INTERCULTURAL COLLABORATIVE LEARNING IN VIRTUAL WORLDS

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ABSTRACT

This chapter evaluates the potential of virtual worlds for intercultural collaborative learning. A case study of a global lecture series is presented that used a virtual world as a platform for intercultural student collaboration. Students' subjective reports served as a basis for exploring cross-cultural differences in the perceived usefulness of virtual worlds for intercultural collaboration, and to examine what they have learned from working in an intercultural virtual team, what problems occurred, and how they resolved them. Based on the evaluation results, suggestions are provided for a culture-aware design of virtual worlds to facilitate intercultural collaborative learning and the development of intercultural literacy.

Keywords: Virtual worlds; global virtual teams; cultural differences; intercultural literacy; culture-aware design

INTRODUCTION

Globalization has profoundly affected work and education in the 21st century. Universities have adopted their missions in response to the demands of

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globalized workplaces, and aim to produce "global citizens" with "global competencies" (Altenbach, Reisberg, & Rumbley, 2009). Intercultural literacy has become one of the core competencies in today's globalized world, and its development has been incorporated in many educational programs (e.g., the Bologna Declaration in Europe[1]). A growing number of universities are offering intercultural learning experiences to students by means of Internet-based distance education (Buchanan, Wilson, & Gopal, 2008; Chia, Poe, & Singh, 2008; Dorazio & Corey, 2007; Liu & Hannafin, 2010). The effective use of information and communication technologies is crucial for members of global virtual teams who collaborate from remote locations. Intercultural literacy and technological literacy are therefore equally important; and they are closely connected as any cultural discourse is directly or indirectly influenced by the essence of its technology (McMinn, 2009).

The chapter explores the potential of virtual worlds – in particular the role of embodiment in a shared three-dimensional (3D) virtual space as its essential component – to support intercultural collaborative learning. The first part of the chapter provides a conceptual definition of "intercultural collaborative learning" and "intercultural literacy," and discusses the core elements of virtual worlds from a cross-cultural perspective. In the second part, a case study of a global lecture series is presented that used a virtual world as a platform for intercultural collaboration between students from 18 universities worldwide. As part of this large-scale international field study, cross-cultural differences are examined between Asian, European, and Arab students regarding their perceptions of avatar-based collaboration in virtual worlds. These findings serve as a basis to derive suggestions for a culture-aware design of virtual worlds as intercultural learning environments. In addition, students' reports are analyzed on what they have learned from working in an intercultural virtual team, what problems occurred, and how they resolved them. These evaluation results lead to a discussion of what needs to be considered in designing virtual worlds for intercultural student collaboration as an effective platform to foster intercultural literacy.

INTERCULTURAL LITERACY AND INTERCULTURAL COLLABORATIVE LEARNING

Intercultural Literacy

Heyward (2002) defines intercultural literacy as a multidimensional construct including the competencies, understandings, attitudes, language

proficiencies, participation, and identities that are necessary for successful living and working in a cross-cultural environment. According to Heyward (2002), the interculturally literate person is able to effectively ''read a second culture, to interpret its symbols and negotiate its meanings in a practical day-to-day context'' (p. 10). Lack of intercultural literacy, on the other hand, leads to ''misunderstandings and intercultural blunders that can be extremely costly to both individuals and organizations'' (p. 10). Table 1 shows Heyward's (2002) developmental model of intercultural literacy with descriptors of its lowest and highest levels.

Intercultural Learning

The development of intercultural literacy requires the individual to learn what culture is by reflecting on his or her own culture, by learning about other cultures, and how to engage successfully with members of other cultures in various social contexts. Thus, intercultural learning takes place

Table 1. Heyward's (2002) Model of Intercultural Literacy.

	Descriptions	
Dimension	Lowest level	Highest level
Understandings	Unaware of own culture or of the significance of culture in human affairs.	Aware of how cultures feel and operate from the standpoint of the insider.
Competencies	No significant intercultural competencies.	Competencies include mindfulness, empathy, perspective taking, tolerance, and communication.
Attitudes	Assumes that all groups share similar values and traits.	Attitudes are differentiated, dynamic, and realistic, and demonstrate an overall respect for integrity of cultures.
Participation	No significant participation and unawareness of cultural dimension of contact.	Well-established cross-cultural friendships and/or working relationships.
Language proficiencies	No significant second language competencies.	Bilingual or multilingual understanding and proficiencies.
Identities	Unformed cultural identity.	Identities are bicultural, transcultural, or global; ability to consciously shift between multiple cultural identities.

through the experience of confronting oneself in a cross-cultural situation (Heyward, 2002). Intercultural learning environments need to be designed in a way that will enable equal participation of members from different cultures, in order to make students aware of their own and foreign cultures, to increase their understanding, to give them the opportunity to develop competencies, to increase their language proficiencies, and to eventually form transcultural or global identities.

Collaborative Learning

A collaborative learning approach appears to be most suitable to provide students with the opportunity to practice effective collaboration in culturally diverse groups. Collaborative learning can be best understood by its distinction from cooperative learning: Learning in cooperative groups takes place individually and involves mostly asynchronous group activities. Group members divide their work, complete subtasks individually, and assemble the partial results into a final group output. In contrast, collaborative learning occurs in coordinated, synchronous activities in which group members collaboratively construct knowledge through negotiation and sharing (Dillenbourg, 1999; Stahl, Koschmann, & Suthers, 2006). Dillenbourg (1999) explains collaborative learning in terms of four critical aspects: situation, interactions, processes, and effects, with bidirectional links among them. For instance, he defines the collaborative situation as a kind of *social contract* between individuals, which specifies the conditions under which some types of interactions *may* take place, yet there is no guarantee that they will actually occur. Hence, the general concern in collaborative learning is to trigger learning mechanisms and to increase the probability for desired types of interaction and positive learning outcomes to occur.

Intercultural Collaborative Learning

If we integrate the above definitions, intercultural collaborative learning refers to intercultural *situations*, in which members from different cultures *interact* in coordinated, synchronous activities with joint efforts and common goals. The *process* in which individuals negotiate and share meanings is expected to lead to positive *effects* regarding the above-mentioned dimensions of intercultural literacy. In contrast to cross-cultural

trainings in which the development of intercultural literacy is the main learning goal, it could emerge as a side effect in intercultural collaboration, which in turn may primarily focus on other (academic) subjects. While this definition of intercultural collaborative learning leaves it open whether the interaction takes place face-to-face (FTF) or computer-mediated, the focus of the chapter lies on cross-cultural interactions in virtual worlds.

POTENTIAL OF VIRTUAL WORLDS FOR INTERCULTURAL COLLABORATIVE LEARNING

Virtual worlds provide new ways for individuals to meet and collaborate from remote locations using graphical representations of themselves (i.e., avatars) in a shared virtual environment. Users can design the appearance of their avatar (e.g., by modifying gender, ethnicity, body shape, hair, and clothes), move their virtual bodies, and jointly look at and manipulate objects in a shared 3D virtual space. They can communicate verbally via text and voice chat, and display nonverbal behaviors by changing the position of their avatar, and choosing from a set of postures, gestures, and facial expressions. These analogies to FTF communication are assumed to create a sense of copresence among interacting users, that is, a feeling of ''being there together'' in a virtual room (Schroeder, 2006). In addition, there are various features that go beyond the simulation of FTF communication, and enable us to overcome the restrictions of the physical world; for example, cultural identity switch by changing one's avatar appearance, or interaction with nonplayer characters controlled by artificial intelligence. These characteristics of virtual worlds open interesting new opportunities for cross-cultural training and intercultural collaborative learning.

Up to the present, only a few case studies on intercultural learning in virtual worlds have been published (Prasolova-Førland & Wyeld, 2008; Wyeld, Prasolova-Førland, & Chang, 2006). Other approaches to cross-cultural trainings in 3D virtual environments can be found in the ''serious games'' literature (Ogan, Aleven, Kim, & Jones, 2010; Warren, Sutton, Diller, Leung, & Ferguson, 2005), some of which described the use of nonplayer characters for cross-cultural role-playing scenarios (Sims, 2007; Zielke et al., 2009). Only one study had been found, which evaluated the development of intercultural literacy in cross-cultural encounters in virtual worlds. Diehl and Prins (2008) applied Heyward's (2002) model of intercultural literacy to interview responses of participants in cross-cultural

language learning activities in *Second Life*. The authors conclude that such activities enhanced intercultural literacy in terms of "fostering use of multiple languages, cross-cultural encounters and friendships, greater awareness of insider cultural perspectives, and openness towards new viewpoints" (p. 101). They also observed that participants modified their avatar appearance in order to construct and shift cultural identities.

Although the potential of virtual worlds for cross-cultural training has been recognized, it is still unclear how virtual worlds need to be designed in order to enhance the intercultural collaborative learning experience, and to foster sustainable, positive learning outcomes. As a first step in this direction, we need to take a closer look at the core elements of virtual worlds from a cross-cultural perspective.

Virtual Space and Place Metaphors

Three-dimensional virtual spaces provide a more vivid and realistic environment compared to 2D representations, and facilitate the creation of a more correct and complete mental model of a collaborative task at hand (Chittaro & Serra, 2004). In line with this assumption, Wyeld et al. (2006) found that the 3D aspect led to more active social involvement and concretization of the performed activities in an intercultural collaboration task in a virtual world.

Virtual architecture always serves – whether intentionally or unintentionally – as a place metaphor and provokes specific types of social behavior. For example, a virtual room that is designed like a lecture hall is likely to trigger similar social norms as in a physical lecture hall, whereas a very different type of social behavior is expected in a virtual space designed as a leisure park. Prasolova-Førland (2008) provides a framework for analyzing place metaphors in virtual worlds for different educational goals, including the factors of appearance (e.g., real vs. abstract), structure (e.g., relationships between different parts of the environment), and roles (e.g., meeting or information place). The framework has been applied in case studies that evaluated place metaphors of a 3D virtual campus (Prasolova-Førland, 2008), and a 3D "virtual stage" for educational role-play and socialization (Prasolova-Førland & Wyeld, 2008; Wyeld et al., 2006).

Cross-cultural meetings in the real world always take place in a specific cultural environment, which determines the social conventions and rules that visitors are expected to follow. Similar effects may be found in virtual worlds that are designed according to physical-world models. In contrast to

the physical world, virtual worlds offer the possibility to design culture-neutral spaces. Whether a virtual space is designed in a culture-specific or culture-neutral way, should be a conscious decision of the virtual world designer depending on the purpose of the cross-cultural meeting. It remains unclear whether cultural distances diminish in a culture-neutral virtual world and become more salient in a culture-(stereo) typical virtual world, and how the design of the environment influences the process and outcome of cross-cultural meetings. Another question that has yet to be investigated is how individuals with different cultural backgrounds would collaboratively create a 3D virtual space, and how world design issues would be negotiated in such an intercultural collaborative design process. Initial findings in this direction are reported by Wyeld et al. (2006). The authors note that "students found they could not assume that their remote counterpart would understand how to use the spaces they had constructed or interpret their actions. Methods needed to be developed that offered 'universal' communication metaphors" (p. 1076).

Avatar–Environment Interaction

As for the design of the virtual space, we have the option of designing the interaction of avatars with the virtual world either as a simulation of the interaction between humans and their physical environment or to introduce new forms of interactions that are not possible in the physical world, which Bowman, Kruijff, LaViola, and Poupyrev (2001) refer to as "the magic approach." Interactions with the virtual environment include how avatars orient themselves, navigate through it, and manipulate objects. In particular, the use of "magic" interaction designs (e.g., pointers to open a virtual door) may be intuitively understood by one culture, but interpreted differently by another culture. Several studies have been published on culture-aware web interface design. These studies investigated cultural preferences, conventions, and interpretation of 2D visual representations, such as icons and graphics (Marcus & Gould, 2000; Mushtaha & De Troyer, 2007; Teasley, Leventhal, Blumenthal, Istone, & Stone, 1994; Zahir, Dobing, & Hunter, 2002). While some cultural differences, such as the meaning of colors (Aslam, 2006; Madden, Hewett, & Roth, 2000), can be expected to apply equally in a 3D virtual space, other cultural differences in the use and perception of the 3D user interface have yet to be evaluated in cross-cultural interaction design studies.

Avatar Appearance and Identity Tourism

The use of avatars as a virtual representation of interacting individuals has been claimed to be of great pedagogical value. Wyeld et al. (2006) found that students across all cultures rated the notion of being able to "hide" behind their avatar as a "liberating and empowering" experience, especially for those who may not have "spoken out" in a cross-cultural FTF encounter. Moreover, virtual worlds provide its users with the freedom of defining their virtual appearance and identity. Visible signs of ethnicity can be used as "decorative features" in the creation of avatars, which can be attached or detached at will (González, 2000). Ethnicity can also be transmitted by choosing an avatar name with ethnic connotations or masked by a neutral avatar name. Identity swapping in virtual worlds makes it possible to experience rather than merely observe what it feels like to be the opposite gender, to have a different race, or no race or gender at all. While gender-swapping is a common phenomenon in cyberspace (Bruckman, 1999; Huh & Williams, 2010; Hussain & Griffiths, 2008), race-swapping is relatively rare (Kolko, Nakamura, & Rodman, 2000).

Such "identity tourism" – to borrow a term introduced by Nakamura (2000) – has consequences for human interaction as it changes the way we behave and perceive each other. It has been found that experiences made in a virtual body that is different from one's real-life appearance can lead to transformed social behavior with transfer effects to real-world behavior, which is known as the "Proteus Effect" (Yee & Bailenson, 2007). It has been suggested to use manipulation and elimination of visual differences among group members as a strategy in virtual world collaboration, as the vividness or salience of group diversity is expected to influence group dynamics (Kahai, Carroll, & Jestice, 2007). This malleability of self-representation in a virtual world could be used to create an unbiased cultural experience (Prasolova-Førland & Wyeld, 2008), and might result in a redeployment of mass-mediated stereotypes (Boellstorff, 2008).

Another issue is concerned with the ability of individuals to identify with their avatar. It might be a hindrance for the intercultural learning experience if avatar customization limits the means for expression of one's identity and belonging (Prasolova-Førland, 2008). We can also expect cultural differences regarding what attributes of avatar appearance are considered as relevant or desirable. According to Hofstede (1991, 2001), cultures differ in the dimension of collectivism versus individualism. Collectivistic cultures, such as those of Asian and Arab countries, place an emphasis on the interdependence of every individual in a collective group, and group goals

have priority over individual goals. In individualistic cultures, such as the United States and Western Europe, personal achievement has priority over group goals, resulting in a strong sense of competition. While individualistic cultures may experience a stronger need to express individual characteristics in their avatar appearance, collectivistic cultures may be more satisfied when being able to display attributes that signalize belonging to a certain group instead of visualizing individual differences among group members.

Ducheneaut, Wen, Yee, and Wadley's (2009) study on preferences in avatar personalization of US Americans provides partial support for this assumption. They found that participants tended to create avatars as idealized versions of themselves, which reflect what would be considered as "improvements" in Western popular culture. Participants tended to create thinner, younger, and more fashionable versions of themselves. The authors note that many scales of avatar customization systems were hardly used, and that they should be optimized for the "perfect body" range, in which users from Western cultures prefer to design their avatars.

Similarly, we can interpret a call from the Arabic world to take the "Islamic perspective" in the design of virtual worlds into account (Yusof & Zakaria, 2007). The authors claim that "if the virtual world platform is going to be useful, effective, and attractive for international collaboration, issues of cultural compatibility must be considered in their systems design" (p. 101). They raise the question of how an identity and image can be created in a virtual world, which would reflect Islamic values. For instance, they request for "virtual burqas," and argue that designers "need to highly consider the image and identity (e.g., clothing) of the female players in particular. For Islamic women, they need to cover their heads with scarf and appropriate piece of cloth and the costumes also need to cover the whole body. As it is now, in all the virtual games, the women seemed to dress in a varied form of costumes, sometimes more exposed, which are not deemed as appropriate for the Muslim female audience" (p. 102).

At this point we may have to reconsider the design of culture-neutral avatars, and think carefully about the consequences. If cultural differences are to be erased, Barwell and Bowles (2000) aptly ask the question, "whose cultures precisely will be lost?" (p. 702).

Interaction between Avatars: The Role of Nonverbal Communication

Virtual worlds support rich behavioral interactions between avatars, which resemble FTF communication. Individuals can use their virtual bodies for nonverbal communication (NVC) in addition to the exchange of verbal

messages via text and audio channels. NVC serves important functions in FTF communication (Feldman & Rimé, 1991). These functions include (a) transmission of meaning to interpret the often subtle meaning behind verbal messages; (b) conversational management to regulate the flow of communication by signalizing who speaks when (i.e., turn taking) and to whom; (c) back-channel responses to provide feedback about the listener's level of comprehension or agreement; and (d) expression of affect to provide information about emotional states and attitudes in order to build an accurate understanding of the social situation.

According to Hall (1976), cultures differ in the extent to which they rely on contextual and nonverbal cues in communication. High-context cultures, including many Asian and Arab nations, use more implicit communication in which meaning and intention are emphasized through the context (e.g., environment, situation, and parties involved) and nonverbal channels. Low-context cultures, such as the United States and most European countries, use more explicit communication in which meaning and intention are emphasized through explicit verbal messages. NVC is therefore of particular importance in intercultural interactions. In addition to hindrances that culturally diverse groups may encounter due to language barriers, individuals must be able to encode and decode nonverbal cues appropriately in order to avoid misunderstandings. However, it is still unclear how these cultural differences in the reliance on NVC are reflected in intercultural interactions in virtual worlds.

The display of NVC in virtual worlds is very different from NVC in FTF interactions. In most virtual worlds, NVC is generated automatically by the software without any user inputs. Avatars try to appear natural, for example, by moving their lips when they are talking, or swinging arms and hips when walking. Most virtual worlds also provide a set of gestures, postures, and facial expressions that users can choose from. For instance, users have the option to wave, laugh, nod, or shake their avatar's head through keyboard commands or by selecting the respective nonverbal behavior from a menu. While nonverbal behaviors contain many nuances and subtleties in FTF communication, virtual worlds typically offer only a limited, predefined set of nonverbal behaviors. NVC displayed by avatars has (at least in current virtual world technologies) no relation to the user's actual nonverbal behavior. It is therefore not surprising that they are relatively rarely used in virtual world interactions (Becker & Mark, 1998, 2002).

However, people often use their virtual bodies as a means of NVC by volitional movement and placement of their avatar in the virtual environment. It has been found that social conventions regarding spatial behavior that can be observed in real-world situations are transferred into the virtual world. For example,

interacting avatars are typically facing one another and respect others' personal space (Bailenson, Blascovich, Beall, & Loomis, 2001; Yee, Bailenson, Urbanek, Chang, & Merget, 2007). The same effect has been found for cultural differences in spatial behavior of avatar dyads in a virtual world (Hasler & Friedman, 2011). Asian dyads interacted at larger interpersonal distances than European dyads, which is what we would expect in an equivalent physical-world setting. It is important to note that this effect was based on participants' actual cultural backgrounds, which were visualized by avatar names with ethnic connotations. The majority used a culture-neutral cartoon-style avatar that was identical for all participants. Those who customized their avatars were mostly European participants. These results indicate that cultural norms regarding NVC matter in avatar-based interactions, and that it deserves special consideration in virtual worlds designed for intercultural collaborative learning.

Although there are some universal consistencies in facial expressions of emotion (Ekman, 1989), cultures vary considerably in the degree of accuracy in their recognition of emotions based on facial expressions (Matsumoto, 1992, 2007). This also has consequences on how emotions are expressed and interpreted based on NVC in Internet-mediated interactions. For example, it has been found that cultures differ in the use of textual expression of moods or emotions (i.e., emoticons) in text-based computer-mediated communication (Kayan, Fussell, & Setlock, 2006). There are also cultural differences regarding the text-strings that are used to compose emoticons (see Takagi (2010) for a collection of Japanese emoticons). Such cultural differences have also been found in the interpretation of avatar facial expressions (Bartneck, Takahashi, & Katagiri, 2004; Koda, 2007; Koda, Rehm, & André, 2008; Yun, Deng, & Hiscock, 2009).

Although the field of research on culture-sensitive design of virtual worlds is beginning to emerge, it has yet to be examined which features of avatar appearance and aspects of NVC are considered as useful, and how they are being used across different cultures. Likewise, more research is needed on how to support cross-cultural meetings in virtual worlds in order to enhance the intercultural learning experience, and to facilitate the development of intercultural literacy. The exploration of these factors is the main goal of the case study, which is presented in the following part.

CASE STUDY

The ShanghAI Lectures: A Global Virtual Education Initiative

The case study was carried out in the context of a global lecture series, called "The ShanghAI Lectures,"[2] on embodied – natural and artificial –

intelligence. The lecture series by the Artificial Intelligence Lab of the University of Zurich was presented in fall term 2009 from Shanghai Jiao Tong University, connecting 18 universities worldwide via videoconference. In addition to global knowledge dissemination on the subject matter, the ShanghAI Lectures aimed to create a platform for the development of intercultural literacy in a global learning and collaboration context, and the conditions for practicing of the effective use of novel collaboration technologies in order to prepare students for a work environment across national borders. In order to comply with these educational goals, a virtual world named "UNIworld" was designed to facilitate intercultural student collaboration. The ShanghAI Lectures also served as a research platform as it provided a unique opportunity to study various aspects of cross-cultural team collaboration and learning in virtual worlds, involving a large, culturally diverse group of students. The case study presented here is part of a broader research agenda in the context of the ShanghAI Lectures (see Hasler, 2010; Hasler, Buecheler, & Pfeifer, 2009).

METHOD

Participants

Participants were 86 (65 male, 21 female) students[3] who volunteered to take part in the research project in the context of the ShanghAI Lectures. They were graduate, postgraduate, and doctoral students majoring in computer science and engineering. Mean age was 24.59 years (SD = 3.10). Forty-three students were Asian (40 Chinese, 1 South Korean, 1 Japanese, and 1 Mongolian), 32 students were European (17 Swiss, 5 German, 3 Polish, 2 Estonian, 1 Czech, 1 Hungarian, 1 Swedish, 1 Albanian, and 1 Italian), and 11 students were from Arab countries (9 Algerian, 1 Kuwaiti, and 1 Iraqi). All participants were nonnative English speakers.

Materials

Virtual world

Students collaborated as avatars in a virtual world named "UNIworld," which was developed based on *Open Wonderland*[4] (version 0.5). Eighteen instances of UNIworld were used, each of which consisted of five virtual team rooms and a public meeting area (see Fig. 1). UNIworld offered public and private text chat, and "spatial audio" communication (i.e., automatic

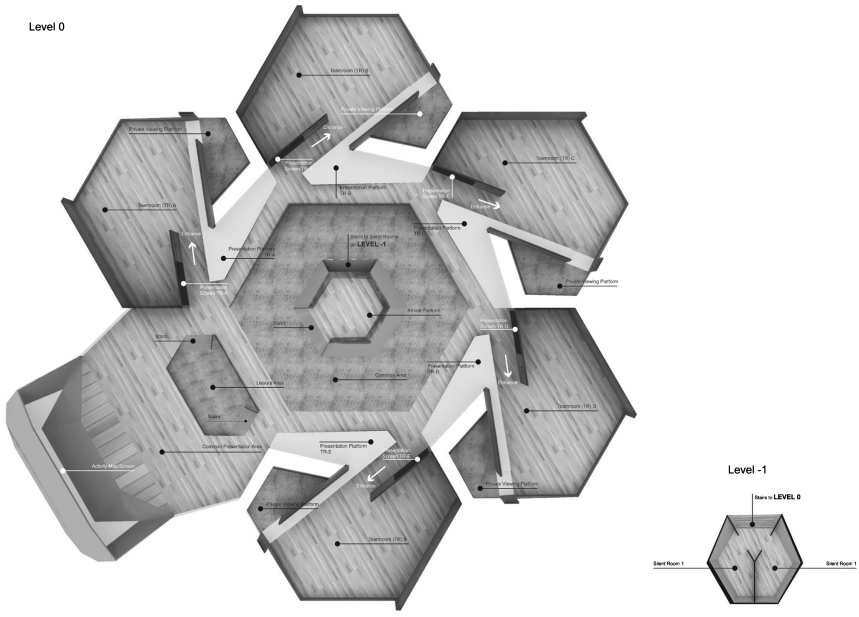

Fig. 1. Architectural Design of UNIworld. (Design by *Henn Architekten*, Munich).

volume adjustment according to the distance between avatars). Collaborative work was supported by in-world application sharing tools, such as web browsers, video-players, PDF viewers, text editors, and whiteboards. The interdisciplinary approach to the design of the UNIworld architecture and collaboration experiences is described in Schmeil et al. (2010).

Avatar appearance

In comparison to other virtual world applications, such as *Second Life*, the freedom to customize avatar appearance was limited in UNIworld. Participants began with a culture-neutral cartoon-style avatar, and were able to customize gender, clothing accessories, and color of skin, hair, pants, shirt, and shoes. These customizations were categorical and did not allow for gradual changes. Fig. 2 shows a group meeting of participants who used default avatars (standing on the right side) and customized avatars (standing on the left side).

Nonverbal communication

UNIworld provides a set of 14 basic postures (e.g., ''sit'' and ''stand'') and gestures (e.g., ''wave,'' ''raise hand,'' and ''nod'') that students could

Fig. 2. Group meeting in UNIworld. (Copyright by Henn Architekten).

perform with their avatars using keyboard commands or by clicking the corresponding buttons. Fig. 2 shows the available set of NVC. UNIworld does not support any user-controlled facial expressions.

Measures

Students were asked to respond to four free-text questions in an online questionnaire. All responses were categorized by two raters. Any disagreements between the two raters were resolved by consensus.

Cross-cultural differences

Two questions were asked to evaluate the perceived usefulness of avatars: ''Do you think the deployment and appearance of avatars was significant for the virtual collaboration experience?,'' and NVC: ''Did you notice others using means of NVC, such as gestures? Do you consider them useful in this

setting?'' In order to explore cross-cultural differences, the responses were analyzed separately for Asian, European, and Arab students.

Intercultural learning
Two questions were asked to evaluate learning effects: ''What did you learn from working in an international (cross-cultural) team?,'' and problems and solutions: ''What problems occurred in your international teamwork and how did you resolve them?'' Responses to these questions were categorized using Heyward's (2002) dimensions of intercultural literacy.

PROCEDURE

Upon registration for the lectures, the students were requested to choose an avatar name and to fill in a profile page on the course website. The online registration form contained a description of the purpose of the research project, the kind of data that will be collected, and the privacy protection procedures. The students were also required to read and respond to an informed consent form. Participation in the research project was an optional part of the lectures, which had no bearing on their academic evaluation. Students were then assigned to international virtual teams of four to five members each, in which they collaborated on group assignments over the course of the semester.[5] Each university provided two to four teaching assistants who graded the student assignments according to standardized instructions and example solutions. The teaching assistants were randomly assigned to five or six international student teams. UNIworld was offered as a collaboration platform, but the teams were free to use additional media to schedule their meetings and to coordinate their tasks. An online questionnaire was administered after the last group exercise, containing the questions that are considered in the current case study.

RESULTS

Cross-Cultural Evaluation of Avatars and Nonverbal Communication in Virtual Worlds

Perceived usefulness of avatars
Fig. 3 shows a comparison between Asian, Arab, and European students regarding their perceived usefulness of avatars for collaboration in virtual

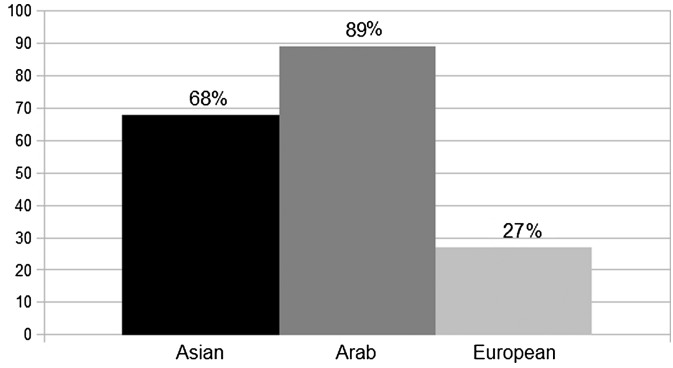

Fig. 3. Cross-Cultural Comparison of Perceived Usefulness of Avatars for Collaboration.

worlds. The bars represent the percentage of statements for each cultural group that expressed usefulness of avatars.

Asian and Arab students perceived avatars more often as useful than useless, while the opposite was the case for European students. A Chi-square test could only be performed for a comparison of ratings by Asian and European students due to the small number of responses from Arab students. The difference in perceived usefulness of avatars between Asian and European students was statistically significant, $\chi^2(1) = 8.72$, $p = .003$. Table 2 shows example statements of the reasons provided for perceived usefulness versus uselessness of avatars for virtual world collaboration by each of the three cultural groups.

Only a few European students clearly indicated that they perceived avatars as useful for remote collaboration, and most of their statements contained some reservations. The most frequent critique was the limited degree of freedom in avatar customization. These statements regarding the importance of individualization in avatar appearance can be interpreted as an indicator of individualistic values in Western cultures (Hofstede, 1991, 2001). Other European students mentioned that traditional 2D communication tools, such as email or chat, were sufficient for effective collaboration. They further mentioned that avatars distracted from the collaboration tasks, and that their handling was too time consuming. Those who perceived avatars as useful mentioned that it made the experience more interesting, and that it facilitated communication. Similar reasons were mentioned by Asian and Arab students for perceived usefulness of avatars.

Table 2. Example Statements of Perceived Usefulness versus Uselessness of Avatars for Collaboration in Virtual Worlds.

Culture	Rating	Example Statements
European	Useful	"Yes. It focused attention in a spatial location. I think that's important for good thinking – to use your body and your senses in a somewhat coordinated fashion. Without avatars, sight wanders off and the attention does too"
		"For this particular experience, sure. I mean it wouldn't have been this experience without, would it?"
	Useless	"No it wasn't especially as it was nearly impossible to individualize the avatars."
		"No, a simple shared whiteboard with audio and chat would be easier to use and much less time consuming."
Asian	Useful	"Yes it's very important. It can help us communicate."
		"Yes of course. You can see the character from the character (^-^)"
	Useless	"No, we all use the same avatar, and we do not care about the appearance."
		"No, it is not very important. Just an avatar having the ability to represent some person will be OK."
Arab	Useful	"Of course, because it represents a simulation about its user, on other hand, I can imagine the user …"
		"Yes I think because it give you a comfortable feeling especially if it's a bit comical"
	Useless	"Deployment, yes. Appearance, not really. Maybe it would be case if I and other member have customized avatar appearance!"

They mentioned that avatars provide information about the user, and create a sense of presence in a virtual space. Arab students also criticized the limitations in avatar customization, whereas Asian students noted that individual appearance does not matter. These statements could be interpreted as an indicator of collectivistic values in Asian cultures (Hofstede 1991, 2001). Although Arab nations are also considered as collectivistic cultures, the statements of Arab students did not contain any indicators regarding the values associated with collectivism.

Perceived usefulness of NVC

Fig. 4 shows a comparison between Asian, Arab, and European students regarding their perceived usefulness of NVC for collaboration in virtual worlds. The bars represent the percentage of statements for each cultural group that expressed usefulness of NVC.

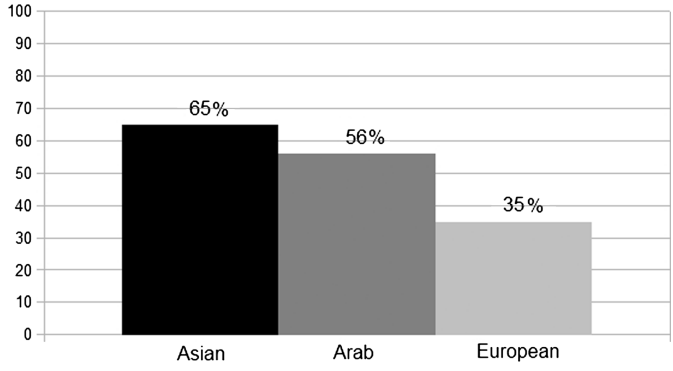

Fig. 4. Cross-Cultural Comparison of Perceived Usefulness of Avatar-Based Nonverbal Communication for Collaboration.

Asian and Arab students perceived NVC more often as useful than useless, while the opposite was the case for European students. A Chi-square test could only be performed for a comparison of Asian and European students due to the small number of responses from Arab students. The difference in perceived usefulness of NVC between Asian and European students was statistically significant, $\chi^2(1) = 3.96$, $p = .047$. Table 3 shows example statements of reasons provided for perceived usefulness versus uselessness of NVC in virtual worlds by each of the three cultural groups.

Students across all cultures who perceived NVC as useful for collaboration mentioned that NVC had the same functions in the virtual world as in the real world (e.g., to express emotions). However, there were cultural differences regarding the relevance and purpose of NVC, which reflect the differences between high-context and low-context cultures (Hall, 1976). While European students saw the main purpose of avatar-based NVC as "enhancing the experience," Asian and Arab students emphasized that NVC facilitates understanding in that it supplies additional information to the verbal communication channel. Asian students mainly noted the limited set of nonverbal behaviors as a reason why NVC was not perceived as a useful feature in avatar-based collaboration. These statements reflect the importance of NVC in high-context cultures. In contrast, most European students argued that there is no need for NVC in virtual worlds because verbal communication was sufficient for effective collaboration. These statements can be interpreted as an indicator of the lower reliance on NVC

in low-context cultures. Some European students also mentioned that NVC would only be useful in virtual worlds if it was intuitive, and used in the same way by all participants as the meaning would be difficult to interpret otherwise.

Evaluation of Intercultural Collaborative Learning in Virtual Worlds

Learning effects

Table 4 shows example statements of students' reports on what they have learned from collaborating with an intercultural virtual team. The statements were classified according to the dimensions of Heyward's (2002) developmental model of intercultural literacy. None of the statements indicated aspects of cultural identity, or the development of transcultural or global identities. The "identity" dimension is therefore not considered in this analysis.

Out of a total number of 72 statements about learning effects from intercultural team collaboration, most were concerned with participation (26 mentions). The majority of students increased their awareness that contact between people from different countries is crucial for an intercultural discourse, and stressed the importance of team working skills and "team spirit". However, only a few students mentioned actual skill improvements regarding how to collaborate across geographical borders and time zones. Nineteen statements were classified as indicators for increased competencies. The students stated that they learned how to communicate with others who have different cultural backgrounds, and to see things from their perspective. While some reported actual skill improvement, others mentioned an increased awareness of the competencies needed for successful intercultural communication and collaboration. Twelve statements were concerned with a better understanding of other cultures and techniques (e.g., active listening, being patient) to improve understanding in the process of intercultural teamwork. Ten statements were concerned with attitudes as they showed an increased awareness of cultural differences regarding values and viewpoints. The least frequently counted dimension was language proficiencies (five mentions), which included the awareness of difficulties in intercultural communication due to language barriers, and an improvement in foreign language skills.

Seven out of 86 students mentioned that they did not learn anything new from working in an intercultural team during the ShanghAI Lectures. As the

Table 3. Example Statements of Perceived Usefulness versus Uselessness of Nonverbal Communication for Collaboration in Virtual Worlds.

Culture	Rating	Statements
European	Useful	"I think they are useful but first we must ensure that we are all using gestures with the same meaning."
		"Well, yes. I think it is useful, because one can show how he feels and can make the atmosphere while working better."
	Useless	"No, because we either used chat or voice. We tried gestures like pointing to an object once but it was too confusing what the other person wanted to express."
		"I never saw anybody using gestures. And honestly they didn't even work with me, if I tried to use them … I think they would have about the same effect as emoticons in chat programs, but be less useful because you can already guess the opponents mood to a large extend by his voice alone."
Asian	Useful	"It's useful sometimes, because when there is no proper ways to describe your idea, maybe the gestures can help us."
		"Using gestures is very useful and important because it makes others understand your ideas more easily."
	Useless	"No, very hard to identify"
		"No, there's not much gestures I can show with the avatar, so I always use words."
Arab	Useful	"Yes. For instance turning around, and over oneself when getting bored, or when waiting a response from other members. Or moving to inform other members that you should change place to have a right perspective of 3D objects and to show how to use it. Yes, it is useful and their interpretation is contextual and easy."
		"I think it is very nice to use gesture for communicating because it gives you a sense that the other one has accepted you and respected you."
	Useless	"Not at all time. Express idea by writing is very useful."
		"Not very much."

main reasons, they mentioned that they already worked in international teams before or that they were familiar with other cultures because they studied abroad. One student noted that his team "seldom got over basic, task-related communication. This seldom got us into real cross-cultural experiences."

Table 4. Example Statements of Intercultural Learning Effects.

Dimensions	Example Statements
Participation	"I've learned to arrange virtual meetings over different time zones."
	"Meeting is difficult, but meeting helps a lot in order to build up a group."
Competencies	"I learned to respect others and to be friendly and considerate."
	"How to communicate with people with different culture."
Understandings	"We should know more about the culture of each other"
	"It is very important to listen and respond."
Attitudes	"That everybody has different work ethics when being in a multicultural class."
	"It reaffirmed my opinion of the fact that people are just as diverse in the same culture as they are between cultures."
Language proficiencies	"Some knowledge about how to communicate with foreign students in English."
	"It happens very fast that there are conflicts, which cannot be resolved because there are language barriers."

Problems

Students' statements about the problems that occurred in their intercultural virtual teamwork were categorized according to Heyward's (2002) model in order to identify issues that may hinder the development of intercultural literacy. Out of a total number of 82 statements, most were concerned with participation issues (48 mentions). Participation included situational factors (e.g., time zones) that influenced students' possibility to meet and collaborate synchronously, as well as personal factors (e.g., commitment and level of contribution) that reflected students' willingness to meet and collaborate. The fact that participation issues are mentioned most frequently is also reflected in the evaluation of intercultural learning effects. As participation was the main issue, it also influenced students' awareness of the importance of being able to (synchronously) meet and collaborate. Twelve statements indicated problems that occurred due to differences between team members regarding their attitudes toward the team, the collaboration tasks, or the distribution of workload. Misunderstandings due to different cultural backgrounds were categorized as understanding issues (10 mentions). Eight statements indicated issues regarding lack of language proficiencies. An inverted frequency of positive learning outcomes and the number of problems was observed for statements regarding competencies. Only four statements were concerned with missing competencies that hindered efficient collaboration with members that have different (educational and cultural) backgrounds. In contrast, the improvement in competencies was mentioned as a frequent

learning outcome. It is also important to note that 12 statements indicated that no problems occurred in intercultural virtual teamwork.

Students' solutions

Table 5 summarizes students' solutions to overcome the issues that they encountered during the intercultural virtual team collaboration. The most frequently mentioned issue was the possibility to meet for synchronous collaboration due to time differences. Although the students tried to resolve this issue by showing more flexibility regarding meeting times, some teams split up and worked individually. It remains unclear whether the often-criticized lack of willingness to collaborate is a consequence of the time zone issue or did in fact rely on students' motivation. The other solutions to overcome issues associated with different attitudes, misunderstandings, lack of language skills, and missing competencies do not appear to require further explanation.

Table 5. Example Statements of Students' Solutions to Improve Intercultural Virtual Teamwork.

Issues Regarding …	Solutions Suggested by Students
Participation	Situational factors: Try to find meeting dates/be flexible (16), distribute tasks and work asynchronously (13) Personal factors: Work with active team members only (13), try to insist and encourage contribution/contact members once more (3), people need to know/get to know their team members in order to be willing to contribute (1), report inactive team members to the teachers (1), reduce expectancies and just do the minimum (1)
Attitudes	Address problems and discuss in team (3), express arguments and opinions (2), accept cultural differences (2), explain your expectations (1), be friendly, accept/respect different values/customs/habits (1), find agreements (1), develop new working schemes (1), somebody makes a decision (1)
Understandings	Interact/communicate more (4), explain things more clearly (2), explain once more (1), try to understand each other in their way (1), discussions, invest more time (1), be patient (1)
Language proficiencies	Improve English skills (4), use written chat instead of audio (2), be patient (2)
Competencies	Share knowledge (1), learn to think from different perspectives (1), bring to the group what you have (1), those who know more should contribute more (1)

DISCUSSION OF A CULTURE-AWARE DESIGN OF VIRTUAL WORLDS

The case study explored cross-cultural differences between individualistic, low-context cultures (i.e., European countries) and collectivistic, high-context cultures (i.e., Asian and Arab countries) regarding the perceived usefulness of avatars and NVC for collaboration in virtual worlds. Based on the evaluation results, possible solutions are derived for a culture-aware design of virtual worlds, which is considered as a prerequisite for effective intercultural collaborative learning. Future research directions are discussed under the perspective of current technological developments.

Avatar Design

European students showed a preference for individualized avatars, which were less important to Asian students who perceived avatars merely as a representation of the user in the virtual space but did not stress the significance of individualistic appearance. This finding indicates that values of individualistic and collectivistic cultures are transferred into the virtual world. As Mushtaha and De Troyer (2007) stated, the perception of our (real and virtual) environment is founded in the very nature of culture: ''Culture affects who we are, how we think, how we behave, and how we respond to our environment. Above all, it determines how we learn. A person's cultural background is learned, not inherited and is made up of experiences gained when growing up in his or her culture. Therefore, cultural background is used in understanding the 'virtual' world on the screen'' (p. 164).

The evaluation results stress the importance for the design of culture-aware virtual worlds that take cultural preferences in avatar design into account by offering more flexibility in avatar customization. In addition to providing means to transfer ''real-world'' identities into the virtual world, we need to make it possible to create new transcultural identities of a global, virtual community that is free of visible signs of gender, race, ethnicity, and class, where other attributes rather than real-world appearance become salient, or alternative, nonhuman representations or hybrid characters can be chosen.

Avatar-Based Nonverbal Communication

Asian and Arab students stressed the importance of NVC, and requested more advanced options to perform nonverbal behavior in avatar-based

collaboration. NVC was of less importance to European students who stated that verbal communication was sufficient for effective collaboration. This finding provides evidence for the relevance of cultural dimensions (e.g., high-context vs. low-context cultures) in virtual world design. Cultures not only differ regarding their reliance on NVC in FTF settings but also transfer their communication styles into the virtual world. The ability to appropriately encode and decode nonverbal cues is crucial in intercultural communication. Virtual worlds provide an additional challenge for appropriate encoding of nonverbal behaviors. While NVC is mostly unconscious to people while interacting FTF, it requires a volitional act in virtual worlds (e.g., keyboard commands). The way user-controlled nonverbal behaviors are currently performed in virtual worlds is neither natural nor intuitive. The fact that nonverbal behavior of avatars is not related to the users' actual behavior places additional demands on the appropriate decoding of nonverbal cues in virtual worlds. If NVC in virtual worlds is used in similar ways as emoticons in text chat (i.e., with cultural variations), we can also expect cultural differences in the intended meaning and interpretation of NVC in avatar-based collaboration.

Current Technological Developments

The avatar customization systems that are integrated in the common virtual worlds are often limited to the design of anthropomorphic avatars, while the design of nonhuman or hybrid characters often requires some creative workarounds (Ventrella, 2011). This places some limitations to the design of culture-neutral avatars to foster transcultural identities, as proposed above. The trend toward more (photo-)realistic human-like avatars, on the other hand, is supported by a number of sophisticated (external) avatar design systems, such as *FaceGen*[6] or *evolver*.[7] However, the import of the digital 3D models that can be created with these systems based on photographs is still not supported by every virtual world. Nevertheless, we are witnessing how the borders between synthetic 3D and video are blurring. We might soon be able to cross the "uncanny valley," in which negative psychological effects are expected when creating virtual humans that almost, but not perfectly, look like actual humans (Seyama & Nagayama, 2007). An important factor that should not be neglected in this development is the behavioral realism of avatars, in which the natural expression of nonverbal behaviors plays a crucial role (Bailenson, Yee, Merget, & Schroeder, 2006; see also Ventrella's

(2011) discussion of the ''uncanny valley of expression'' and his proposition of a ''gestural Turing test'').

For an effective use of avatar-based NVC in intercultural collaboration, we need to find new ways of how avatar gestures, postures, and facial expressions can be performed more naturally and intuitively. Amarakeerthi, Ranaweera, Cohen, and Nagel (2009) describe a feature developed for *Open Wonderland* that triggers avatar gestures based on keywords in a text-chat. For example, an avatar would automatically be displayed as laughing when the user types '':D.'' A similar approach uses speech input to create avatar gestures based on speaking style (Neff, Kipp, Albrecht, & Seidel, 2008). These text and voice puppeteering methods are described in more detail in Ventrella (2011), and are illustrated on the author's website.[8] Others utilize new techniques for real-time mapping of facial expressions onto avatars using video image, which has previously only been possible by attaching markers on the participant's face (Bailenson et al., 2006). There are also approaches that combine different speech- and video-based methods for real-time multimodal human–avatar interaction (Yun, Renxiang, Huang, & Danielsen, 2008). Probably the most promising development in natural human–avatar interfaces is controller-free gaming devices, such as *Microsoft's Kinect*, which has recently become commercially available. Such ubiquitous tracking technologies make it possible to map a user's body movement in real time onto his or her avatar. Many research labs are currently experimenting with these novel technologies, and are developing interesting new ways of expressing nonverbal behaviors in virtual worlds. For example, researchers at the Institute for Creative Technologies of the University of Southern California used *Kinect* and the *OpenNI* toolkit[9] to trigger predefined avatar animations in *Second Life* through natural body movement (Institute for Creative Technologies (ICT), 2011). Natural human–avatar interfaces will certainly revolutionize the way we interact with avatars in virtual worlds in the near future.

Future Research Directions

Many avatar customization systems are designed and optimized for a specific culture, which limits the possibilities to express and explore different cultural identities in a virtual environment. In order to design more flexible avatar customization systems, more research is required about which attributes in avatar appearance are considered as relevant across different cultures, and which nuances are requested by different cultures in which

range of the respective attributes (Ducheneaut et al., 2009). Recent empirical studies investigated ''cultural identity switching'' in virtual worlds as a method to foster perspective taking in cross-cultural encounters. However, the results are inconsistent regarding the direction of the effect. Some found a decrease in racist attitudes when White participants were represented by Black avatars (Gonzales, Falisi, & Hancock, 2010), while others found the opposite effect in that being transformed into a Black avatar resulted in activation of negative stereotypes and greater racial bias (Groom, Bailenson, & Nass, 2009). Thus, the psychological consequences of ''cultural identity tourism'' in virtual worlds, and the conditions under which it may result in positive or negative outcomes, require further research.

Another line of research investigates the impact of salient group identity on normative behavior, which can easily be manipulated in avatar appearance. Kim (2011) describes two differential effects of uniform virtual appearance (i.e., group members being represented by identical avatars) as a means of ''surpassing individuals' social or cultural differences'' (p. 248). A clear visual distinction between one's own group (i.e., in-group) and an opposing group (i.e., out-group) resulted in increased willingness to agree with in-group members' opinions. At the same time some participants perceived a threat to their uniqueness if all in-group members were represented by the same avatar, which in turn resulted in participants' need to diverge from their in-group members' opinion in order to restore their uniqueness. Hence, as for the use of (stereo-) typical avatars as a means of cultural identity tourism and perspective taking, the impact of the utilization of culture-neutral (or identical) avatars as a technique to ''neutralize'' or eliminate cultural differences in virtual worlds requires careful consideration and a better understanding of the respective consequences.

As for the perceived usefulness of avatars and preferences regarding avatar appearance, cultural differences appear to be an important factor to consider in avatar-based NVC. However, possibly due to the limited expression of nonverbal behaviors in the currently available virtual world technologies, social scientists have not paid much research attention to NVC in virtual worlds yet; except for a small number of studies on virtual proxemics; that is, the distance at which avatars interact in virtual worlds (Hasler & Friedman, 2011; Yee et al., 2007). The study of NVC in virtual worlds is expected to become more interesting and relevant considering the current development in natural human–avatar interfaces, which bear a high potential for enhanced, mediated cross-cultural encounters. Researchers at the Advanced Virtuality Lab of the Interdisciplinary Center Herzliya are currently developing a translator of NVC for avatar-based cross-cultural interactions in using body

tracking systems, similar to translation systems that exist for verbal communication (Hasler, 2011). Whenever the NVC translator recognizes a cultural difference in a gesture performed by one participant, it translates the intended meaning depending on the other participants' cultural background, and replaces this transformed avatar gesture in real time.

While the current evaluation was focused on cross-cultural differences in the perceived usefulness and preferences for avatar appearance and NVC, there are other factors that have yet to be investigated, such as cross-cultural differences in the interpretation of place metaphors, and cultural preferences in avatar–environment interaction. Cultural dimensions (e.g., high vs. low-context cultures and individualism vs. collectivism) provide a useful framework for exploring cross-cultural differences. However, such "sophisticated stereotyping" (Osland & Bird, 2000) has to be interpreted with caution as these dimensions do not convey the complexity found within cultures. In addition to cross-cultural differences, other factors (e.g., personality and gender) need to be examined regarding preferences in the design of virtual worlds.

LESSONS LEARNED ABOUT INTERCULTURAL COLLABORATIVE LEARNING

How to Facilitate Intercultural Collaborative Learning in Virtual Worlds

One of the goals of the ShanghAI Lectures was to facilitate intercultural collaborative learning, and to explore whether virtual worlds can be used as an effective platform for the development of intercultural literacy. Students' reports were analyzed regarding what they have learned from working in an intercultural virtual team, what problems occurred, and how they resolved them. The evaluation results indicated that virtual worlds have the potential to effectively support intercultural collaborative learning, and to foster the development of intercultural literacy under certain conditions. The students reported various learning effects in terms of an increased awareness and skill improvement regarding Heyward's (2002) dimensions of intercultural literacy. They were able to overcome many of the problems that they were facing during their intercultural team collaboration (see Table 5). However, some of the issues could be (at least partly) reduced by those who are involved in the design and administration of a global virtual education project (including the lecturers, teaching assistants, and the designers of the virtual world and collaboration tasks).

Participation

Possibility and willingness to attend synchronous team meetings in the virtual world were mentioned as the most frequent issue in intercultural collaboration. If different time zones hinder team members to work synchronously on their tasks, additional tools need to be provided that support asynchronous teamwork (e.g., backboards, discussion forums, file sharing, and collaborative text editing tools). Although many tools are available for free that support asynchronous teamwork, only a few teams made use of them. The students reported that most of their asynchronous work was coordinated via email. A collection of different tools that supplement one another has also been recommended based on the lessons learned from another cross-cultural education project, which used a virtual world as the main (synchronous) collaboration platform (Wyeld et al., 2006). The authors further noted that some tools were more appropriate for different phases of the collaboration process.

Future virtual student collaboration projects that use virtual worlds as a collaboration platform should also consider more advanced in-world collaboration tools. For example, *Open Wonderland* offers a variety of modules that can be installed as extensions to the standard in-world collaboration tools.[10] The active open-source community is constantly extending and adding modules, which include avatars (e.g., import functions for photo-realistic *evolver* avatars or scripts for nonplayer characters), collaboration tools (e.g., group chat, presentation features, meeting organizers, and screen sharer), world models (e.g., auditorium and gallery), multimedia elements (e.g., microphone for speakers, movie recorder, music player, and photo album), simulations (e.g., educational simulations of machines or computer algorithms, and a feature to drag and drop animations into the virtual world). The use of more advanced in-world collaboration tools may not only improve teamwork efficiency but also increase students' motivation to participate in synchronous team meetings in virtual worlds.

However, many of the currently available virtual world modules that were designed to facilitate collaborative work are merely a copy of techniques that are commonly used to support teamwork in FTF settings or "two-dimensional" collaboration tools, such as whiteboards and text editors. There is a need for more advanced group work technologies that are suitable and specifically designed for a virtual 3D environment. Such advanced collaboration features should go beyond importing "2D tools" into a 3D virtual world. Interesting approaches in this direction have been reported by researchers at the MIT Media Lab who developed tools for real-time visualizations of group interaction processes in virtual worlds (Drew, 2008;

Drew & Donath, 2008). Especially the dynamic visualization of affective processes could be highly beneficial for mutual understanding in multicultural virtual teams.

Attitudes, understanding, and competencies

In order to foster an intercultural discourse, students should be encouraged not only to meet for task-related work but also to socialize with their team members and other participants. The teams in the ShanghAI Lectures were not provided with any cross-cultural training because intercultural learning effects were expected to emerge as a side effect. However, trust and relationship building is crucial for effective collaboration, especially in global virtual teams composed of members with different cultural backgrounds (Jarvenpaa & Leidner, 1999). This process should be supported by team building and icebreaker tasks at the beginning of a collaboration phase. Although such "get acquainted" tasks have not been used in the ShanghAI Lectures, they can be expected to positively influence students' attitude toward their members, and reduce conflicts in the subsequent work-related group tasks. Furthermore, the role of the teaching assistants needs to be reconsidered. They were mainly instructed to provide the student teams that they have been assigned to with feedback on their group tasks. This feedback was usually given by email, and the teaching assistants did not have direct (i.e., synchronous) contact with their teams. In future projects of this kind, the teaching assistants should supervise their teams also in other (social) aspects, and meet them on a regular basis as avatars in the virtual world. Those students who encountered problems with their teams mostly reported them to their local lecturers. However, the local teaching staff at each participating university could often only offer "local solutions" for individual team members. It might be beneficial if the students are requested to work out solutions within their team with the support of teaching assistants as mediators.

How to Evaluate Intercultural Collaborative Learning Effects

The evaluation of the learning effects and the problems that occurred in the intercultural virtual teamwork was based on students' subjective reports collected at the end of the course. In order to determine whether or not students increased their intercultural literacy, future cross-cultural education projects should include pre- and post-course measurements. Standardized instruments are available that can be used to measure different

dimensions of intercultural literacy, for example, the Intercultural Sensitivity Scale (Chen & Starosta, 2000), the Behavioral Assessment Scale for Intercultural Communication Effectiveness (Koester & Olebe, 1988), or acceptance of social stereotyping (Carter, Hall, Carney, & Rosip, 2006).

Additional insights could be gained by an objective evaluation of intercultural learning effects and possible conflicts, which requires observation of actual team behavior over time. Virtual environments make it possible to automatically collect data on the users' behavior in an unobtrusive way. A behavioral tracking and visualization system developed for detailed analysis of avatar behavior in *Open Wonderland* is described in Hasler (2010). Future cross-cultural education projects should also evaluate long-term effects regarding the sustainability of intercultural relationships, as well as transfer effects from the virtual collaborative learning experience to real-world behavior.

NOTES

1. The Bologna Declaration (1999), retrieved from http://ec.europa.eu/education/policies/educ/bologna/bologna.pdf on May 1, 2011; see Altenbach et al. (2009) for a review of other international education programs.
2. More information on the ShanghAI Lectures project and participating universities can be found at http://shanghailectures.org
3. In total 282 students participated in the ShanghAI Lectures. The sample of 86 participants only includes students from Asia, Europe, and Arab countries who filled in the surveys used in the current case study. Other nationalities were not considered in this case study due to their small number.
4. http://openwonderland.org
5. The group exercises are described in more detail in Schmeil, Eppler, and de Freitas' chapter in another Hinrichs and Wankel book, called *Engaging the Avatar*, soon to be released by Information Age
6. http://www.facegen.com
7. http://www.evolver.com
8. http://www.avatarpuppeteering.com
9. http://www.openni.org
10. http://openwonderland.org/module-warehouse/module-warehouse

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LESSON PLAN: GOALS OF THE SHANGHAI LECTURES

This lesson plan provides an example of how lectures can be given to a global audience with attendees and speakers from various locations, and to create an international collaborative learning environment on a particular academic topic. The case study presented in the chapter is based on the ShanghAI Lectures, a global digitally mediated course on ''Embodied Intelligence'', given to more than 250 students worldwide in approximately 20 universities. The lectures are presented by international experts and broadcast via videoconference. In addition, the students collaborate in interdisciplinary, multicultural teams on exercises in a 3D virtual environment. The course is intended for students with little or no computer science background.

Learning goals are formulated for both students and instructors as participants in a globally connected academic community:

- *Content-related learning goals*: Students become familiar with the far-reaching implications of embodiment for the development of intelligent behavior, and learn about the basic concepts, methods, techniques, and major issues in the study of intelligent natural and artificial systems that will enable them to understand, design, and build such systems. Instructors learn how to design exercises in this particular subject area in a way that exploits the potential of a virtual world, and is intelligible for an interdisciplinary, multicultural audience.
- *Intercultural learning goals*: Students increase their intercultural literacy by working in multicultural virtual teams (e.g., increasing their awareness of cultural differences and learning how to resolve conflicts in a culturally diverse team) in order to prepare them for a global workplace. Instructors learn how to effectively support cross-cultural teamwork in mediated environments by providing guidance and feedback in a culturally adept way.
- *Technological learning goals*: Both faculty and students gain first-hand experience of avatar-based collaboration, learn about its potentials and shortcomings, and can master virtual world technology effectively as a novel collaborative environment.

CONTENT OF THE LECTURES

The lectures are about natural and artificial intelligence, with a focus on the concept of embodiment (''Embodied Intelligence''). While in the classical approach ''intelligence'' was viewed essentially as information processing taking place in the brain, more recently the notion of embodiment (i.e., the idea that intelligence is emerging from a complete organism interacting with the real world) has been gaining increasing acceptance. As a consequence, intelligence is not longer a matter of the brain only, but of the interplay of brain, body (morphology and materials), and the environment.

The implications of an embodied view on intelligence are not only of a scientific nature but also lead to a completely different way of how we view ourselves and the world around us. Examples and illustrations are taken from humans, animals, engineering (robotics in particular), and business. Using the method of ''understanding by building'', the lectures provide a set of design principles that on the one hand enable a better understanding of biological systems, and on the other provide heuristics for how to design artificial ones, in particular robots.

COURSE PROGRAM

Week 1	VC	Welcome, site presentations, overview.
Week 2	VC	Intelligence: Artificial Intelligence and its landscape.
Week 3	CVE	Discussion session, exercises.
Week 4	VC	Prerequisites for a Theory of Intelligence.
Week 5	CVE	Discussion session, exercises.
Week 6	VC	Intelligence: Properties, Principles, and Development.
Week 7	CVE	Discussion session, exercises.
Week 8	VC	Evolution: Cognition from Scratch.
Week 9	CVE	Discussion session, exercises.
Week 10	VC	Collective/Modular Robotics, Intelligent Companies.
Week 11	CVE	Discussion session, exercises.
Week 12	VC	Intelligence in Ubiquitous Systems and Interfaces.
Week 13	CVE	Discussion session, student presentations.

VC, Videoconferene; CVE, Collaborative Virtual Environment (''UNIworld'').

MODES OF PARTICIPATION

As universities have different requirements or preferences regarding the presentation style of lectures, several participation modes should be offered.

Making real-time attendance (of the lectures and discussion sessions) optional is important due to time zone considerations.

	Lectures (Videoconference)	Discussions (Virtual World)	Exercises (Virtual World)
A	Active participation	Active participation	Active participation
B	Connect, but watch/listen only	Optional	Active participation
C	Watch only recordings	Optional	Active participation

TECHNICAL COMPONENTS AND MATERIALS

Lectures (Videoconference). The lecture series is broadcast via videoconference, connecting local (physical) lecture halls around the world. In order to create an intercultural discourse, we recommend to include presentations from the various sites that demonstrate their own perspectives on the subject matter. Varying the broadcast location of the lectures also provides students with the ability to experience intercultural differences in presentation. It has further been found to be crucial for an increased awareness and sense of presence of a global community that participants not only meet as avatars but also see the ''real'' people with various cultural identities in the videoconference sessions.

Reading Assignments (Textbook). The lectures are supplemented by reading assignments (book chapters and papers; two hours per week). The textbook *How the Body Shapes the Way We Think – A New View of Intelligence* by Rolf Pfeifer and Josh Bongard, MIT Press, 2007, is used as compulsory reading material and provides the ''backbone'' of the lecture series. This is a nontechnical book that does not require prior training in any special discipline. Additional materials, in particular scientific papers, are provided during the course.

Discussion Sessions (Virtual World). Experience has shown that students rarely speak up during a globally connected videoconference lecture of this size. In order to increase the level of interactivity between students and lecturers, and to facilitate students' active participation, we introduced international discussion sessions held within the virtual world. Every second week, instead of a videoconference lecture, participants log in as avatars and discuss the topics that have been introduced in the previous week. They are requested to submit their questions to the lecturer beforehand by email.

Virtual worlds provide a safe environment that increases students' confidence to raise their hands due to an "equalizing effect" (i.e., visual anonymity). Being represented as an avatar leads to a reduced (i.e., less visually salient) hierarchy between students and lecturers. Another advantage of holding discussion sessions in a virtual world is the possibility of multiple comments at the same time using text-chat. Especially students with poor English skills feel more comfortable to formulate questions in text format than using voice chat. However, voice chat has been shown to be an essential feature, which should be used by the lecturer who leads the discussion, and for technical staff to provide help in case of technical problems. In order to avoid disturbing background noise, all participants are advised to mute their microphones when not speaking.

In addition to text and voice communication, several tools are available in a virtual world that can be used to make discussions more interactive, such as whiteboards or sticky notes for idea generation (i.e., collective brainstorming) in which each participant can become active and edit the shared notes. Since multimedia works effectively in the virtual world, any website, wiki site, blog site, or other Internet interface can become part of the environment. Also, conversations can be cut and pasted onto note cards and handed out through objects that are clicked on by the students. Students are not confined to a particular time slot to review presentation materials because the content can persist in the environment as long as the faculty leaves their presentations.

Group Exercises (Virtual World). In addition to attending the lectures and discussion sessions, students are required to work in international virtual teams on exercises that are designed to deepen the understanding of the materials presented (two hours per week). Each team is assigned to a team room in the virtual world where they meet and collaborate on the group exercises. Teaching assistants who are recruited from the participating universities supervise four to five international student teams, which they have been randomly assigned to. They are the main contact person for the students if they encounter any problems during their virtual teamwork, and are also responsible for grading students' work. Example solutions and detailed instructions are provided to the teaching assistants in order to assure a standardized grading of the exercises.

Virtual worlds are particularly useful for demonstration of 3D simulations, demonstration of objects interacting with each other, and visualizations in general. The instructions to the virtual world exercises used in the ShanghAI Lectures are available to registered users on the course website (http://shanghailectures.org).

Projects Assignments (Different Collaboration Media). In addition to the group exercises, students are requested to choose a project that they work on with their international team. A collection of projects along the typical steps of research in Artificial Intelligence (AI) is offered. The projects contain different elements of AI research to give students an impression of the tasks that scientists in this field are currently working on. While the exercises are specifically designed to be completed in the virtual world, students are advised to use different tools to collaborate on their projects. The virtual world was offered as a collaboration platform during the ShanghAI Lectures, providing each student team with their own virtual team room, and a group chat feature, which made it possible to work ''quietly'' (i.e., having private group conversations). However, most student teams used traditional chat tools (e.g., Skype and MSN) and email to coordinate their project work. Virtual worlds provide an interesting option for creating virtual galleries of students' project work. Students can display the process and outcome of their projects in the virtual world using poster signs or links to web pages.

Web-Based Resource (Course Website). Recordings of the lectures, guest talks, discussion sessions, as well as additional study materials, instructions to exercises, and announcement of project assignments were published on the course website, and remain available for registered users (http://shanghailectures.org). The course website is also used as a community platform, which requested each participant to create a profile page. We found it important that each participant has the possibility to show who they are in the physical world, and optionally upload photos. This is particularly important in an intercultural learning environment in which students collaborate with team members who they have never met before, and do not have the possibility to meet face-to-face. Adding physical-life information/photos adds a personal dimension to an otherwise anonymous mediated contact.

Assessment/Evaluation (Virtual World and Online Survey Tools). In order to assess students' AI-related knowledge, traditional (paper-based) exams are administered locally at each university. Feedback on the technology and intercultural teamwork experience is collected via online surveys. In addition, we used an integrated tracking system, which unobtrusively tracks participants' behavior in the virtual world. Such observational data of actual group processes have been found to be highly valuable to increase our understanding of cross-cultural collaboration in virtual worlds.