PILÉFACE has dealt essentially with its problem-solving and tutoring abilities, less with its interface capabilities or intelligence. In this paper, our discussion is also focused on the linguistic and tutoring goals of PILÉFACE, namely taking into account the pragmatic aspects of speech acts, and to their cultural implications and consequences, and how these aspects interact with user modeling.

### 1.2 The three operating modes of PILÉFACE

The system is to operate under one of three modes. In *generation mode*, the system is to produce *utterances* consistent with the proposed communication situation and the proposed

communication intention, as a student would do. In *analysis mode*, the system is to determine whether, how and why an utterance, proposed by a student for instance, is or is not consistent with the predefined communication situation and intention. In *tutoring mode*, the system is to exhibit the capabilities of the above two, but also some additional dialogue and feedback capabilities. Note that, although the implementation details of the third mode are outside the scope of this paper, its design is best suited to give examples of cultural aspects that PILÉFACE is equipped to account for.

### 1.3 Other culture-aware systems

Certainly pragmatics had been tackled in computational linguistics long before our research started [1], but not (to our knowledge) its incorporation into a program aimed at second language acquisition. However, since then (and fortunately), some other systems have been developed or are being developed, much more sophisticated!

For example, the *Croquelandia project* is an “online immersive environment designed to help students develop more sophisticated language skills” [21], in various Spanish-speaking cultures. The project leader is Julie Sykes, a Ph.D. candidate in Spanish and Portuguese studies. Croquelandia was built using *Croquet*, an open source software development environment that makes possible the creation of multi-user virtual worlds. More details can be found in the paper by Andrew Cohen [5], one of Sykes’s supervisors.

Another major project dealing with pragmatics and therefore with culture is the *Tactical Language Training System (TLTS)*, led by Lewis Johnson and his colleagues [11] using educational animated agents. The Tactical Language Training System helps learners acquire communicative competence in spoken Arabic and other languages. An intelligent agent coaches learners, assessing their mastery and providing tailored assistance. Learners then perform missions in an interactive story environment, where they communicate with autonomous, animated characters. The team’s fundamental hypotheses are that such a learning environment will be more engaging and motivating than alternative approaches, and will lead to more rapid skill acquisition.

A project using TLTS is *Tactical Iraqi* [10], an educational game using video-game-like visuals and also speech recognition rather than written responses. In that application, “Each language training package is designed to give people enough knowledge of language and culture to carry out specific tasks in a foreign country, such as introducing yourself, obtaining directions, and arranging meetings with local officials.” (p. 291). However, the TLTS team considers *Tactical Iraqi* as more than a game [13], and even describes TLTS as “a serious game for learning foreign language and culture”, since “The language courses delivered using TLTS have a strong task-based focus” (p. 307).

## 2. Examples of culture-aware pedagogical dialogues

In a type of exercise that the system deals with, the student is placed in a communication situation, i.e. the computer plays the role of the person whom the student is talking to (the student’s addressee), and presents her with the situation parameters and the communication intention. Unlike to Croquelandia, the student’s reply is open. An example of such an exercise is the following (text presented by PILÉFACE, in the learner’s native language):

*I am one of your professors, French, stand-offish and severe. You are a first year student, somewhat timid. You pass by me in a hallway of the Computer Science building of the University, in September, in the afternoon of a recess day. You are with friends of yours, whom you would like to impress. I am the professor whom you would like to greet to show your friends that you already know me well and that I already know you. How do you greet me?*

We now present what could be three typical exchanges between the student and the intended PILÉFACE system following the above exercise statement. These exchanges have been set up by Diane Huot, a colleague specialized in language acquisition, based on her practice. They illustrate not only the typical adaptation of the teacher's pedagogical practice to the learner's reactions or behaviors, but also the variety of cultural aspects that may come up in the student's answers. The student's input is preceded by "\*\*\*", and our comments are right-indented with respect to the computer-student dialogue.

## 2.1 First example

In this example, the learner is supposed to be known as analytically minded, and is therefore invited by PILÉFACE to some reflection about his or her own interventions.

*\*\* Bonjour, Monsieur.*

*Very good!*

*But will your friends have the impression that you know me more than they do?*

This PILÉFACE intervention starts a reflection about the student's production. The learner will eventually give a good answer because she will have become aware of the need to add something to or subtract something from that production.

*\*\* Yes.*

*Oh, not at all! Unless you want to hide the fact that you know me... Try again.*

PILÉFACE continues the meta-linguistic reflection discussing the initial "Bonjour, Monsieur".

*\*\* Bonjour, Monsieur. Comment allez-vous?*

*Well done, bravo!*

The student's production (utterance) is in conformity with the parameters of the reference context. Here again, we could imagine another reflexive intervention, summarizing the elements contributing to the appropriateness of this answer.

## 2.2. Second example

In this example, the learner has been recognized as "global" in the learner model.

*\*\* Bonjour, Monsieur.*

The student's production is the same as above.

*Very good!*

*But your friends will not know that you know me better than they do. Try again!*

This software intervention shows the learner, directly and without telling why, that her reply is not totally adequate.

*\*\* Bonjour, Monsieur le Professeur [+ gesture: slap on the back]*

The system should have the capability to allow at any time the learner to give non verbal indications on what she would like to do: gestures, voice tone or intensity,

wink, smile, etc. This capability could be implemented simply, e.g. by pointing on the screen (e.g. via a light pen or mouse, or even directly with the finger) one of the pictograms displayed for that specific purpose by the system at the dialog start, or in a more sophisticated way, e.g. by using animated agents [4 papers].

*Oh no! Inappropriate, that slap on the back! Try something different!*

Here again, the system emits a verdict.

*\*\* Bonjour, Monsieur. [It is impossible to show my friends that I know you well.]*

*OK. We'll come back to this again later.*

Using the hints she received, the learner could not do better. The system considers that situation as still not mastered, and will return to it later, not to discourage or exasperate the learner by insisting further or by giving too numerous explanations

### 2.3. Third example

Here the tutor's pedagogical behavior is of a mixed type. This example also illustrates the influence of geographic and cultural parameters on the student's production.

*\*\* Salut, Monsieur!*

*"Monsieur", is fine, but "Salut" is too familiar. Try again.*

*\*\* Salut, Monsieur le Professeur.*

*Oh no! You insist in being impolite?*

*\*\* No*

*Then try again.*

*\*\* Bonjour Ruddy!*

*Can you really call a teacher by his first name, when you barely know him?*

*\*\* In Quebec, yes.*

*Then it is OK, I accept your argument.*

*But I am French, and, besides, standoffish and severe. Thus try again.*

*\*\* Bonjour, Monsieur.*

*Yes! But if you want to give your friends the impression that you know me more than they do, then add "Comment allez-vous?". Thus you'll say: "Bonjour Monsieur! comment allez-vous?" (but not "Salut", by all means!)*

The student has tried four times to answer the exercise. Rather than returning to it later, the computer-tutor chooses to complete the student's answer immediately.

### 3. Which types of cultural aspects may occur?

The above examples show at least two cultural aspects appearing into this type of exercise: a slap on the back, and more relaxed rules used in Quebec for adopting a familiar addressing style. More generally, what types of cultural aspects may pop up? We distinguish here extra-linguistic knowledge, or world knowledge, and linguistic knowledge.

### 3.1 World knowledge

Preston [22] counted  $n = 50$  *input parameters* (pp. 34-35) influencing the language variation or *output parameter*, here the utterance expressed in a communicative situation. One approach to make these influences explicit would be to construct a correspondence table with  $50 + 1$  columns, but that would be unrealistic. Another approach consists in expressing the relationships between input parameters and the output parameter as *rules*, but without each rule enumerating in its conditions the relevant value(s) of *every* input parameter. In this approach, instead, each rule would take into account in its premises only *a small number of parameters* (2 or at most 3), and would provide in its conclusion, not the value of the output parameter (impossible since the latter depends on about 50 parameters, not 2 or 3), but the value of some *intermediate parameter* (to be defined), summarizing the premise parameters. The way to construct these rules and to chain them to one another is implicitly directed by a *structure* and possibly a *precedence order* on the input parameters as such. One of the main problems that PILÉFACE tries to tackle is precisely *making explicit such a structure*, which also constitutes one of its originalities.

Rather than simply stating such rules in a random fashion, we also attempted to categorize them in the process. We did so in a somewhat arbitrary way and following a terminology specific to PILÉFACE since this categorization is still exploratory and rapidly changing. However, through this categorization, we defined an *ontology of variables and rules describing a communicative situation and their inter-relationships*. For lack of space, I give only a summary here (specific examples are in [15]):

- *Typological rules* are the simplest, for the knowledge they carry is not reasoning knowledge. They express a simple categorization or reformulation of a state of fact.
- *Situational rules* are rules directly related to the type of situation in which the actors interact. They may further be subdivided into spatio-temporal rules, socio-cultural rules, and relational rules (note that, by default, socio-cultural rules most often have consequences of a relational nature, but that the converse does not hold in general).
- *Behavioral rules*, in contrast to situational rules, which describe a situation in a static way, express how someone may behave in this type of situation. We may further subdivide them into rules related to the situation itself (shared by everybody in a given culture) and rules related to the actors' personality (depending on the actor, any such rule may thus be arbitrarily replaced by another one stating the contrary).

Such rules are at the core of the rule structuring and variables hierarchies of PILÉFACE, as part of the system modeling [17]. However, because of their number and fuzziness, not all of them have been implemented or tested (is such a task feasible?). This part of PILÉFACE is likely to remain an ongoing project (volunteers welcome!...).

### 3.2 Linguistic knowledge

Linguistic knowledge or *language rules* (here related to the French language) as such are usually better formalized and categorized, and we only briefly evoke them here, but giving in each case examples or culture-aware knowledge. Using the traditional separation between the four fields of linguistics, we can distinguish:

- *Language attitude rules* or *pragmatic rules*, such as the slap on the back (if non-verbal behaviors are implemented or simulated), the addressing rules, the formal vs. informal addressing rules (in French “tu” vs. “vous”), etc.;

- *Semantic rules*, like the appropriate use of affectionate terms of address (e.g. “honey” in English, or “chou” or “lapin” in French, are not immediately translatable into the other language);
- *Syntactic rules*, like the agreement consequences of using the formal or informal style, or the possibility to repeat the greeting formula in Quebec (e.g. “Bonjour bonjour!”);
- *Lexical rules*, like the use of “Adieu” to mean “Hello” in Switzerland, or the use of “Bonjour” to mean “Good bye” in Quebec.

All these linguistic rules are actually known and used in PILÉFACE.

## 4. Implementation of these cultural aspects in PILÉFACE

How is PILÉFACE equipped to deal with these various cultural aspects of communication exchanges? To answer that question, it is convenient first to remind the reader of the *data organization* and of the *system architecture* of PILÉFACE (see [14] for more details). Only then we show *how the various cultural aspects* examined in 3 fall into this architecture.

### 4.1 Data organization: problem specification

To construct the PILÉFACE system, we first had to organize and specify the problem data, i.e. completely describe the communication intention, the communication situation, and the corresponding linguistic production or form, here an utterance.

The *communication intention* or goal [2, 23, 24] is the simplest, since it is clearly specified. In fact, we had to restrict the expertise domain of our system [6] and, in order to abide by the communicative approach principles, we chose the communication intention as the criterion used to do so. In its first version, our system thus only deals with the intention of *greeting someone* in a face-to-face setting, since it is one of the first communication goals expressed by an individual. Other possible intentions to communicate are: excusing oneself, saying goodbye, or making a request.

The *communication situation* was the most complex problem data to formalize. To describe it, we developed a model [16] that meets several interesting criteria. The main one is that it separates the elements describing the situation, or *situation parameters*, from the social, cultural, affective, psychological, and economic elements, or general knowledge associated with them, which is independent from any particular situation and thus can be stored in permanent external knowledge bases. This knowledge is necessary to fully interpret the implications of the situation parameters and to make proper inferences from them. For the interested reader, [15] show in detail the groups of parameters we have identified so far, as well as the general external knowledge associated with each group.

The last component of the problem data is the linguistic form or *utterance* used to express the communication intention, here greeting someone. Utterances are described by a formal BNF-type grammar and by sets of rules of different kinds: *syntactic* (agreement rules for instance), *semantic* (only certain adjectives may be used to address the interlocutor), and naturally *pragmatic* (to make the utterance components appropriate to the situation). Our grammar specifies three main components for a greeting utterance: a *greeting formula* like “good morning”, “hello”, “hi”, etc. (only mandatory component), a *term of address* like “Sir”, “Professor”, a first name, “honey”, “you”, etc., and an *inquiry* like “how are you?”,

“OK?”, etc. This knowledge is also stored in an external problem-independent base. Finally, a dictionary (not detailed here) is used to describe and store the various terms that may appear in a target-language utterance (here a French utterance).

## **4.2 Reasoning mechanisms and system architecture of PILÉFACE**

The reasoning mechanisms of the PILÉFACE system result from two fundamental decisions about the flow of knowledge from the communication situation and intention to the corresponding utterance(s) to be generated or analyzed. These decisions allow us to define the exchange style and the summarized context, which can then lead us to define the system architecture.

### **4.2.1 Exchange style**

The first decision is *theoretic*. It consists of separating the linguistic aspects of the problem, characterizing the utterance, from the other aspects (sociological, cultural, geographical, and psychological) identified in 4.1, characterizing the situation. We thus defined an arbitrary border, the *exchange style*, as a compulsory intermediate step of the system cognitive process. Its definition is based on the following criterion: if we were interested in teaching English or Spanish rather than French as a target language, the rules *constructing* the exchange style from the given communication situation description would be left unchanged (in a given culture, see 4.3 and 5), whereas the rules *using* the exchange style to derive and generate or analyze possible utterances would have to be modified according to the selected target language. Incidentally, that separation led us to realize that some communicative situation parameters influence the exchange style, while some others (e.g. addressee’s name or time of day), used only in the utterance generation or analysis, do not.

### **4.2.2 Summarized context**

The second decision has an *empirical* basis. It consists of extracting from the description of the communication situation (complete and possibly complex) some information that is perceived to be *necessary and sufficient* to derive the utterance(s), or the exchange style. Indeed, this complete description can be quite complex; for example, Preston [22], by studying and comparing the classifications of variables made by various authors, showed that about 50 factors may influence the linguistic form (in our case, the final utterance). The main reason underlying this decision is to circumvent the combinatorial explosion, by describing the current situation with a higher, more general abstraction level [19]. That extracted information constitutes the *summarized context*.

### **4.2.3 System architecture: three serial modules**

Thus, on the reasoning chain going from the given situation description (and communication intention) to the linguistic form (or utterance) to be produced or analyzed, we defined at least two compulsory intermediate passage points, i.e. the summarized context and the exchange style, in that order. In a divide-and-conquer way, these two passage points led us to model the cognitive process of PILÉFACE as a serial set of three different *inference engines*, each one having its own permanent knowledge base:

- the *extractor*, which takes as input many situation parameters (in particular the behaviors, attitudes and roles of the actors) and produces the corresponding *summarized context*;
- the *formalizer*, which takes as input the summarized context and “converts” it into the *exchange style* that will characterize the final utterance;
- the *generator* and the *analyzer*, respectively in generation mode and in analysis mode (see section 1), which take as input the exchange style, the intended communicative intention, and a few other situation parameters, and produce either *one or several utterances* (generation mode), or a *diagnostic of the submitted utterance* as to its appropriateness to the situation (analysis mode).

At present, we have essentially implemented the formalizer, the generator, and the analyzer. A fundamental and extensive theoretic study in linguistics has been attempted (volunteers welcome!) to define and model the various situation parameters and their interrelationships, so that we could, starting with a (possibly very complex) situation description, (almost) automatically build the summarized context.

#### 4.3 How the cultural aspects fall into the architecture of PILÉFACE

The correspondence between the general framework describing the types of cultural aspects to take into account (making the implicit explicit) and its instantiation in the PILÉFACE architecture is summarized in figure 1. As stated earlier, the extractor is only partly designed, and thus most of the situational and behavioral rules are not implemented. However, this is not by accident: these usage rules, which are probably the ones in greater number, are the most difficult to be made explicit, and that probably explains why making them explicit is still a fundamental research problem in linguistics. As a result, designing the extractor would be the most difficult part of the system, but also the most rewarding.

GENERAL FRAMEWORK		PILÉFACE IMPLEMENTATION	
Parameters	Input parameters (communication situation)	Problem statement (or situation description parameters)	
	Intermediate parameters	Summarized context Exchange style	
	Output parameters (linguistic realization)	Generated utterance(s)	
Rules	(Typological knowledge)	“Typological”	All knowledge bases
	Pragmatic (world) knowledge	“Situational” (all ?)	Extractor knowledge base
		“Behavioral” (most ?)	Formalizer knowledge base
Semantic and syntactic knowledge	“Linguistic” (all)	Generator knowledge base Analyzer knowledge base	

Figure 1. - General framework (cultural factors) and PILÉFACE architecture.

#### 5. Extensibility of the culture-aware capabilities of PILÉFACE

The PILÉFACE system has been designed and built to take into account the pragmatic aspects of French. To apprehend really what its culture-aware capabilities are, it is

necessary to examine what should be done to extend its capabilities to take into account the pragmatic aspects of another target language. The answers to that question depend on the considered target language, but even more on the culture in which that language is inserted. We distinguish two cases, depending on whether we stay in a Western culture, or if we move to a culture other than Occidental.

### **5.1 In a Western culture**

In all Western cultures, the knowledge contained in the knowledge bases of the Extractor and the Formalizer (world knowledge) is essentially the same (but not identical), with a few linguistic variations. For example, Brown and Levinson [3] have identified some “politeness universals in language use”, which have then been exploited by Johnson et al. [12] as tactics for their pedagogical agents: as regards German and US English “Politeness ratings are remarkably similar between the two languages and cultures.” (p. 304). More specifically, all Western languages have a formal way and an informal way to address a person (“tu” vs. ”vous” in French, “tu” vs. ”Lei” in Italian, “tu” or “vos” vs. “Usted” in Spanish, etc.), if we except English (which has “you” as unique addressing pronoun). The distinctions between these addressing styles are roughly the same in all these languages, except for regional variations (e.g. the one mentioned in the example 2.3).

As for implementation, it is mainly the proper linguistic knowledge, i.e. the one encompassed in the Generator or Analyzer, which must be changed according to the target language (and that linguistic knowledge is to account for the regional variations).

### **5.2 In a non-Occidental culture**

However, the variations are much more important between a Western culture and a non-Occidental one, as well as between non-Occidental cultures. Examples of such cultures are African, Islamic, or Asian cultures (and each of these adjectives encompasses several cultures). Indeed these variations encompass behaviors and attitudes in addition to oral expressions. For example, in Thailand (a country that I, a Western professor, visited for several successive months), the social hierarchy goes from Buddha at the top, down to the King, to monks, to parents and teachers, in that order; teachers are thus relatively high in that hierarchy, to such an extent that there exists a “teachers day” in all schools and universities. For example, still in Thailand, dressing for work or for school is very important and can be perceived as constraining to a Westerner: on the one hand, I had been surprised, during my first extended visit to Australia, to see a colleague give his class dressed in his shorts (which we certainly would not do in France or in Canada!); on the other hand, building on that experience and erroneously transposing it to Thailand, I thought that I could at least go to the university in my shorts on a particularly hot day when I was not teaching, but one of my students, accidentally seeing me, made me understand (not directly, because of the deference due to teachers; see above) that my dressing was not appropriate, even if not teaching, because I was a professor. As a third and last example, the “family” plays a more important role in all African cultures and in Islamic cultures than in the Western ones, by its size and also by its social and spiritual roles.

Such diverse cultural factors are widely independent from the language, and are “above” the language. If the corresponding knowledge were to be encoded in a PILÉFACE-like

system, it would be mainly enclosed in the Extractor and possibly (to a lesser extent) in the Formalizer knowledge bases, where roles, attitudes and behaviors are accounted for. Of course, in addition, and assuming that the PILÉFACE architecture can still remain (which may be debated), the language-specific factors would have also to be coded, in the Generator and in the Analyzer knowledge bases, like for Western languages.

## Conclusion

Starting with culture-aware pedagogical language-teaching dialogues, we have shown which types of cultural aspects may occur in such dialogues, how these cultural aspects are actually implemented in the data organization and system architecture of PILÉFACE, and how they could be extended using that architecture. Thus, PILÉFACE is readily equipped to take into account many socio-cultural aspects in the communicative situations it handles. This is not surprising since cultural factors are addressed when dealing with pragmatics, and dealing with pragmatics (as part of the communicative approach to language acquisition) is the main purpose of PILÉFACE, and the initial reason for its development.

However, these cultural aspects are but a part of the cultural factors to be taken into account in an educative system, especially (but not only) on the Internet, where teaching methodologies and instructional design cannot always be universally applied. Indeed, through their underlying preconceptions, their impact can greatly vary from one culture to another, and the Internet addresses simultaneously all possible cultures. More generally, such a wide cultural awareness should be incorporated in any system that aims to be efficient from the communication standpoint: teaching and learning are such domains, but also marketing, advertisement, politics, government, etc. The difficulty here is to be clear and transparent while respecting all cultures.

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## References

1. Allen J. F. & Perreault C. R. (1980) Analyzing intention in utterances. *Artificial Intelligence*, Vol. 15, p. 143-178. Reprinted in *Readings in Natural Language Processing* (B. Grosz, K. Jones, B. Webber, eds.). Morgan Kaufmann (Los Altos, California, U.S.A.), 1986, p. 441-458.
2. Austin J. L. (1962) *How to Do Things with Words*. Clarendon Press (Oxford, England).
3. Brown P. & Levinson S. C. (1987) *Politeness: Some universals in language use*. Cambridge University Press (New-York, N.-Y.).

4. [AIED 2005] Chee-kit Looi De, McCalla G., Bredeweg B., Breuker J., eds. (2005) *Artificial Intelligence in Education: Supporting Learning through Intelligent and Socially Informed Technology*. Proc. of the 12th Internat. Conf. on Artif. Intell. in Education (AIED 2005), Amsterdam, 18-22 July 2005. IOS Press (Amsterdam, the Netherlands), 1012 pp. Available at <[http://books.google.com/books?id=bR1pKYncHA4C&dq=johnson+beal+tactical+iraqi&lr=&hl=fr&source=gbs\\_summary\\_s&cad=0](http://books.google.com/books?id=bR1pKYncHA4C&dq=johnson+beal+tactical+iraqi&lr=&hl=fr&source=gbs_summary_s&cad=0)>, visited on 13 May 2008.
5. Cohen A. (2008) "Teaching and assessing L2 pragmatics: What can we expect from learners?". *Language Teaching*, Vol. 41, p. 213-235. Cambridge University Press (Oxford, England).
6. Hayes-Roth F., Waterman D. A. & Lenat D. B., eds. (1983) *Building Expert Systems*. Addison-Wesley (Reading, Mass., U.S.A.).
7. Huot D. & Lelouche R. (1991) "Les variables de la situation de communication dans l'enseignement du français langue seconde ou étrangère : quelques difficultés de définition". *Revue de l'ACLA – Journal of the CAAL*, Vol. 13, N° 2 (Automne 1991), p. 85-94.
8. Hymes D. H. (1984) *Vers la Compétence de Communication* (Towards Communication Competence). Hatier (Paris, France), November.
9. Jackson P. (1990) *Introduction to Expert Systems, 2nd edition*. Addison-Wesley (Reading, MA).
10. Johnson W. L. & Beal C.: "Iterative evaluation of an intelligent game for language learning". In [4], pp. 290-297.
11. Johnson W. L., Marsella S., Mote N., Viljahlmsson H., Narayanan S. & Choi S. (2004) "Tactical Language Training System: Supporting the rapid acquisition of foreign language and cultural skills". In Proc. of *InSTIL/ICALL 2004 Symposium on Computer Assisted Learning*, paper 005. Venice (Italy), 17-19 June 2004. <[http://www.isca-speech.org/archive/icall2004/iic4\\_005.html](http://www.isca-speech.org/archive/icall2004/iic4_005.html)>.
12. Johnson W. L., Mayer R. E., André E., & Rehm M. (2005) "Cross-cultural evaluation of politeness in tactics for pedagogical agents". In [4], pp. 298-305.
13. Johnson W. L., Viljahlmsson H., & Marsella S. (2005) "Serious games for language learning: How much game, how much AI?". In [4], pp. 306-313.
14. Lelouche R. (2002) "From the communication situation and intention to the linguistic form: design approach of the PILÉFACE system". Proceedings of *ICCE 2002, the International Conference on Computers in Education*, Auckland (New Zealand), 3-6 December 2002, Vol. 2. IEEE Computer Society (Los Alamitos, Calif., USA), p. 917-921.
15. Lelouche R. (1994) Dealing with pragmatic and implicit information in an ICALL system: the PILÉFACE example. *J. of Artificial Intelligence and Education*, Vol. 5, No. 4, p. 501-532.
16. Lelouche R. (1986) "Quelques aperçus sur la modélisation de la description statique d'une scène". Proc. of the *Second International Conf. on Artificial Intelligence (CIAM 86)*, Marseille (France), 2-5 December 1986. Hermès (Paris), p. 121-139.
17. Lelouche R. & Huot D. (1998) "Influence of situation communication variables on linguistic form". *Computer-Assisted Language Learning* (ISSN 0958-8221), Vol. 11, No. 5 (December 1998), Special issue on French contributions to CALL (M. Zock, ed.), p. 523-541.
18. Lelouche R. & Huot D. (1985) "*Fondements et objectifs d'un système intelligent pour l'apprentissage des langues*". Research report DIUL-RR-8506, Comp. Science Dept, Laval Univ. (Québec, Canada), May, 42 p.
19. Lenat D., Hayes-Roth F. & Klahr P. (1979) *Cognitive Economy*. Working paper HPP-79-15, Stanford Heuristic Programming Project, Stanford University (Stanford, Calif.), June 1979, 46 p.
20. Levinson S. C. (1983) *Pragmatics*. Cambridge Univ. Press (Oxford, G.-B. and New-York, N. Y.).
21. Lopez C. (2008) "Croquelandia: the next best thing to being there". Univ. of Minnesota, U.S.A. Available at <<http://dmc.umn.edu/projects/sykes/index.shtml>>, visited May 2008.
22. Preston D. R. (1986) "Fifty some-odd categories of language variation". *International Journal of the Sociology of Language*, Vol. 57, p. 9-47.
23. Searle, J. (1979). *Expression and Meaning: Studies in the Theory of Speech Acts*. Cambridge University Press (Oxford, England).
24. Searle J. (1969) *Speech Acts*. Cambridge University Press (Oxford, England).

# Using Culture to Motivate Learning in a Digital Game Based Learning Environment

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**Abstract.** The educational game described in this paper, *Trinbago Adventures*, is being developed with the intention of addressing the following research question: whether culture can be used to motivate learning and create appeal in an educational gaming environment such that determinate learning objectives are achieved by the players. In particular, this game targets undergraduate university students native to the Caribbean region, and who are enrolled in computer science degree programs at the University of the West Indies. The components which make up the game's architecture, and the activities and strategies employed to motivate and measure learning are described along with the enhancements Caribbean culture brings to the learning experience when used. The paper also reports on two successful examples of game based learning environments which augment motivation by using culture, and outlines the challenges to be faced with the development of *Trinbago Adventures*.

**Keywords:** educational game, culture, humour, learning, motivation.

## 1 Introduction

*"It have any pommerac around here?" "Reverse back down the road until you see a man selling coconut on the side in ah dead out old truck. Sometimes it does have a lady selling near there." Dass followed the man's instructions when suddenly 'badam!' the car hit a pothole. Unfazed, he continued back up the road when as the car turned the corner, he had to mash brakes ...a pothong was sprawled off in the middle of the road. After the animal cheups and slowly moved out of the way at the last minute, Dass found the lady. The lady approached the window as the car stopped, "Yes doux-doux, the pommerac sweet too bad. Ten dollars ah heap." Dass replied, "Ah go take that heap there tants." He collected the fruit, added it to his cache, and consulted his map for the next direction."*

The narrative given above describes a typical scenario within an educational game designed using the sociolinguistic context of a Caribbean island setting for motivating learning. The interaction models common to the Caribbean region are a complex interplay of social and cultural elements, heavily influenced by a heritage of English, Dutch, Portuguese, French and Spanish vernacular. As such, the narrative above

would cause some confusion and possible discomfort to readers who are unfamiliar with the dialect since there are many instances of incorrect grammar and words which sound like gibberish (see Appendix for a glossary of terms used). The opposite would be true for readers who are aware of the colloquial speech used in the Caribbean (West Indies) by either being native to the region themselves or through interactions with West Indian speakers.

The educational game described in this paper, *Trinbago Adventures*, targets undergraduate students enrolled in the computer science degree program at the University of the West Indies which is a multiple-campus university distributed across Jamaica, Barbados, and Trinidad and Tobago. Of the three locations, the game has been designed for computer science students enrolled at the Trinidad and Tobago campus (hereafter referred to as U.W.I.), and therefore features the culture, unique scenery, and diverse fauna of the Caribbean twin-island nation. The game derives its name from ‘Trinbago’, a common expression used to refer to the single statehood of both islands [1]. At U.W.I., the majority of the computer science students are familiar with the Trinbagonian culture either being citizens or native to the Caribbean region. The inspiration for the game emerged after several interesting observations were made by the authors in and out of computer science programming classes. Generally, they are able to understand abstract concepts after observing the execution of actual code but they require a lot of programming practice as a result; this is rarely pursued by the students out of class. In addition, the students’ inclinations towards technology (evident by their constant preoccupation with online tools and mobile devices) and present lack of motivation in attending lectures strengthens the prospects of using digitally enhanced learning environments. Furthermore, the students often respond positively to instruction laced with local stories and language since it creates an encouraging, familiar setting for discussion.

These observations prompted the research question that *Trinbago Adventures* intends to address: whether culture can be used to motivate learning and create appeal in an educational gaming environment such that determinate learning objectives are achieved by the players. The paper is organised as follows: Section 2 describes the general design of *Trinbago Adventures*, the components which make up the game’s architecture, and the activities and strategies employed to motivate and measure learning. Section 3 discusses the value of incorporating cultural context into learning environments, and particularly highlights how Caribbean culture enhances the learning experience when used. Section 4 reports on successful examples of learning environments which augment motivation by using culture and by being game-based. Section 5 goes on to outlines the challenges to be faced with the development of our educational game. The paper concludes in Section 6 with the current status of the game and plans for future work.

## **2 Game Design: Trinbago Adventures**

A citizen of Trinidad and Tobago is sometimes referred to as a ‘Trinbagonian’, however, residents of Trinidad are referred to as ‘Trinis’. These terms will be used

throughout the paper. In addition, students and learners are referred to as players in the remainder of the paper.

## 2.1 Game Description

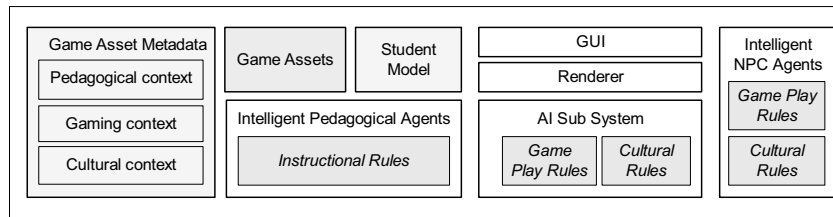
*Trinbago Adventures* is an adventure/driving game and offers two modes of game play: players may either embark on treasure hunt rallies, or go on free form exploration of the island landscape. In the treasure hunt rallies, players must race (long distance) across the country within a certain time frame while collecting unusual items or treasures located along the driving course. They have to interpret a navigational rally map in order to find the checkpoints stationed at unknown locations. The second mode, free form exploration, does not have a time limit so players can travel around the country going to places of interest, sightseeing, or exploring new routes and streets. They must obey the traffic laws at all times while being wary of the 'Trini' driving culture. Hazards such as potholes, road construction, 'badjohn' drivers (a local term for motorists who drive inconsiderately and recklessly [2]), and occasional crossing animals are common in the game, and players need to find ways of overcoming these obstacles. These and other examples of local culture are widespread throughout the game so players are exposed to the more humorous elements of a typical Trinbagonian way of life as depicted in the scenario at the start of the paper. For instance, a 'pothong' is a dog of mixed or uncertain breed, generally keen on eating and sleeping rather than pursuing trespassers in spite of their fierce nature. These dogs often enjoy the warmth of sitting in the roads oblivious of the annoyance they cause to motorists, and are a common sight in Trinidadian villages and towns.

*Trinbago Adventures* is an educational game and as such there are learning objectives in the game. Drivers must be able to configure their vehicles' operational features prior to use and during use since things often go wrong during the game. Features such as starting, braking, accelerating, engaging the autopilot, cruise control and navigational guidance system require knowledge of computer science concepts since players are essentially programming the functionality into their vehicles. These features are required in both the treasure hunt rallies and free form exploration. Participating in the treasure hunt rallies however requires additional functionality such as keeping a digital record of treasures collected, and decoding the rally map. Players can also seek guidance from locals or auto mechanic garages when in difficulty.

## 2.2 Game Components

One of the research objectives of *Trinbago Adventures* is to analyse the impact of culture on motivation to play and learn using digital game based learning environments. Consequently, the game must be able to represent elements of Trinbagonian culture such that the player's interest in the cultural representation can be captured and analysed. Additionally, the game must be able track and measure the player's learning progression resulting directly from motivation to interact with the cultural elements of the game. Figure 1 shows the architecture of the game which has been designed with

these requirements in mind. Intelligent Tutoring Systems have a long history of modelling and assessing a learner’s knowledge during electronic tuition. Accordingly, the game architecture is composed of major ITS components (student model, instructional rules, intelligent agents) for these purposes along with several other components critical for a gaming environment (renderer, AI sub-system, game rules). These will now be explained in more detail.



**Fig. 1.** Game Architecture of Trinbago Adventures

The student model serves the traditional purpose of recording the player’s knowledge levels, learning achievements, and learning goals. It stores logs of the pedagogical events in the game such as the player’s successful and failed attempts at learning activities, time taken to give answers, suggested hints and instructional guidance given to the player. In addition, the model tracks the player’s interaction with the game, and records information related to how the game is being played. This includes player dwell time on game objects, game branches followed during game play, number of interactions with non-player characters (NPCs), rewards collected, and penalties earned. It is essentially a snapshot of the player’s educational and gaming experiences. Intelligent pedagogical agents constantly access and update the student model in response to messages from the game’s AI sub-system. Whenever a game event occurs, the AI sub-system forwards information such as input data and event type to these agents. Subsequently, instructional rules are used by the agents for decision making relevant to the event with the end result of scaffolding the learning activities and determining appropriate feedback for the player. Any feedback given is stored in the student model so that the records of the player’s experiences are kept up to date.

Another type of agent featured in the *Trinbago Adventures* architecture is the NPC agent. These are essential because they emulate the verbal and non-verbal culture in the NPCs featured throughout the game. Cultural rules are used by these agents for expressing typical ‘Trini’ behaviour, and add cultural intelligence to the game. For example, the dog in the scenario is an NPC in the game, and would have rules governing its behaviour which embody how a local ‘pothong’ reacts when a vehicle approaches. The use of culturally intelligent agents follows the methodology laid out by Blanchard, Razaki, and Frasson [3] for making Intelligent Tutoring Systems (and by extension this game) culturally aware. These cultural rules are closely related to the game play rules which govern how the game works, dictate how and when audio and visual feedback is given, and control the transition of the game scenes. The AI Sub System and the renderer are mandatory components of any game since they form part

of the game engine. Together, they control the execution and appearance of the game using these game play rules.

One of the most important components in the architecture is the repository of game assets. This repository holds the educational material in the form of game images, audio clips, and animations. Each game asset is described by metadata which specifies the cultural, pedagogical, and gaming context relevant to the asset. Consider the dog again; the game assets for the dog would be a collection of image files and audio files. The cultural context would describe the assets as those of a 'pothong', the gaming context would describe the assets as being those of an NPC which obstructs the player, and the pedagogical context would describe the assets as being generic precursor events for initiating learning activities. These descriptions are cursory for the purposes of the paper as there would be more metadata associated with the assets particularly related to emotive perspectives. Games assets are selected by the game play, instructional, and cultural rules based on the changing state of the game (mirrored in the student model and in the intelligent agents) and presented to the player by the renderer in a continuous game loop.

### 2.3 Game Play

*Trinbago Adventures* is a driving game and as such players need to control basic features of a vehicle related to guiding its movement. These involve starting the engine, stopping or slowing the vehicle's progression, altering the direction of the vehicle's movement, and shifting gears in vehicles with manual transmission. In addition, players need to configure the instrument display panel in the vehicle which reflects important state such as fuel level, rate of travel, and engine speed for example. Secondary features such as the windshield wipers, windows, and indicator lights, can also be controlled by the player. All of the vehicle's features and functions are linked to specific learning activities and computer science topics as shown in Table 1. Players therefore need to program the feature's functionality into their vehicles by writing code before they are able to use the feature. Depending on the vehicle chosen by the player, the basic functionality (and by extension the difficulty of the learning activity) varies. Throughout the game, these exercises are administered so that their delivery is integrated into the storyline using cultural elements.

So for example, in the scenario when the player, Dass, drove into a pothole the car would have jolted on impact. Consequently, the indicator lights could have stopping working properly as a result; at this point a learning exercise related to conditional statements could be introduced so that the player has to re-configure the light control. Here, the player has to understand the computer science concepts designated in the learning exercise (as determined by the pedagogical agents based on the student's mastery of conditional statements) and be able to apply the necessary skills required to complete the exercise. If for instance, the player has weak debugging skills then the game activity would require the player to spot and fix the error in the code controlling the indicator lights. On the other hand, if the player has weak coding skills then the exercise may be to write the code from scratch (implying a more severe jolt and a significantly larger pothole). A successful attempt at the exercise yields a game reward

to the player such as being able to use the functionality in the game or being able to advance along the roads in the game and find a treasure easily.

**Table 1.** Table of computer science concept/topics corresponding to learning activities linked to the vehicle features. Each feature is available in either one or both of the game modes

Vehicle Feature	Computer Science Concept/Topic	Game Mode
Starting Engine	Object Oriented Programming	Free Form; Rally
Moving/ Stopping Vehicle	Variables, Control Structures	Free Form; Rally
Instrument Display Panel	Object Oriented Programming	Free Form; Rally
Secondary Features	Variables, Conditional Statements	Free Form; Rally
Autopilot	Algorithms (searching, insertion), Data Structures (graphs)	Free Form
Navigation: Road Map	Algorithms (searching, display), Data Structures (graphs)	Free Form
Navigation: Rally Map	Algorithms (parsing, display), Data Structures (queue, list)	Rally
Treasure Screen	Algorithms (searching, sorting), Data Structures (binary tree)	Rally

Figure 2 shows a road map<sup>1</sup> (lower center) of part of San Juan, a town in Trinidad. The green circles represent the starting and ending locations of the player's vehicle, the red circle (labeled CP) represents a check point, and the green line shows the pathway taken by the driver. Players are given a rally map for the treasure hunt (rally) mode of the game and this map can take one of two forms of mapping: Tulip Mapping or Herringbone Mapping. Examples of these are also shown in Figure 2. On both rally maps the vehicle is represented by a filled circle or ball and the direction in which the driver must head is shown by the arrow. The Tulip mapping is simpler than the Herringbone mapping because each box on the Tulip map grid represents a road that is either taken (indicated by an arrowhead) or ignored (indicated by the absence of an arrowhead). This can be observed in Figure 2 where the eleven boxes shown in the Tulip map grid correspond to the eleven driving directions shown on the extreme left of Figure 2. The Herringbone mapping only shows ten symbols (or lines) since the fourth driving direction is not explicit on the map. After turning left at the T junction (third direction), the driver encounters a road on the right and since it is not shown on the Herringbone map grid, the driver has to turn down that road. The Herringbone mapping only shows the roads which are to be ignored and it is more time consuming to interpret as result (more difficult game level). Note also that the location of the checkpoint is not revealed on either of the navigational rally maps however after the driver has passed the checkpoint it appears on the road map.



nese, African, Spanish, French, Amerindian, and British populations have been integrated to form a unique language which sounds comical and is often satirical in a humorous way. The phonology of TEC adds even more dimension to language since the pronunciation of a word can change its meaning. When TEC used to describe the customs and everyday events characteristic to Trinidad, the local culture can be represented as a narrative that has comedic appeal as in the scenario.

Humour plays an important role in learning environments because it promotes a lighthearted and memorable learning experience. According to Dormann and Biddle [4], humour is a valuable tool because it not only enhances a student's mood through affective learning but also commands the student's attention and encourages retention of material as a result of comical moments. Humour also promotes greater student interaction and social discussion of amusing anecdotes used in the learning process. Dormann and Biddle [4] go on to add that humour can be used to diffuse frustration and hostility because it decreases the pressure (on the student) to learn and perform. Again, this is valuable in disciplines where academic competition is stressful or where the material being learnt is difficult or abstract. In computer science some of the topics have the potential to be highly theoretical until they are applied to examples/situations that students are able to relate to. Humour is intrinsic in *Trinbago Adventures* because of the sociolinguistic context and cultural idiosyncrasies. Furthermore, rich story-based scenarios can be easily put together by describing simple events (such as waiting in traffic for example) using TEC phrases and by including Trinidadian cultural twists related to these events. Blanchard and Frasson [5] give further support for the integration of cultural backgrounds into ITS and eLearning environments adding that it is useful for stimulating student motivation through self-directed learning.

In the game, culture therefore plays several roles. Firstly, it is used to instill curiosity by being a natural source of humour. This provokes interest so that players must complete the learning exercises in the game if they want to explore and experience more of the entertaining moments/interactions. Secondly, local events are being represented as game events and game challenges. Culture is therefore being used both as a reward and as a challenge. Lastly, cultural elements are being used to create an educational environment that gives players a sense of belonging, ownership, and familiarity. This is important because the game instills pride in the students since it acknowledges, represents, and integrates their cultural background into a tool for learning computer science.

#### **4 Boosting Motivation Using Educational Games**

Strategies for inspiring and upholding student motivation have been prescribed in several instructional design models. Bixler [6] examined several of these models and found that they all overlapped and emphasized four conditions in particular. The conditions, which form the core of the ARCS model of motivation [7], are: attention, relevance, confidence, and satisfaction. Keller [7] explains that these elements can be used to systematically predict and influence motivation when matched with the students' characteristics and needs. The work of Malone and Lepper [8] provide greater

elaboration on how these elements can be implemented in a digital game based learning environment. For example, they recommend that challenge should be maintained in a game in a manner that produces uncertain outcomes and builds the player's self esteem through social relevance; this relates to all of Keller's motivational elements. In *Trinbago Adventures* the use of culture inspires learning since many of the challenges are graded to suit the player's knowledge and skill levels so that the feedback given not only helps the player to gain proficiency in computer science but it instills curiosity. Furthermore, the constant feedback and clear instructional goals delivered using the local sociolinguistic context aligns with many of the design guidelines laid out in [8]. By following these principles, the culturally aware strategies used in the game increase the appeal of the instructional activities even more because the learning experience is perceived as more enjoyable by students.

The Tactical Language and Culture Training System (TLCTS) [9] developed for teaching communication skills and foreign culture illustrates the viability of using a cultural context in a game based learning environment. One of the TLCTS Arabic language courses, Tactical Iraqi, was tested by several members of the Marine Corps where the majority of the participants had no substantial knowledge of Arabic. Johnson [9] states that the participants who were familiar with the Iraqi culture (after having been deployed to Iraq) were able to appreciate the cultural context of game, and consequently they picked up on the language faster and performed better than their peers (who were unfamiliar with the Iraqi culture). This observation supports the decision made in *Trinbago Adventures* to target students native to the Caribbean region since appreciable knowledge of the sociocultural context aids in the overall success of the learning experience. In addition, Johnson [10] comments that a game based approach attracts students with 'little initial motivation to study' and allows more effort to be focused on the quality of instruction being provided.

MOCAS (Motivational and Culturally Aware System) [5] is another example of a game-based learning environment which augments culture and motivation. Adventure games, role playing games and strategy games have been popular game genre choices among instructional technologists because of their suitability to specific learning situations. MOCAS adopts many characteristics of a role-playing game (particularly the collaborative and interactive aspects) while adapting the instructional strategies and content used according to the player's culture. Heavy use of cultural rules and pedagogical agents gives this system the cultural intelligence needed for guiding the learner and for facilitating free-form exploration. The motivational strategy of building confidence is shown in MOCAS since it encourages players to discover and explore the gaming environment which changes based on their cultural background. This game targets a wider audience than *Trinbago Adventures* and as such it requires cultural profiling.

The adventure game genre setting is ideal for encouraging reflective thinking (by solving educational puzzles in the form of game challenges) and for expressing culture (through interaction with NPCs). Because of the extensive use of narrative, this genre offers greater motivational benefits because it immerses students in a controllable fantasy world which stimulates curiosity through mystery and challenge. Unlike most learning environments, adventure games tend to put less pressure on players and are often non-confrontational; this supports player versatility by being more inclusive

from gender and instructional perspectives. Furthermore, this genre is more conducive for integrating the motivational strategies discussed earlier since the cultural expressions of Trinidad and Tobago have a story-telling bias. These characteristics essentially predisposed the design of *Trinbago Adventures* towards an adventure game theme.

## 5 Challenges and Future Work

The preliminary design and research motivation for an educational driving/adventure game, *Trinbago Adventures*, have been described in this paper. Presently, the game is in the design stages where the content and rules are being developed to work with the game play and motivational strategies outlined earlier. However, several challenges remain to be tackled in this work. Firstly, the design is an ambitious one which will involve considerable development time and expertise from both an ITS perspective and a game development perspective. Secondly, in order for the game to be taken seriously by students, the use of Trinbagonian culture must mimic real life events, characters, and behaviour with an acceptable degree of plausibility. Thirdly, the amount and type of cultural expressions used in the game must be carefully chosen and limited to a certain extent. This is necessary because when too much vernacular is used to reflect the phonology of the Trinbagonian language it becomes difficult to understand. Also, owing to the humorous nature of the culture used in the game, too much usage can become distracting to students. Lastly, since the game is being developed to investigate how culture affects motivation, the game must be able to represent cultural elements in a computationally measurable model.

In order to address these challenges, the plans for additional work include following up on research that has been done along similar lines. For instance, the work done in [11] on assessing intercultural competence is useful for informing how to integrate and measure the impact of culture on player motivation. Also, the cultural profiling conducted in [3] is valuable for determining how to select the right amount of cultural expression for students playing *Trinbago Adventures* so as not to be distracting or confusing. Future work that will also be undertaken includes the selection of development tools and the conversion of these designs into a working game prototype which will be used in empirical studies to validate the research objectives stated in the paper. Possible tests include tracking the player's in-game interactions so that dwell time and access patterns are linked to game characters, objects, and events so that overall the player experiences could be assessed such that the cultural source of motivation (interactions, language, or events) can be identified. By isolating specific elements of Caribbean language and culture and incorporating them into a game-based learning environment, this research holds promise for motivating students to learn computer science concepts using an engaging tool that offers a humorous take on everyday experiences and events.

## References

1. Mendes, J.: Côté ci Côté là: Trinidad and Tobago Dictionary. 2nd Edition. John Mendes, Trinidad and Tobago. (2007)
2. Winer, L.: Badjohns, Bhaaji Banknote Blue: Essays on the Social History of Language in Trinidad and Tobago. The University of the West Indies, Trinidad and Tobago. (2007)
3. Blanchard, E., Razaki, R., Frasson C.: Cross-Cultural Adaptation of e-Learning Contents: a Methodology. In: Richards, G. (ed.): ELearn 2005. 1895-1902. AACE, Chesapeake. (2005)
4. Dormann, C., Biddle, R.: Humour: Why are Serious Games so Serious? In: Taisch, M., Cassina, J.(eds.): Learning with Games, Sophia Antipolis, France. 449-456. (2007)
5. Blanchard, E., Frasson, C.: Easy Creation of Game-Like Virtual Learning Environments. In: Workshop on Teaching with Agents, Robots, and NLP at ITS 2006. (2006)
6. Bixler, B.: Motivation and its Relationship to the Design of Educational Games. Available online: [<http://archive.nmc.org/events/2006summerconf/materials/Bixler/m&g.pdf>] (2006)
7. Keller, J.: How to Integrate Learner Motivation Planning into Lesson Planning: The ARCS Model Approach. Paper presented at VII Semanario, Santiago, Cuba. (2000)
8. Malone, T. W., Lepper, M. R.: Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning. In Snow, R. E., Farr, M. J. (eds.): Aptitude, Learning and Instruction: III. Conative and Affective Process Analyses. 223-253. Hillsdale, NJ, Erlbaum. (1987)
9. Johnson, W.L.: Serious Use of a Serious Game for Language Learning. In: Luckin, R., Koedinger, K. R., Greer, J. (eds.): AIED 2007. vol. 158, IOS Press, Amsterdam (2007)
10. Johnson, W.L., Vilhjalmsson, H., Marsella, S.: Serious Games for Language Learning: How Much Game? How Much AI? In: Looi, C.-K., McCalla, G., Bredeweg, B., Breuker, J. (eds.): AIED 2005. vol. 125, IOS Press, Amsterdam. (2005)
11. Ogan, A., Alevan, V., Jones, C.: Culture in the Classroom: Challenges for Assessment in Ill-Defined Domains. In: Alevan, V., Ashley, K., Lynch, C., Pinkwart, N. (eds.): Workshop on Intelligent Tutoring Systems for Ill-Defined Domains at ITS 2006. 92-100. (2006)

## Appendix

Glossary of terms used in the scenario

Word/Phrase	English Meaning
It have...	Are there any...
Pommerac	Pear shaped red fruit with white fleshy insides. Also known as Malay Apple and Mountain Apple
Reverse back	Reverse (a vehicle)
Dead out	Past its prime
Mash brakes	Press the brake pedal
Pothong	Dog of mixed or unknown breed
Cheups	Express annoyance
Doux-doux	Expression of endearment. Derived from the French for sweet.
Sweet too bad	Tasty; enjoyable experience
Ten dollars ah heap	Ten dollars for one heap
Ah go...	I will...
Tants	Aunt, or any person who is like an aunt



# Using a Peer Moderator to Support Collaborative Cultural Discussion

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**Abstract.** Intercultural competence is a skill of growing importance, but it is difficult for students to acquire. A typical learning task in this domain is participation in discussion, but as many classes move online, students do not always get the discussion support available in a traditional classroom. We develop a simple model for good cultural discussion and use it to explore a method of assessing student contributions to an online forum and delivering feedback – a peer moderator from the class supported by adaptive assistance. We report on our experience in an exploratory pilot where we compare the adaptive support to an unsupported peer moderator. We found initial promise that students may benefit from the adaptive support provided by this system.

## 1 Introduction

With the growth of affordable communication and transportation technologies, people from different cultures now interact on a daily basis for reasons of commerce, politics, and leisure. To have a successful interaction, it is not adequate to view the world only from a home culture’s perspective (such as, “Iranians won’t ever get to the point when I try to talk about business”). Nor can one simply memorize a list of facts from a new culture (such as, “Iranians prefer relationship-building small talk before getting down to business”). These facts do not represent the richness of social phenomena or individual differences, and are not flexible enough to be applied in rapidly changing circumstances. Rather, it is necessary to be interculturally competent, a quality composed of skills like the ability to interpret phenomena with a culturally appropriate perspective, or the ability to act in culturally appropriate ways (see Byram’s *saviors* [1]). However, these skills are difficult to acquire, in part because people instinctively interpret events from their home culture’s perspective [2]. Even though intercultural competence is an essential part of many second language curricula [e.g., 3], most learners need additional support or training to develop along the spectrum of cultural competence [2]. In our research we attempt to investigate how providing support to students engaging in cultural discussion can facilitate the acquisition of cultural skills.

Discussion, or a critical analysis of relevant issues through the production of verbal or written output, is important to intercultural competence for two reasons. First, it is a learning tool. It can enable students to practice the skills of intercultural competence and to learn from their peers. For example, the process of giving students input (such

as culturally-relevant video), having them notice and reflect on relevant features, and produce written or verbal output under the guidance of an instructor is a primary technique for getting students to acquire skills like taking the perspective of another culture [4]. An implementation of this model in an interactive learning environment was shown to produce learning gains [5]. Second, being able to organize and express cultural explanations is an end in itself. Applying intercultural competence in real contexts includes the need to converse intelligently about other cultures, and additionally demonstrates that students have acquired the skill of critical analysis of cultural behavior. For example, in a study investigating how educational software in the One Laptop per Child project was interpreted by students of another culture [6], children in Uruguay who received laptops disliked a music authoring tool which was supposed to help them learn about recording. Investigators were able to interpret and then explain to a wide audience the reasons behind this reaction, including that there was no music the students could really relate to provided in the tool [7]. Once cultural differences are noticed, it is important to be able to interpret and explain these differences.

Because unsupported student discussion is at a low level of cultural competence [5], it is important to investigate techniques that can enhance these interactions. Expert moderation, where teachers guide discussion to create productive talk, is one approach that is thought to have a positive effect on learning in discussion. As more and more classroom discussion moves to asynchronous online discussion forums, teacher moderation of the discussion is still beneficial [8], but teachers often have too many responsibilities to actively moderate every forum [9]. It is possible that students in the class, known as peer moderators, may be able to help fill this role, and they may even benefit themselves from doing the moderation [10]. However, in initial exploration with 8 students who wrote feedback to a preexisting cultural discussion thread, we found that the quality of the feedback varied greatly between students. For example, in reference to a post that stated children in France would not let their parents know about their grades in school, a good moderator responded by highlighting the different perspectives in the situation: "...Also remember - this is French culture so the child/parent relationship may be different than our own American understanding. It could be that children and their parents commonly share such info." However, in response to the same post, a weaker moderator simply wrote, "The child needs to know, or he/she will never learn. He/she needs to be scared." It is possible that an intelligent tutoring system that observes the discussion, helps detect problematic areas, and provides feedback, could provide support to a student who is performing the moderation. Adaptive technology has been used in the past successfully in more well-defined domains, but its potential has not been fully explored in ill-defined domains [11]. In order to make adaptive technology work in this domain, a model needs to be developed to form a basis for feedback, and then feedback needs to be designed and delivered in a way that improves the quality of the discussion.

Currently, supporting competent intercultural discussion is an open problem. In our work, we created a model of intercultural competent discussion, which included both domain-general dimensions and dimensions unique to the domain of intercultural competence. We used the model both for supporting moderators in analyzing discussion posts and as a basis for an automated system that helps moderators provide feedback to the discussion forum. We ran a small exploratory pilot comparing guided peer

moderators to unguided peer moderators and took a preliminary look at how the model was communicated to students and its effect on student discussion.

## **2 Modeling Good Intercultural Asynchronous Discussion**

To support intercultural discussion, a model must exist that can be used to evaluate responses and create feedback. This constraint is particularly challenging because intercultural discussion is ill-defined; for example, experts may judge aspects of the contribution with different weights and students may look at multiple aspects of any one issue to formulate a valid response. In this initial attempt at providing support, our model focuses on a salient subset of the domain, with the assumption that providing feedback on a subset of skills would still be beneficial. To develop the model for our system, we conducted both a theoretical analysis based on existing literature and an empirical analysis based on previous study data. We distilled our findings into five dimensions which were then used to guide automated support.

### **2.1 Theoretical Analysis**

To improve student interaction in an online cultural discussion forum, it is important to establish which student behaviors are likely to be beneficial. Because good general discussion skills are necessary to have a successful cultural discussion, we look at behaviors that contribute to both skill sets. At a basic level, Guzdial and Turns [12] argue that sustained on-topic discussion will lead to learning in an online discussion forum. More specifically, they define three measures of discussion quality: the length of the discussion, the number of students participating, and the focus of the discussion on course topics. Guzdial and Turns define an on-topic post as any reference to class learning topics. Schemes have also been created to assess the quality of students' individual contributions. Many of the schemes were inspired by Bloom and Krathwohl's [13] cognitive taxonomy of educational objectives, where they classify student processes on six levels: knowledge, comprehension, application, analysis, synthesis, and evaluation. Henri [14] applied a similar model to an analysis of the cognitive dimension of asynchronous forum contributions. Her work has been adapted to look at a number of qualitative student behaviors in asynchronous forums, including the depth of student cognitive processes [see 15 and 16 for examples].

Additionally, there are qualities of a good cultural discussion distinct from qualities of a good discussion in general. For example, Steglitz's [17] measures of intercultural perspective taking are important for assessing student display of intercultural competence during a discussion. Steglitz defines three levels of perspective taking in writing, described here in simplified form:

1. No evidence of cultural explanation  
(e.g., "This is the wrong way to do things")
2. Unspecific cultural explanation  
(e.g., "I think the French see education differently")

### 3. Specific, elaborated cultural explanation

(e.g., “French students seem to see education differently, perhaps because they take more personal responsibility in the education system”)

In our work, the aspect of intercultural competence that we are focusing on is the skill of giving specific, elaborated cultural explanations for the cultural issues. To exhibit this ability, students must interpret events from a cultural perspective (i.e., understand that a behavior is culturally motivated), and then identify and express the cultural norm that evoked the behavior.

## 2.2 Empirical Analysis

We used previously collected data to supplement our theoretical analysis of good asynchronous cultural discussion. In these previous studies, students used the e-learning environment and discussion board with no moderation or support.

The first problem that was observed in the corpus was the lack of correct facts. While many of the issues related to cultural topics have no black and white answers, there still remain statements on which most experts would agree. For example, most stores in France were closed on Sundays during the 1960s. When students made incorrect statements, frequently the rest of the group did not have enough knowledge to contradict or correct them, and therefore the misconception might remain or even give rise to further incorrect analysis based on that statement. Therefore, we felt that having correct facts was a critical dimension of a good post.

Additionally, it was noted that a number of students introduced novel information, either from personal experience (e.g., “When I visited France, I saw ...”) or prior knowledge (e.g., “This is a Biblical name, and the majority of the French belong to the Catholic church ...”). This novel information allowed other students to follow up with a new analysis of the existing discussion or sparked a new discussion that resulted in a better cultural perspective. In interpreting a cultural behavior, an important skill is to compare the behavior with previous cultural knowledge.

The data also supported the results of the theoretical analysis, showing that being on topic, writing an analysis, and presenting multiple perspectives were not ubiquitous in students’ posts, making these dimensions targets for adaptive support.

## 2.3 Hierarchical Model

From this empirical and theoretical analysis, we generated a model with five dimensions that could be targeted by adaptive support. Two of the dimensions were task dimensions, relating to what makes a good discussion post. These dimensions are general enough that they would be critical for succeeding in a cultural discussion.

1. Is the post on-topic? (*addressing Guzdial and Turns’ [12] criteria*)
2. Does the post have a good argument (a conclusion and supporting evidence)? (*addressing in a simplified way the cognitive depth of the post, as in Bloom [13]*)

We also included two dimensions relating directly to intercultural competence:

3. Does the post show awareness of multiple points of view or an alternate point of view? (*addressing the Steglitz [17] criteria*)
4. Does the post introduce relevant new facts not directly from the video? (*taken from our corpus analysis*)

Finally, we included a dimension to check whether the discussion includes correct and relevant cultural knowledge from the video:

5. Does the post reference at least one correct cultural element specific to the themes of the video, and no incorrect cultural elements? This is the only dimension which is tied to a specific cultural issue. In the implementation of the model, we identify several categories of facts that may be important for each film clip. (*taken from our corpus analysis*)

In order to produce concise feedback that was meaningful to students, we organized these five dimensions in a theoretical hierarchy of importance (see Figure 1). The large diamonds in the diagram represent the primary decision points for assessing posts, and are organized from most important to least important from left to right. The "on topic" dimension is at the highest level of priority, because if the content of the post was not relevant to the cultural issue then it makes no sense to examine whether, for example, the post contains a good argument. Novel facts are the lowest-priority dimension, because they add to a post but are not necessary for a good post. The small diamonds are secondary decision points that augment the assessment; for example, once we ascertain that the post does not contain multiple perspectives, we then check to see if it uses correct facts. Feedback (represented by squares) focuses on the primary lacking dimension, but also incorporates a second lacking dimension as needed.

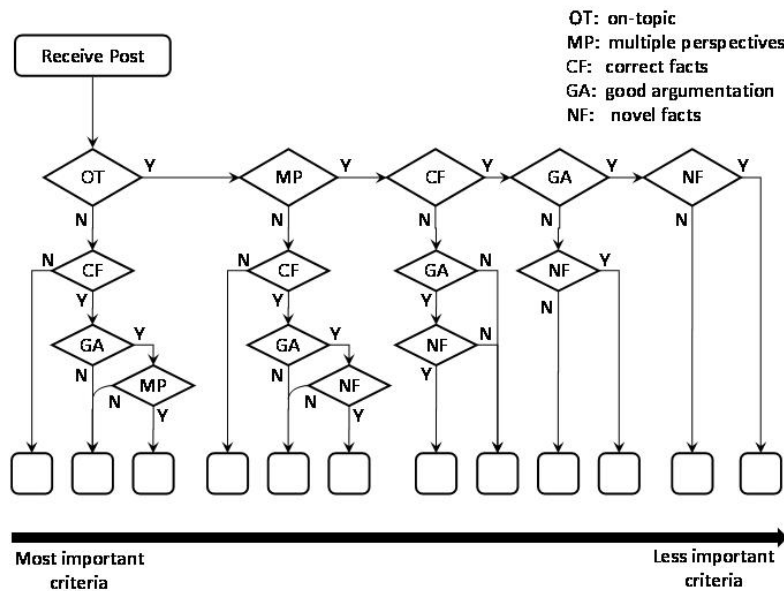


Figure 1: Model used to assess a discussion post and provide feedback

### 3 Using the Model to Deliver Automated Adaptive Feedback

#### 3.1 Design of Learning Environment

We designed the automated discussion forum support around an existing e-learning environment for helping students develop intercultural competence skills, which was based on Liddicoat's model [4]. Students are instructed to watch a video clip from a French film that includes cultural content related to a given theme (e.g., a video clip from the movie *Monsieur Ibrahim* that touches on immigration issues). They follow a sequence in which the video is paused, they predict the next event, and then reflect on the result. Students are then given a prompt for forum discussion. For *Monsieur Ibrahim*, the prompt was:

Post with questions, analysis, or other thoughts about the immigration issues in France you've seen. Think about the racial and ethnic stereotypes in France that you have seen depicted in this film to get started.

In this exercise, students are given authentic material and scaffolding in order to facilitate deep processing. They then produce output in the form of discussion posts, helping them to further analyze the material. The discussion objectives were not to have students weigh in with unsubstantiated opinions about the film events, whether positive or negative. Instead, we expected students to recognize the behaviors in the film that were culturally motivated, and then discuss potential cultural explanations for the film events. In this study our goal was to explore how this student discussion could be supported with peer moderators from the class.

Moderators are asked to reply to the board with feedback on the posts that have been made so far and guidance for further discussion. We then used our model of good cultural discussion to design support to improve the quality of feedback from the moderators. Moderators go through three steps:

1. *Rate post.* Moderators choose a post from the discussion that they believe may need some assistance. When they make their choice, a dialog pops up that asks them to rate the selected post based on the five model dimensions. These ratings are then submitted to the moderator support agent. See Figure 2.
2. *Receive feedback suggestions.* The intelligent moderator support system then uses the ratings to construct a feedback template based on the hierarchical structure of the model (e.g. "... Have you considered... That changes your interpretation of events because..."). The system also suggests three facts about the culture that the moderator might want to incorporate into his or her post, based on which category of facts the moderator indicated were lacking in the post (e.g., Unemployment can be a cause of violence in the immigrant communities in France.)
3. *Write post.* Moderators are then encouraged to fill in the template with specific details from the post they are replying to. They submit the feedback as a post to the discussion forum.

I think that racism is really terrible, but it exists also in the US. For the French, because their population is small, they are very concerned with protecting their heritage. Maybe this discrimination is a result of the fear of losing their heritage.

ljq10 • 06/04/07 10:13

**Evaluate the message you are responding to by clicking on the appropriate characteristics. You will then receive advice to help you prepare your response.**

No  Yes  Is the post on-topic?

No  Yes  Does the post present a well-defined argument (with evidence and a conclusion)?

No  Yes  Does the post present new, relevant facts not included in the video?

No  Yes  Does the post present multiple points of view?

Does the post reference these cultural elements?      If yes, are the facts correct?

Stereotypes about Arabs       Yes

The immigrant situation in France

Relations between cultural groups in France

Appliquer    Annuler

**Figure 2.** Rating interface for the moderator, translated into English

This approach uses our model to assist the moderator in making a good analysis of a post through the use of a rating scaffold, and then automatically produces a customized template based on the analysis. The template in turn is used to assist the moderator in providing appropriate feedback to the other posters in the discussion.

### 3.2 Exploratory Pilot

In a small pilot, we explored what effect the feedback support may have had on the moderator posts, and what effect the moderator posts may have had on the discussion as a whole. Was our model of good discussion communicated through the feedback and reflected in the larger discussion? Observations from the pilot are intended to inform the future design of the automated system.

We drew subjects from an upper-level college French classroom, containing students whose French writing ability was sufficient to participate in a complete discussion. Volunteer students from the class were assigned to moderate the assignment. This class had 14 students, which allowed two randomly assigned conditions to run on separate discussion boards, one with two supported moderators and one with two unsupported moderators. However, only 10 students posted to the discussion forum. Students were instructed to watch the video and then post at least once on Monday, Wednesday, and Friday. Moderators were given separate instructions to read posts and reply either on Tuesday and Thursday, so that there would be time for students to read the moderators' posts before writing to the board on subsequent times. While the supported moderator received the adaptive help described above, the unsupported moderator was simply given the same content about successful moderation on paper, in a non-adaptive form.

Each condition's board received posts from 3 posters and 2 moderators. The moderator support board received 12 posts total over the week (4 from moderators and 8 from the other students), which was slightly less than the assignment required. Moderator posts in this condition were longer than the regular posts. In the unsupported condition, enthusiastic moderation led to 9 moderator posts and 10 by other students. Here the trend was reversed, with regular posts longer on average than moderators. Two coders who were blind to condition then rated all posts on the five dimensions of our model on a binary scale and resolved differences through consensus.

Our first question for exploration was how moderators incorporated the feedback they received and therefore the concepts of the model into their posts. On the surface, moderators did not appear to utilize the support. One of the moderators did use the rating system and arrived at ratings similar to our ratings of the posts, and the other didn't follow the rating system at all, choosing instead to give the posts she replied to a perfect score. Both moderators deleted the feedback template we provided and wrote their own feedback. While the support was underutilized, the four moderator posts in the automated support condition demonstrated multiple perspectives, prior personal experience, and good argumentation. For example, one moderator chose to respond to the following post:

“Do you think that, at the end, he made a little joke about the word Arab? For me, it's like he is commenting on the big problem of stereotypes of race and religion in France; that all the Arabs have stores and work all the time”

This post was rated as being on-topic and having multiple perspectives, due to the recognition of the stereotypes existing in France. The moderator replied:

“It is not a joke, it seems to me, but a stereotype that comes from the manner in which the French think. Here, in the US, it's the people who call storekeepers Koreans. Do you think for the same reason? Also, for the Catholics, Sunday is a sacred day, for God, but the Arabs are a different religion. Is Sunday also exceptional? If yes, why is it that they work?”

In the first line, the moderator acknowledged a conclusion the poster made and clarified the point. The moderator then compared a US perspective to the French perspective, using prior knowledge about the US perspective. The moderator also brought up an important point for understanding the movie, which is that Sunday is a sacred day for Catholics but possibly not for Muslims. Finally, the moderator asked thought-provoking questions to keep the discussion going. Although the moderator's understanding of the situation was not perfect, the end result was an improvement in the overall quality of the discussion. Additionally, the moderator added more questions three hours later to keep the discussion active:

“Another question: why does M Ibrahim say, That's why I call you Momo, it's less intimidating, after Momo says That's not my name. Did he say it because he's young? Or maybe because of the differences in their religions? (I assume that Momo is Jewish)”

Taking this sort of initiative shows the moderator's enthusiasm for the cultural discussion – and the post shows an awareness of the cultural differences between M Ibrahim and Momo.

In the unsupported moderator condition, moderators were working from the instruction sheet we provided (or from personal experience) rather than using the auto-

mated adaptive support to guide their decisions about the posts they were replying to. This activity required less effort than making ratings and reading the feedback template, which may have contributed to the board receiving more than twice as many moderator posts. However, out of these 9 posts, only 4 were rated as successful moderating posts. These moderators rarely presented or encouraged multiple perspectives or provided novel connected information, tending instead to use a strategy of asking a single question to further the discussion. For example, on the unsupported board, a student posted:

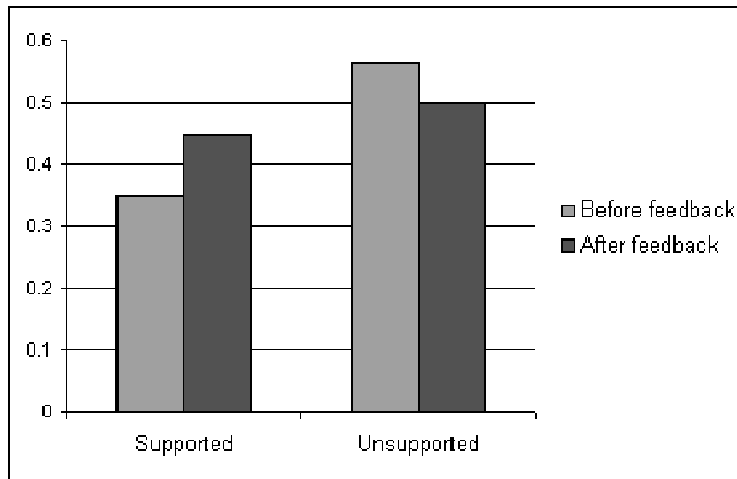
“At the beginning, I didn't make the connection between the hours of the store Sunday. For Arabs, Sunday isn't a religious day. But, for the Catholics, it's very important to observe Sunday with reverence. So, it is a big cultural mistake between the French (a culture where the majority is Catholic) and the Muslims.”

This post was rated as being on topic, exhibiting multiple perspectives, and introducing novel facts (Sunday is a religious day for Catholics; in France, the majority of the people are Catholic). The moderator responded:

“It's a good point. I didn't think of the religion and its role in this scene when I watched it. Do the Arabs have a religious day like the Christians have Sunday for the day of God?”

Although the moderator posed the same question as the moderator in the supported board, he or she did not bring any new perspectives or prior knowledge to the discussion. Further, in this case, the original post was more culturally competent than the original post in the supported moderator condition, and could have provided more material for the moderator to expand upon.

Next, we attempted to look at the quality of the regular student posts before and after they received feedback given by the moderators, a difficult task due to the low number of students who posted. We divided posts into two categories based on student exposure to moderator feedback. Because each thread was on a separate page of the discussion board, it was more likely that when a student posted in a particular thread, they read the feedback in that thread than in any other. Therefore we placed posts that were made before any moderator feedback appeared in the thread in one category, and posts that were made after feedback appeared in the thread in a second category. Figure 3 shows the ratings for each set of posts by condition, before and after feedback. Scores were given by averaging post ratings across all dimensions and across all students. In the supported moderator condition, the posts were rated fairly low at the outset, but had a trend towards improvement after feedback from the moderator. In the unsupported condition, posts were relatively highly rated from the beginning, and seemed to drop slightly after feedback. While these numbers are initially promising, a full study is necessary to gain valid results, due in part to the low number of participants and the discrepancy in post ratings between conditions before students had received feedback.



**Figure 3.** Fraction of posts in moderator study with high scores by condition. As the sample size is very small, caution in interpreting these numbers is encouraged.

## 6 Discussion & Conclusions

We have outlined a representation of good discussion in intercultural competence, communicated that representation to students, and examined what effect the feedback had on the student discussion. We attempted to communicate the representation to students and improve student discussion through automated feedback delivered to the moderator. Although the moderators did not always comply with the ratings and tended to delete the feedback template, they appeared to do a good job of incorporating relevant concepts in their posts, in particular compared to moderators in the unsupported condition. This “implicit” effect of the moderator support may be due to the required step of rating posts prior to replying to them, which made the dimensions of a good post salient to the moderator as they were considering their feedback post. Whether we should encourage moderators to mention the dimensions more specifically in their feedback to student posters is still an open question.

The pilot we ran yields several future directions with respect to design and evaluation of future iterations of the automated moderator support. First, the model’s ability to assess students on the five dimensions could probably be improved. As a first pass, we successfully used our model to analyze relevant aspects of student posts, and observationally the model fit the data. However, despite the relative improvement we saw in student posts, most student posts were not rated at a very high quality. This observation is unsurprising given how difficult intercultural competence skills are to acquire, but implies that a future version of the model might make finer-grained distinctions at the lower end of each dimension. For example, rating the dimensions on a continuum rather than on a ‘yes’/‘no’ scale might capture more subtleties in the student posts, in addition to providing more insight into improvement in student posts. Second, not all moderators complied with the ratings, and it would be useful to inves-

tigate why this was the case. Perhaps the process took too much time, or perhaps the moderators did not fully understand the dimensions. We could conduct a thinkaloud with students to determine why the ratings system was not always used, and then work with the students to make the system more intuitive. Finally, the feedback template was often deleted by moderators, and this outcome is not generally desirable. It may be that our provided feedback template was too complex or too unfamiliar for peer moderators to be motivated to fill out, and had moderators actually used the feedback template the quality of the discussion may have increased even further. Therefore, we plan to investigate why moderators did not use the feedback template, and explore alternative methods for encouraging moderators to incorporate the ITS feedback more explicitly in their posts to students. We believe that a necessary follow-up step in this work would be to conduct a full study relating supported moderator feedback to discussion quality.

Although this research is preliminary, our approach is a first step toward helping students acquire intercultural competence skills by providing automated intelligent support for cultural discussion. While our model for good cultural discussion is a subset of the actual extensive qualities of good cultural discussion, it seemed that it still provided a decent basis for intelligent support, suggesting that we can get traction in a complex domain with a simple model. Further, we attempted to circumvent current intelligent technology which cannot fully and accurately analyze the cultural content of student posts by having peer moderators rate the posts, providing the peer moderators with automated adaptive feedback suggestions, and having them construct the feedback. This approach may not only benefit the posters to the discussion board, but may also encourage learning gains on the part of the peer moderator. In the pilot, the quality of feedback provided by the peer moderators was varied, and it is possible that better guidance given to the peer moderator would improve the quality of their posts to the discussion forum and therefore the discussion as a whole. Alternatively, the approach may provide a stepping stone for implementing full intelligent support for a discussion forum, as a corpus of moderator ratings might serve as training data for an automated system that can independently rate student posts. In general the process of providing intelligent help to peer help in order to combine the best of both approaches appears initially promising. We have taken a first step toward the goal of constructing an intelligent learning environment for the acquisition of intercultural competence.

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## References

1. Byram, M. (1997). *Teaching and Assessing Intercultural Communicative Competence*. Clevedon: Multilingual Matters.
2. Bennett, M. J. Towards ethnorelativism: A developmental model of intercultural sensitivity. In R. M. Paige, Ed., *Education for the Intercultural Experience*, 21-71. Intercultural Press, Yarmouth, ME, 1993.

3. ACTFL (American Council on the Teaching of Foreign Languages) (1996). Standards for Foreign Language Learning: Preparing for the 21st Century. New York: ACTFL.
4. Liddicoat, A. J., & Crozet, C. (2001). Acquiring French interactional norms through instruction. In K. R. Rose & G. Kasper (Eds.), *Pragmatic development in instructional contexts*. Cambridge: Cambridge University Press.
5. Ogan, A., Alevin, V., and Jones, C. 2008. Pause, predict, and ponder: use of narrative videos to improve cultural discussion and learning. In *Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems*(Florence, Italy, April 05 - 10, 2008). CHI '08. ACM, New York, NY, 155-162.
6. <http://laptop.org>
7. Hourcade, J. P., Beitier, D., Cormenzana, F., & Flores, P. Early OLPC Experiences in a Rural Uruguayan School. Presented at Alt.CHI 2008.
8. Mazzolini, M. & Maddison, S. (2003). Sage, guide or ghost? The effect of instructor intervention on student participation in online discussion forums. *Computers and Education*, 40, 237-253.
9. Beaudin, B. P. (1999). Keeping online asynchronous discussions on topic. *Journal of Asynchronous Learning Network*, 3(2), 41–53 [On-line]. Available at: [www.aln.org/alnweb/journal/vol3\\_issue2/beaudin.htm](http://www.aln.org/alnweb/journal/vol3_issue2/beaudin.htm).
10. Nachmias, R., Mioduser, D., Oren, A., & Ram, J. (2000). Web-supported emergent collaboration in higher education courses. *Educational Technology and Society*, 3(3), 94–104.
11. Lynch, C., Ashley, K., Alevin, V., & Pinkwart, N. (2006). Defining ill-defined domains; a literature survey. In V. Alevin, K. Ashley, C. Lynch, & N. Pinkwart (Eds.), *Proceedings of the Workshop on Intelligent Tutoring Systems for Ill-Defined Domains at the 8th International Conference on Intelligent Tutoring Systems* (pp. 1-10). Jhongli (Taiwan), National Central University.
12. Guzdial, M., & Turns, J. (2000). Effective discussion through a computer-mediated anchored forum. *Journal of the Learning Sciences*, 9, 437–469.
13. Bloom, Benjamin S., and Krathwohl, David R. Taxonomy of Educational Objectives: The Classification of Educational Goals, by a committee of college and university examiners. [Handbook I: Cognitive Domain](#). New York, Longmans, Green, 1956.
14. Henri, F. (1992). Computer conferencing and content analysis. In A. Kaye (Ed.), *Collaborative learning through computer conferencing: the Najaden papers* (pp. 117–136). Berlin: Springer.
15. Hara, N., Bonk, C., & Angeli, C., (2000). Content analyses of on-line discussion in an applied educational psychology course. *Instructional Science*. 28(2), 115-152.
16. Lee-Baldwin, J. (2005). Asynchronous discussion forums: A closer look at the structure, focus and group dynamics that facilitate reflective thinking. *Contemporary Issues in Technology and Teacher Education*, 5(1), 93-115.
17. Steglitz, I. (1993). *Intercultural perspective-taking: The impact of studying abroad*. Unpublished dissertation. University of Minnesota.

# **Cultural Variables in the Building of Pedagogical Scenarios: the Need for Tools to Help Instructional Designers**

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**Abstract.** This study investigates the application of cognitive informatics in the domains of education and culture. It focuses more particularly on cultural diversity in computer-assisted distance learning environments. The goal of this investigation is to allow for significant and more authentic learning by way of an instructional scenario method that integrates the processing of cultural variables through the use of a knowledge base called “Cultural Diversity”. The hypotheses are as follows: 1) to create an instructional design method that makes it possible for designers to consider and process cultural variables, while exploiting the novel technical possibilities offered by the semantic Web, will facilitate authentic learning, promote equitable access to education and improve scenario efficiency, 2) to systematize support for designers by means of knowledge-based tools that will allow them to consider and process cultural variables and become creative mediators, rather than consumers. This study will model, implement and test a) a “cultural diversity” knowledge base that is exploitable by a system designed to help instructional designers in their design tasks and b) a method to process cultural variables that can be implemented into an instructional design process.

**Keywords:** Cultural Diversity, Instructional Design, Authentic Learning, Pedagogical Scenarios

## **1. Introduction**

There are numerous reasons for the enhanced popularity of distance training programs that are available today: the ever-increasing need for continuing education, the exponential number of new online learners and the desire, by universities, to reach a clientele challenged by time constraints or remote locations. Since many distance training programs are offered at an international level, learners registered for a given course often have disparate cultural heritages. Indeed, according to Goodear (2001), Australia has witnessed a proliferation of Web learning resources and platforms, adding that the multidimensional nature of Web-based technologies offers the possibility of reaching a wide range of learning needs in a culturally diversified learning environment.

The role of culture in these new types of instructional interactions is thus of great interest. We believe that cultural variables must be considered in the instructional design process and that tools must be provided for designers who may be ill-prepared when it comes time to plan material for a culturally diversified clientele. Moreover, in her study on instructional training references published between 1993 and 2003, Man (2004) reveals that cultural variables are rarely or never taken into consideration. She concludes that future instructional designers are not well equipped to design material destined for a clientele whose cultural background is either different or diversified.

This paper presents a tool currently being developed for instructional designers: the “Cultural Diversity” Knowledge Base (KB) which is built on the basis of the “Cultural Factors” ontology, which is also under development. Firstly, the notion of culture is explained. Secondly, the KB is presented and emphasis is placed on the conceptualization of the “Cultural Factors” ontology. Finally, future works are briefly described.

## 2. Culture

The etymology of the word “culture” comes from the Latin term *colere* which means “live”, “cultivate” or “honour”. The notion of culture is defined in various ways and in different fields. For instance, in their book called *Culture: A Critical Review of Concepts and Definitions*, [Kroeber](#) & Kluckhohn (1952) inventoried a list of over 200 different definitions for the word *culture*.

Two definitions seem most widely accepted: *individual culture*, which refers to the set of general knowledge acquired by an individual and *collective culture* which, is a set of usages, customs, artistic, religious and intellectual expressions that define and differentiate a group, a society. *Collective culture* refers to a shared set of convictions, of ways of viewing the world or interacting in it, which guide individuals or groups in a more or less conscious manner.

This paper addresses the concept of collective culture only. Personal culture would comprise the learner’s set of unique characteristics, to be taken into account in the framework of tutoring. Such a topic would be a valuable research topic for the fields addressing student modeling.

### 2.1. Collective Cultures

The concept of collective culture comes from an anthropological movement. Considered the father of British anthropology, Edward Tylor (1832-1917) first suggested a definition for the concept of culture:

Culture or civilisation, in its broadest ethnological sense, refers to this complex whole that comprises knowledge, beliefs, art, ethics, rights, customs and other capacities or habits acquired by humans as members of society. (cited in Cuche, 2004)

This excerpt indicates that culture is acquired, learnt. The individuals' knowledge is considered, albeit always from the perspective of a group member.

Likewise, Hofstede & Hofstede (2005) define culture as *the collective programming of the mind that distinguishes the members of one group or category of people from others. (p.4)*. Their view of culture refers to patterns of thinking, feeling and acting. They specify that culture is always a collective and learned phenomenon.

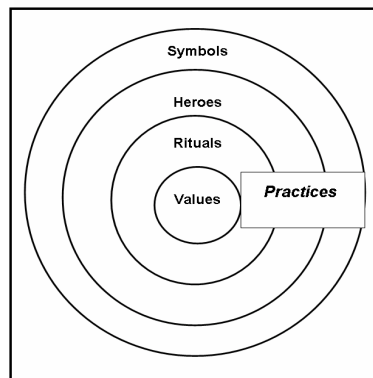
UNESCO adopted such a perspective and defines *culture* as follows:

The set of distinctive spiritual, material, intellectual and emotional features of society or a social group, [...] it encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs.<sup>1</sup>

Since this definition is based on an international consensus, it has been adopted for the purpose of this research.

### 2.1.1 Components of a Collective Culture

Hofstede & Hofstede (2005) present the manifestations of culture at different depth levels, using four concepts: symbols, heroes, rituals and values. They introduce such terms with an analogy to the various onion skins in which symbols, appearing on the outermost layer, represent the most superficial elements while values, the innermost concept, is shown as the deepest manifestation of culture. The first three onion skins (symbols, heroes and rituals) are visible in practice, contrary to values. This anthropologic approach respects the adopted definition.



**Fig. 1:** The “oignon”: Manifestations of Culture at Different Levels of Depth (Hofstede & Hofstede, 2005)

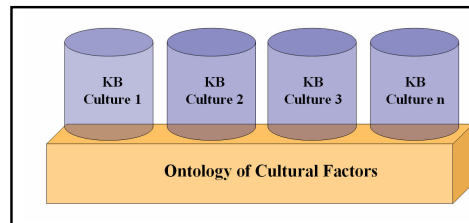
<sup>1</sup> UNESCO Universal Declaration on Cultural Diversity, Mexico City Declaration on Cultural Policies, July 26 to August 6, 1982.

In the model proposed by Hofstede & Hofstede, values take a central position. At the very heart of societies, endowed with the power of influencing learning and/or instructional designers' tasks, they have a direct impact on all other layers of the onion.

### 3. The “Cultural Diversity” Knowledge Base

As highlighted by Powell (1997), when teaching in a foreign culture, knowledge transfer depends on the trainer's capacity to establish connections with the learners and to communicate with them in an efficient manner. He adds that the latter must incorporate the learners' technical, cultural and organisational situations. Since designers are not necessarily knowledgeable in various cultures, we believe that a KB on these topics has become essential.

As specified by Mizoguchi (2004), “a differentiation must be made between *“ontology”* and *“knowledge base”* as to their roles, meaning that the ontology provides a system of concepts that are used to build a knowledge base. Consequently, an ontology can be a specific conceptualization of the target world, defined by the engineers who create the knowledge base, hence a traditional meta-system knowledge base.” To enable data consistency in the KB and cross-cultural equivalences, the KB will be built on the basis of an ontology of cultural factors, which is at the heart of this research project. The following figure presents the “Cultural Diversity” KB, which is composed of various knowledge bases, all instantiated from the “ontology of cultural factors.”



**Fig. 2.** Representation of the “cultural diversity” KB.

Each KB thus constitutes an instance of an ontology which is specific to a given culture. Each concept of the ontology will then take on different values according to the reality of each culture represented. In the framework of this research, the development of at least four instances has been planned: one for the province of Quebec (Canada), one for Mauritius and two others to be announced. Plans have been made to work with instructional designers at these locations in order to instantiate knowledge bases. Indeed, as Goodear (2001) explains, it is beneficial to tap into the knowledge of people from the area where the target populations live, in order to avoid imposing the perspectives of observers from another culture looking in from the outside.

### 3.1. Engineering an Ontology of “Cultural Factors”

Mizoguchi (1998) proposed three levels of ontologies: level 1 where an ontology is a structured collection of terms; level 2, comprising level 1 with formal definitions of concepts, relations and constraints which enable computers to make interpretations; level 3 ontology can be executed. The cultural factor ontology remains at level 1: a number of cultural factors likely to influence learning and/or instructional designers’ work have been identified and structured into four main categories. The following table presents an initial version of a list of factors generated by a literature review on the topic, as well as a research internship conducted at the *Virtual Center for Innovative Learning and Technologies (VCILT)* at the University of Mauritius in 2006. During this study, semi-structured interviews were conducted with nine instructional designers in order to inventory the cultural factors likely to influence learning in their practice of instructional design.

Table 1 presents factors organized into four main categories. They pertain to learners, human interactions, resources for learning and teaching and learning environments. Each of these categories is associated with sample factors.

Table 1: Four Categories of Cultural Factors

Examples of Cultural Factors	
Cultural Context	<b>Learner</b>
	Motivation ValORIZATION of formal education Locus of control Attitude towards school work
	Values Values (Hofstede’s dimensions)
	Perceptions Cultural stereotypes Attributional Process
	Learning Styles Learner = passive or active in the world
Cultural Context	<b>Human Interactions</b>
	Professor-Learners Expectations – Respective roles (Eg. Prof. = model or mentor) Behaviorist vs socio-cultural orientation
	Learner-Learners Competition vs collaboration (individualism vs collectivism Hofstede)
	Learner-Family ValORIZATION of school work Family obligations
Cultural Context	<b>Learning Objects</b>
	Granularity Atomic object vs aggregation (quantity of culture)
	Flexibility Content = fixed vs = flexible
	Significance Symbols, pictures, icons, signs = culture specific vs universally recognized
Cultural Context	<b>Learning Environments</b>
	Types Pedagogic community vs online distributed
	Teaching and learning rituals Individualised vs community-based learning Learner = passive vs = active in the world Communication patterns
	Orientations Behaviorist vs socio-cultural orientations Accent on product or on process
	Interface Significance = culture specific vs universally recognized

The importance of context must be highlighted since it has an impact on each category. Moreover, it has an effect on the design of scenarios where the elements of such categories converge.

The elements that make up the cultural context refer to those presented above in Figure 1, that is symbols, heroes, rituals and values.

### **3.1.1 The Learner**

Learners' sources of motivation vary from one culture to another. For example, the value of formal education, especially for those of the female gender, differs in African and North American cultures. Not all learners feel that they can control their destiny in their roles of students. In certain cultures, individuals' fate is pre-determined and they are left with little control over their destiny. Their attitude towards schooling can be significantly affected and, in our opinion, it is essential to consider such factors when attempting to maintain high motivation levels for these different learners.

Learners' values are most likely to affect their learning and attitudes towards the competencies to be developed. Hofstede (1980) suggested four main facets for culture, and a fifth was subsequently added. They are the following: 1) Power Distance (i.e. the "submitted's" level of acceptance that power is shared unevenly), 2) Individualism vs. collectivism, 3) Masculinity vs femininity, 4) The uncertainty avoidance index and, 5) Long term orientations. These facets are considered in this study in order to identify factors that influence learning.

Learners' perceptions must also be considered. For instance, there are cultural stereotypes that can influence learners' behaviour when interacting with peers from different cultural backgrounds. Gunawardena, Wilson and Nolla (2003) cite Chen and Starosta (1998) who noted that the influence of culture on perception is often reflected in the attributional process. They specify that attribution means that we interpret the meaning of others' behaviours based on our past experience or history.

Learning styles vary from one culture to another. In certain cultures, learners must remain passive while in other cultures, they are expected to play an active role, interact with professors and build knowledge. As stated by Gunawardena, Wilson and Nolla (2003), *the instructor and the individual student bring to the course a set of non-negotiables inherent in their own cultures. These include language, beliefs, preferred methodologies and learning styles, knowledge and skill base, and attitude about learning.*

### **3.1.2 Human Interactions**

What about instructors' expectations towards learners or learners' expectations towards their professors? Reeves & Reeves (1997) address such issues and stress that the fundamental instructional values of one culture can be inappropriate in another culture. For example, they refer to the behaviour of students' apprehension to ask questions about the material presented, or their attempts at challenging instructors. Such behaviour may be accepted in North America, yet it would be unseemly in many European countries. In order to identify such factors, four main types of interactions will be considered: professor-learner, learner-learners, learner-family and learner-social environment.

Furthermore, regarding human interactions, Gunawardena, Wilson and Nolla (2003) add that *if we subscribe to the view that knowledge is socially constructed (Vygotsky, 1978), then the group interaction becomes critically important and becomes part of the design.*

### **3.1.3 Learning Objects**

According to Wiley (2002), in order to be reused, LOs should be as neutral as possible. However, students need certain references or anchors for learning to occur and LOs must be presented in a context that is meaningful to them. The results found during the aforementioned research study, conducted at University of Mauritius, support such a concept: all designers interviewed admit to working for a diversified clientele and most of them claim that they specifically consider this element when scripting; eight of nine designers mention that the material they use has to be adapted to their local context and they believe that culture influences the design of LOs; most of them consider that the reuse of certain LOs can be difficult and cite “adaptation to the local context” as the reason therefore. The granularity of LOs becomes an important cultural factor and needs to be considered because, contrary to aggregated resources, atomic resources are less likely to be burdened with content that is loaded with strong cultural connotations.

Yet another factor to be considered is the flexibility of resources, as well as the orientations that guide their design (behaviourist vs. socio-cultural orientations), which can vary from one culture to another. According to Wild (1999) *the artefact or instructional product the designer produces “embodies cultural influences such as the instructional designer’s world view, their values, ideologies, culture, class and gender, and their commitment to a particular design paradigm (cited in Gunawardena, Wilson and Nolla, 2003).*

Finally, the level of significance of resources must be taken into account, given that the symbols, signs and pictures which are used are not always recognized universally. Certain culture-specific symbols can become a hurdle to learning for those of another culture. For instance, the significance of colours varies considerably from one culture to another.

### **3.1.4 The Learning Environment**

According to Sanchez & Gunawardena (1998), the heterogeneity of cultures and learning styles must become the starting point of learning environments, in order to provide rich learning experiences for learners from a variety of backgrounds. It is thus clear that, considering cultural variables has become necessary to the development of distance learning environments and that current technological means can facilitate such tasks.

As for the learning environment, we consider types, teaching and learning rituals, orientations as well as the particularities of the interfaces.

The expression “teaching and learning rituals” refers, for example, to the types of learning that learners are used to; for instance: are they used to being passive or active in the world? Are they used to individualised or community-based learning? According to McLoughlin and Oliver (2000), *the community of inquiry approach (Lipman, 1991) with its emphasis on collaboration, shared experience and*

*participation, offers a robust theoretical basis for the design of culturally specific environments.* However, we feel that the willingness of actors, within the learning environment, who adopt such practices may differ from one culture to the other. Communication rituals are also part of this category of factors. Silence is interpreted differently from one culture to another and politeness rules vary (Johnson, 2005). In these environments, communication spaces must be planned according to such differences.

Marcus and Gould (2000) point out that Website metaphors, mental models, navigation, interactions or appearance can confuse, or even offend, or alienate users (cited in Gunawardena, Wilson & Nolla, 2003). This is also true for virtual learning environments and the cultural particularities of the interfaces must be taken into account in the instructional design process. For instance, certain authors recommend providing learners with the option of modifying the user interface to suit their preferences.

We consider that “culturally sensitive” (Powell, 1997) instructional designers’ tasks consist of designing according to these four main categories of factors. Moreover, according to Goodear (2001), the development of a learning environment that respects cultural variables becomes a responsibility that must be shared among instructors, designers/developers, administrators and learners.

#### **4. Future Works**

We believe that a methodology to process cultural variables in instructional design will better equip instructional designers, thus promote more authentic learning, improve scenario effectiveness and offer access to equitable education, as “*all persons are entitled to quality education and training that fully respects their cultural entity*” (UNESCO, 2002). We also consider that such a method can enhance resource reusability by indexing scenarios according to their cultural variables.

Consequently, we propose: 1) a “cultural diversity” KB that can be exploited by 2) a “Cultural INDEED” (Cultural INstructional DEsign to Enable Diversity) system, in order to support designers in their revised task and 3) a methodology that embeds cultural variables into the instructional design process.

##### **4.1 Formalization of the Ontology and Knowledge Base Instantiation**

Once the level 1 ontology (Mizoguchi, 1998) is validated, its formalization will begin in order to bring the “Cultural Factors” Ontology up to level 2 (Mizoguchi, 1998) and enable computer-assisted interpretations. The culture KBs will then be instantiated.

##### **4.2 The “Cultural INDEED” System**

The “Cultural INDEED” system will support instructional designers in carrying out novel instructional design tasks. The developed functionalities will allow these

professionals to primarily consider cultural variables, while designing and/or adapting training scenarios. Contextualized help features will make it possible to query LO repositories as well as knowledge bases for the various cultures concerned. Catalogue and research functions will allow for the indexing of pedagogical scenarios according to their cultural variables, as a complement to the standards already in place.

#### **4.3 A Method to Process Cultural Variables in Instructional Design**

The main themes of the processing methods of cultural variables in instructional design are decision steps actually identified according to the generic steps of an instructional design process: analyze, design, develop, implement and evaluate. Such decision steps will allow interactions between instructional designers and “Cultural INDEED” to produce instructional scenarios that respect cultural variables while fostering authentic learning. The proposed method for processing cultural variables will thus generate a space to organize the various tools developed.

### **5. Conclusion**

As mentioned above, we believe that cultural variables must be considered in the instructional design process and that designers must be provided with appropriate tools. This paper presents a solution for a culturally-aware authoring process and outlines the iterative processes required to develop such a solution. The “Ontology of Cultural Factors”, at the heart of this research project, is considered a potentially useful tool. The earliest steps of the conceptualization efforts carried out for this ontology have been presented. Cultural factors that can influence learning and/or instructional designers’ tasks have been identified and a first set of organized factors has been introduced. Through the Q4R-Quality for Reuse ([www.Q4R.org](http://www.Q4R.org)) project, the international community will be consulted regarding the identified factors. After such consultations, the ontology of cultural factors will be conceptualized and validated. Once the Cultural Factors ontology is formalized, it will be used to instantiate the KBs for the selected cultures. Such instantiations will form the “Cultural Diversity” KB.

The “cultural diversity” knowledge base will be used by the “Cultural INDEED” system to help designers adapt their work and consider cultural variables when they design learning scenarios, environments, and resources. It is our hope that such a solution will indirectly provide learners with richer, more equitable and more authentic learning experiences.

### **Bibliography**

- Cuche, D. (2004). La notion de culture dans les sciences sociales. Paris.
- Goodear, L. (2001). Presentation of Findings 2001 Flexible Learning Leaders Professional Development Activity: Cultural Diversity and Flexible Learning [Electronic Version] from:

[http://www.flexiblelearning.net.au/leaders/events/pastevents/2001/statepres01/papers/l\\_goodear.pdf](http://www.flexiblelearning.net.au/leaders/events/pastevents/2001/statepres01/papers/l_goodear.pdf)

- Gunawardena, C. N., Wilson, P. L., & Nolla, A. C. . (2003). Culture and online education. In M. M. a. B. A. (Eds.) (Ed.), *Handbook of distance learning* (pp. 753-775). Mahwah, NJ: Lawrence Erlbaum Associates.
- Hofstede, G. H., J.G. (2005). *Cultures and Organizations: Software of the Mind* (Revised and Expanded 2nd Edition ed.). New-York, NY: McGraw-Hill.
- Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.
- Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Beverly Hills, CA: Sage.
- Kroeber, A. L., Kluckhohn, C. (1952). Culture: A critical review of concepts and definitions. In *Papers of the Peabody Museum of American Archaeology and Ethnology* (Vol. 47). Cambridge, MA: Harvard University Press.
- Man, S. (2004). Are Preservice Instructional Designers Adequately Prepared For Tomorrow's Diverse Learning Audience? A Cultural Analysis of Textbooks (1993-2003) Used for Instructional Design, University of South Florida, Florida.
- McLoughlin, C. (2006). Adapting E-Learning across Cultural Boundaries: A Framework for Quality Learning, Pedagogy, and Interaction. In A. Edmundson (Ed.), *Globalized E-Learning Cultural Challenges* (pp. 223-238). Hershey, USA: Information Science Publishing.
- McLoughlin, C., & Oliver, R. (2000). Designing Learning Environments for Cultural Inclusivity: A Case Study of Indigenous Online Learning at Tertiary Level. *Australian Journal of Educational Technology*, v16 n1 p58-72 Fall 2000.
- Mizoguchi, R. (2004). Le rôle de l'ingénierie ontologique dans le domaine des EIAH. *Revue STICEF*, 11.
- Mizoguchi, R. (1998). A Step Towards Ontological Engineering. Paper presented at the 12th Conference on AI of JSAI.
- Paquette, G. (2002). *Modélisation des connaissances et des compétences pour concevoir et apprendre*. Sainte-Foy, Québec: Presses de l'Université du Québec
- Powell, G. C. (1997). On Being a Culturally Sensitive Instructional Designer and Educator. *Educational Technology*, v37 n2 p6-14 Mar-Apr 1997.
- Reeves, T., Reeves, P.M. (1997). The effective dimensions of interactive learning on the WWW. In B. H. Khan (Ed.), *Web-based instruction* (pp. 59-66). Englewood Cliffs, NJ: Educational Technology.
- Sanchez, I., Gunawardena, C.N. (1998). Understanding and supporting the culturally diverse distance learner. In C. C. Gibson (Ed.), *Distance learners in higher education* (pp. 47-64). Madison, WI: Atwood Publishing.
- UNESCO. (2002). Déclaration universelle de l'UNESCO sur la diversité culturelle. From <http://unesdoc.unesco.org/images/0012/001271/127160m.pdf>
- Wiley, D. (2002). *The Instructional Use of Learning Objects*. Bloomington, Indiana: Agency for Instructional Technology and Association for Educational Communications and Technology.

## **Short Papers**



# Sociocultural Interfaces for E-Learning

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**Abstract.** We hereby introduce a doctoral research project involving a multi-disciplinary approach to create socio-cultural interfaces for e-learning systems. The interfaces in this project will be adapted according to the user's sociocultural preferences. The model modeling of these interface system we will use is an ontology in order to broaden the specifications of the user's sociocultural profile. For organizing this interface, the interface menus and objects will take into account the sociocultural dimensions of users. The ontology will be developed in OWL-DL, using the Protégé ontology generation tool. We will present the context of this project with the principles drawn from research of cultural dimensions and usability studies in relation to sociocultural differences and how ontology can be used to make e-learning systems more accessible.

**Keywords:** e-learning, interfaces, ontology, profile, sociocultural.

## 1 Introduction

The web-based e-learning systems have been more and more incorporated to the knowledge acquisition process, as a mediation tool between the user and his knowledge. This is why e-learning has been increasing in a very significant way. It so happens mainly due to the development of e-learning systems that are more and more adaptable to the user's profile, favoring the knowledge acquisition process. The development of e-learning systems differs from the development process of other systems. It is aimed at responding to the specific needs of users, thus requiring teams of specialists such as: psychologists, educators, anthropologists, sociologists, system analysts, Web-designers, programmers and technicians who are responsible for Web security and marketing. That is why the making of e-learning systems through the Web has been increasingly adjusted to the users characteristics and becomes a rather complex and a challenging task to be overcome. Taking into consideration the spreading and use of such systems in the e-learning process, the interface takes on a very important role, because it is through this interface that interactions between user and objects of knowledge are made. The interface of learning systems must center on the

communication processes that are taking place and, consequently, make the learning process easier.

## **2 Motivation**

Our problem is the usability of e-learning systems in cross-cultural context, where they do not take enough into account the users' culture. Our investigation began where students were faced with difficulties of the use of e-learning systems created outside Brazil. Considering the importance of interaction in e-learning systems and the cognitive processes which are involved in the interaction, we thought it was important to adapt the design of interfaces to the culture of the users, so to create more effective systems. For Evers (2002) the importance of the language, metaphors, symbols and colors have different understandings in different cultures. According to this, we will develop an ontology that intends to describe cultural constraints and to ensure the sociocultural personalization of users in e-learning systems. When using ontologies for the specification of the interface elements and the cultural dimensions, we will try to integrate in the e-learning system a model of the sociocultural profile of Brazilian users according to Hofstede.

## **3 Methodology**

Because of increased interest nowadays in the customization of users on e-learning systems, this strengthened the need for effective means of modeling the users profile. In our research, we have chosen to develop a sociocultural profile model for e-learning user through an ontology, following the new trends in information and communication technologies, in a trial to better customize them (Razerita, 2003 and 2004) and in accordance to the semantic Web endeavor (Berners-Lee et al. 2001).

To construct the ontology we used OWL DL, since it is sufficient to formalize the domain knowledge, in order to specify which resources are fittest to be used to compose the interface for different user types of an e-learning system. This will enable to decide on resources that should be part of an interface, in order to personalize an e-learning system to Brazilian users. In order to establish the interface adaptation criteria on the basis of the sociocultural information present on the ontology, we will carry a survey with the e-learning students, aiming to know which are their preferences in terms of layout, the interface elements, language, colors, texts, animations, multimedia, symbols, as well as their preferences in communication tools in the e-learning systems. Thus, we conducted interviews with a group of users, in order to discover these preferences.

Based on the knowledge acquisition about those user preferences we will be able to obtain a conceptual basis, from which we can model and populate an ontology that can track these users sociocultural profile. The questions used to assess the cultural profiles in the study were developed based on cultural identified dimensions by Hofstede (1991). One of these questions, for instance, is about the demographic identification, layout, communication tools, symbols, colors, etc.

The contributions concerning the impact of dimensions cultural in interface web site design are described by Marcus (2000), in study for effects of culture on usability

interface, also were part of our search. Based on the sociocultural profile information from interface users, an e-learning prototype interface will be constructed, supported by a set of guidelines proposed in the students interview.

#### 4 Ontology

The word «ontology», originates from the «philosophy» used by Aristotle to define the study of the “being qua being”. Sowa (2006) mentions it when classifying what exists or may exist in a specific domain of knowledge. The word «ontology» has been widely used in the Computer Science nowadays and its concept may vary according to its applicability. It was first introduced in Artificial Intelligence by Neches et al (1991), where he defines ontology as «the basic terms and relations comprising the vocabulary of a topic area, as well as the rules for combining terms and relations to define extensions to the vocabulary». The best-known definition of ontology was the one given by Gruber (1993), who defines it as follows: «ontology is an explicit specification of a conceptualization». Uschold and Gruninger (1996), on the other hand, define it as «a shared understanding of some domain of interest». Perez (2002), however, defines it as a collection of what exists at a certain domain of knowledge, with its concepts, relations, axioms, functions and instances. Maedche (2002) shows a rather formal concept of ontology which is expressed by the form  $O = \{C, R, I(C), I(R), A\}$ , where C and R are two disjointed collections, where C is used to represent the concept or classes collection of a certain domain and R represents a collection of relations among these concepts or classes. The I(C) represent a collection of instances from the concepts in C and the I(R) represent a collection of relations for each relation in R; the A represent a collection of axioms expressed in a suitable logical language that refers to the concepts and relations defined in O. There are some languages to represent the ontology such as the Web Ontology Language (OWL) (OWL, 2004) origin from DAML+OIL. The OWL allows the description of ontology, according to the norms defined by the W3C, making it possible to define a collection of classes, relations, as well as restrictions in interpretation through axioms. The OWL characteristic is its robustness once it possesses better facilities to express meanings and semantics than XML, RDF and RDF Schema, even though it is based on RDF and RDF Schema using the XML syntax. OWL is fit for use in applications that need to process the information contents, instead of only presenting the visualization of such information. OWL is divided in three sub-languages: OWL DL, OWL Lite, and OWL Full. On our research, we have chosen to work with OWL DL because this one is sufficient for the knowledge domain to be rendered formal, especially for imposing restrictions on the resources use.

The ontologies are, nowadays, the model tool for the description of user's profiles in communication and information systems via Web. Through these ontologies, we describe the user's profiles and make inferences adding new information about the profile of a specific user (Dolog et al. 2004). That is why the use of ontologies has become useful in our purpose of sociocultural user's personalization in e-learning systems. When using ontologies on the specification of interface elements, as well as on the cultural dimensions, we will be allowing the modeling of sociocultural profile of users in the Brazilian culture on e-learning systems. Following the new trends of

information and communication technologies and thus making them better personalized, as well as in accordance to the Semantic Web purpose (Berners-Lee et al., 2001), research has been conducted on the use of ontology aiming to structure concepts and the collection rules of inference. This will enable to deduct resources automatically, in order to offer new possibilities on the personalizing of new systems for those users of communication and information technologies (Razmerita, 2003, 2004). The Web is viewed as rather focused to the processing and organization of information, in a way that is also more intelligible by machines.

## 5 Culture

Culture is a concept that allows multiple definitions. Rose (2001) regards it as complex and diversified, as resulting from the interest specialists in social science have, which is based in patterns upon which the different ways of life are associated, from the concepts people have about themselves and the practices originated from such ideas. Culture may be understood as a collection of values, ideas, beliefs and social guidances formed by memory, identity and future vision, which are supported by one or more national languages, embodied within traditions, habits and manners more or less institutionalized, shared by most of the members of a community or society (Bouchard, G. et al., 2007). Culture is a collective programming of the mind that allows us to differentiate the members of a group from the others (Hofstede, 1991).

The anthropologist Hofstede (1991) points out some of the characteristics that are perceivable and differing in people's culture, after having carried through research on culture within organizations in several countries. With the purpose of turning the concept of culture into operational, he has classified the cultures according to their dimensions: i) Power distance : refers to the degree individuals with less power have in accepting the inequality in the distribution of power; ii) Individualism : mentions the degree in which the culture places the individual himself and the familiar nucleus in evidence in relation to the society as a whole, opposing collectivism to the individualism; iii) Masculinity : refers to the degree up to which the masculine roles in ascension and competition are placed in evidence, opposing feminism to the masculinity; iv) Uncertainty avoidance: refers to the degree of anxiety individuals have towards uncertainty; v) Long-term orientation : refers to the degree of acceptance of the society in whether adopting or not long-term commitments as well as its traditional values.

The study points out the culture as being reflecting of different perceptions of the world, where we may consider culture as the mirror that reflects the way people see the world. People have different ways to analyze and interpret the facts according to the culture they are inserted in, therefore, depending on the type of culture people are from, the individuals have distinct viewpoints upon a specific fact, and the interpretation of this fact depends on the cultural rules of the group they belong to. The cultural rules absorbed by cognizance draw individuals to different kinds of behavior about a fact in particular, causing them to be differentiated one from another.

## 6 Conclusion

Considering the importance of interactions in e-learning systems and the socio-cognitive processes which involve these interactions, the use of interfaces adapted according to the culture they are destined, contributes to create more effective systems. The ontology took an important role on the specifications of the interface elements when it permits the adaptation to the user's culture. We expect this work to be contributing in the process of customization of users on e-learning systems through sociocultural model of users based on ontologies.

## References

- Badre, A.N. and Barber, W. (1998). Culturability: The Merging of Culture and Usability. In Proceedings of 4th Conference on Human Factors & the Web.
- Berners-Lee, T., Hendler, J. et Lassila, O. (2001). The Semantic Web. In: Scientific American, May, 2001.
- Bouchard, G. et al. (2007). La transmission de la culture : les enjeux du present, Journal le Devoir, Un cahier special de l'Institut du nouveau monde. January 20, 2007.
- Dolog, P.; Henze, N.; Nejdil, W. and Sintek, M. (2004 ). Personalization in Distributed e-Learning Environments. In Proc. of WWW2004 - The Thirteenth International World Wide Web Conference, May 2004.
- Evers, V. (1998). Cross-cultural understanding of metaphors in interface design. In Ess, C. and Sudweeks, F., Proceedings CATAC'98, Cultural Attitudes towards Technology and Communication, 1-3 August, science Museum, London. University of Sydney.
- Evers, V. and Day, D. (1997).The role of culture in interface acceptance. In S. Howard, J. Hammond and G. Lindegaard (Ed), Human Computer Interaction INTERACT'97. Chapman and Hall, London.
- Gruber, T. (1993). A Translation Approach to Portable Ontology Specifications. Knowledge Acquisition, 5(2), 199-220.
- Hofstede, G. H. (1991). Cultures and organizations: software of the mind. London. New York, McGraw-Hill.
- Maedche, A. (2002), Ontology Learning for the Sematic Web. Kluwer Academic Publishers.
- Neches, R.; Fikes, R. E.; Finin, T.; Gruber, T R.; Patil, R.; Senator, T. and Swartout, W. R. (1991). Enabling technology for knowledge sharing. AI Magazine, 12, 35-56.
- OWL (2004). OWL Web Ontology Language Guide. Accessed online, April 2, 2007, <http://www.w3.org/TR/2004/REC-owl-guide-20040210/#OwlVarieties>
- Peréz, A. G. & Corcho, O. (2002). Ontology Languages for the Semantic Web. IEEE intelligent systems.v. 13, n. 1, p. 54-60. January 2002.
- Razmerita, L. V. (2003). Modèle Utilisateur et Modélisation Utilisateur dans les Systèmes de Gestion des Connaissances: une Approche fondée sur les Ontologies, Thèse doctorat, Présentée a l'IRIT Toulouse, France.
- Razmerita, L. e Gouarderes G. (2004). Ontology-based User Modeling for Personalization of Grid Learning. Services, Grid Learning Services Workshop (GLS 2004) in association with Intelligent Tutoring System Conference, ITS 2004, Brazil pp.105-115.
- Rose, G. (2001).Visual Methodologies: An Introduction to the Interpretation of Visual Materials. Thousand Oaks, CA: Sage.
- Sowa, J. F. (2006). Ontology. Accessed online, March 3, 2006. <http://www.jfsowa.com/ontology/>
- Uschold, Mike & Michael Gruninger. 1996. Ontologies: principles, methods and applications, The Knowledge Engineering Review 11(2). pp. 93-136.



# Extending ITS Authoring Tools to be Culturally Aware

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**Abstract.** Intelligent tutoring systems have been successful at fostering learning, and hence are being increasingly used to provide distance learning. Several studies show that culture affects the way people learn and interpret information. However, despite these studies, most of the existing systems have not been designed to be sensitive to culture. Bridging the gap between culturally-aware systems and existing intelligent tutoring systems is a formidable task given the complexity of existing ITSs. In this paper, we discuss the template feature of the Assistment system as a simple prototype for extending existing ITS authoring tools to be culturally aware. The template feature currently allows the author to not only include culturally-specific elements, but also to define and use relevant culture-bearing units. Further, we suggest that implementing this feature is cost effective, and does not negatively impact content creation time.

**Key words:** culturally aware, authoring tools

## 1 Introduction

Although intelligent tutoring systems are being used for distance learning, these systems have not been designed to be culturally sensitive despite evidence that culture has implications on how people learn and interpret information [3]. Extending existing ITS authoring tools to be culturally aware is a challenge due to the complexity of these tools, the cost for extending them, and the expected increase in content creation time. In this paper, we present the template feature of the Assistment system as a simple prototype for extending existing ITS authoring tools to be culturally aware. While this feature has similarities to the authoring tool described by Blanchard et al. [2], it is important to notice that enabling the production of culturally-aware content is one of its several uses, and that since this feature is an extension of an existing authoring tool, it is limited in its scope in targeting cultural contexts.

## 1.1 The Assistment Project

The Assistment project is a joint research effort by Worcester Polytechnic Institute and Carnegie Mellon University. The Assistment system assists while it assesses. It assists students in acquiring different skills through the extensive framework of scaffolding questions, hints, and incorrect messages [5]. Assessment of student performance is provided to teachers through real-time reports based on statistical analysis. The Assistment Builder is used to build assistments that are then assigned to students. The use of simplified “pseudo-tutors” in the Assistment system has been able to reduce the time required to build a single hour of content from 100 to 1000 hours to 10 to 30 hours [6], [4]. The pseudo-tutors in our system (i.e., a problem with any scaffolding) are called “assistments,” and each assistment consists of a single main problem, hints, scaffolding problems, and buggy messages [6].

## 2 Variabilized Templates in the Assistment system

The template feature of the Assistment system allows authors to build variabilized templates that can be used to generate isomorphic content and to introduce contextualization of assistments [7]. The goal of the work presented in this paper is to provide the authors in the system an easy-to-use tool to build content sensitive to culture.

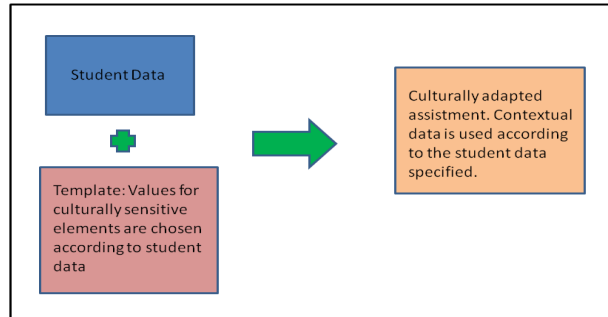
### 2.1 Culturally Aware Templates

Figure 1 shows the basic functioning of culturally aware templates — templates that are adapted according to culture. The three parts involved are a repository of student specific data obtained from user profiles of students in the system, the culturally aware templates created using the Assistment Builder, and a run-time system that retrieves student data and adapts the content based on culturally specific information.

### 2.2 Building Culturally Aware Templates

Templates in the Assistment system are supported by the concept of variables which are placeholders for elements that vary across otherwise similar assistments. In this case, variables relate to contextual data that varies with culture.

Each variable in a template has a name and a value. To associate a variable with user data, its name has to take the form “x\_depends\_on\_y” which implies that the variable depends on the existing data called y. For example, “sport\_depends\_on\_country” implies that this variable depends on the country the student belongs to. This framework allows authors to either use traditional culture-bearing units or to define and use new culture-bearing units [1]. For instance, if the author wanted to extend the definition of cultures to “micro-cultures” like schools or states, variables like “activity\_depends\_on\_school” or “team\_depends\_on\_state” could be constructed and used.



**Fig. 1.** Culturally Aware Templates

Values of variables are used to adapt the contextual elements of a problem based on culture. For instance, if the system is used in three countries say the United States, India, and Canada, the variable “currency\_depends\_on\_country” can be defined to take the values of American dollars, rupees, and Canadian dollars respectively. This is defined using the syntax “default: dollars, United States: American dollars; India: rupees; Canada: Canadian dollars” where each country is followed by the appropriate currency and default signifies the default value for the currency. Figure 2 shows the construction of four such variables depending on the country of the student. Once defined, these variables can be used throughout the assistment using a special syntax of the form `%v{variable-name}`. Figure 3 shows a culturally aware template in which the the name of the person, currency, currency symbol, and sport is decided by the country of the student.

**Variables**

sport\_depends\_on\_country = {default: football; United States: soccer; India: cricket; Canada: hockey}  
Variable has string values. Drag ✎ 🗑️

---

currency\_depends\_on\_country = {default: dollars; United States: American dollars; India: rupees; Canada: Canadian dollars}  
Variable has string values. Drag ✎ 🗑️

---

name\_depends\_on\_country = {default: Jim; United States: Harry; India: Rahul; Canada: James}  
Variable has string values. Drag ✎ 🗑️

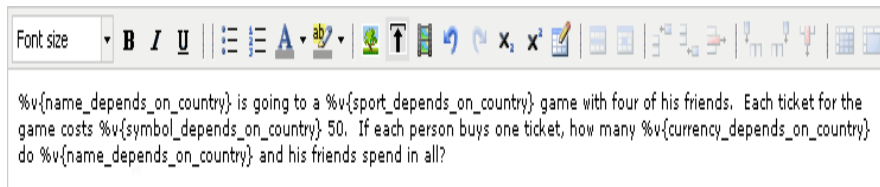
---

symbol\_depends\_on\_country = {default: \$; United States: \$; India: Rs; Canada: \$}  
Variable has string values. Drag ✎ 🗑️

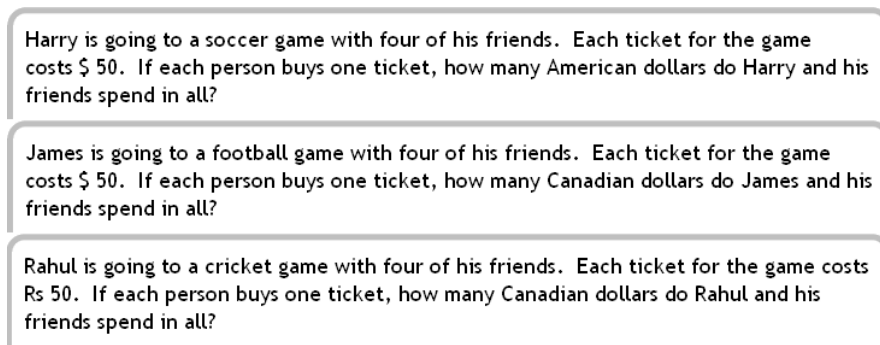
+ [New variable](#)

**Fig. 2.** Variables defined for use in the culturally aware template. Variables can depend on various user specific data; in this example, the variables depend on country.

Once a template has been created with the appropriate culturally dependent variables, it can be assigned to students. The run-time system retrieves student specific data relating to culture-bearing units and looks for variable values corresponding to this data. These value then adapt the template based on cultural information. For instance, if a student in India is using the system, the previous assistment would have “cricket” substituted for the variable “sport\_depends\_on\_country,” “Rahul” for “name\_depends\_on\_country,” “Rs.” for “symbol\_depends\_on\_country,” and “rupees” for “currency\_depends\_on\_country.” Figure 4 shows how the template assistment from Figure 3 is adapted for users in the United States, India, and Canada.



**Fig. 3.** A culturally aware template where the currency, sport, symbol, and name are defined based on the country the student belongs to.



**Fig. 4.** The main problems of three instantiations of the variabilized template

While Figure 4 shows a simple example involving the introduction of culturally specific contexts, an author can associate complete cover stories with culture-bearing units. Further, since variables are associated with individual assistments, the author can vary culturally specific information with different assistments.

### 3 Discussion and Conclusions

In this paper we present the templates feature of the Assistment system as a simple prototype for extending existing authoring tools to be culturally aware. Further we suggest that implementing this feature is easy and cost-effective. The implementation of culturally aware templates in Assistment involved the expansion of the system database to include detailed user profiles and to store variables. About 400 lines of Ruby code was required to support the building of culturally aware content. This suggests that extending existing authoring tools in this way is a feasible option that takes into account the cost and time required for extension.

### 4 Future Work

We plan to extend our tool to address deeper cultural contexts by altering the assistment structure and teaching techniques based on culture. We would also like to automate the process of providing culturally-specific data by having a repository of this data available as part of the system.

### 5 Acknowledgments

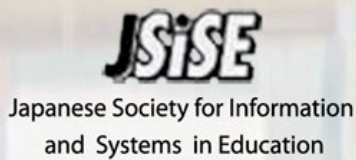
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### References

1. Chick, Garry: Culture-Bearing Units and the Units of Culture: An Introduction. *Cross-Cultural Research*. **35(2)** 91–108 (2001).
2. Blanchard, E., Razaki, R., Frasson, C.: Cross-cultural adaptation of e-Learning contents: a methodology. *International Conference on E-Learning*. (2005).
3. Hofstede, G.: *Cultures consequences: comparing values, behaviors, institutions, and organizations across nations*. 2nd edition. London: Sage Publications. (2001).
4. Koedinger, K. R., Alevan, V., Heffernan, N. T., McLaren, B. & Hockenberry, M. Opening the Door to Non-Programmers: Authoring Intelligent Tutor Behavior by Demonstration. *Proceedings of AI in Education*. 162–173 (2004).
5. Razzaq, Feng, Heffernan, Koedinger, Nuzzo-Jones, Junker, Macasek, Rasmussen, Turner & Walonoski.: A Web-based authoring tool for intelligent tutors: Assessment and instructional assistance. In Nadia Nedjah, Luiza deMacedo Mourelle, Mario Neto Borges and Nival Nunes de Almeida (Eds). *Intelligent Educational Machines*. Intelligent Systems Engineering Book Series. Heidelberg, Berlin: Springer. 23–49(2007).
6. Turner, T. E., Macasek, M. A., Nuzzo-Jones, G., Heffernan, N.T., Koedinger, K.: The Assitment Builder: A Rapid Development Tool for ITS. *Proceedings of ITS '05*. 929–931 (2005).
7. Vartak, M. P., Almeida, S. F., Heffernan, N. T.. Cost-Effective Content Creation with Variabilization. *Technical Report WPI-CS-TR-08-03*, Department of Computer Science, Worcester Polytechnic Institute, (2008).



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