

An innovative approach to task design and implementation in multimodal collaborative virtual environments

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This research presents multimodal communication in collaborative virtual environments (CVEs) for English as a Foreign Language (EFL) learners using text, voice, lip motion, and body language. The proposed CVE, named VEC3D 3.0, is based on a computer-assisted language learning (CALL) task-based design to elicit multimodal communication. The current work presents the task-based design, its application, and implementation in VEC3D 3.0.

Keywords: Collaborative virtual environment; multimodal communication; EFL; task design

Introduction

This study explores how 3D virtual reality technologies might be used for developing multimodal communication in collaborative virtual environments (CVEs). The advent of 3D virtual reality together with on-line 3D chat, computer vision and graphics technologies, and the new generation 3D CVE named 3D Virtual English Classroom (VEC3D 3.0), enhances users' immersive experiences via real-time written and voice-to-voice communications.

Communication is based on words, gestures, body language and tone of voice. Therefore, the attempt to ease and naturalize human communication over the Internet must allow linguistic, actional, and visual communication. Evidence supports interpersonal multimodal communication as critical for language acquisition through multimodal interaction integrating visual, aural, linguistic and nonverbal communication.

This project is important for multimodal

communication and **CALL** task design, inspiring **EFL** learners to take part in **CVEs**. This conceptually novel platform has potential in various settings, including language learning in classroom and commercial settings. Engaging in **CVEs** facilitates prolonged immersion experiences, and extensive interaction, which are required for writing and conversation class. Since nonverbal communication is critical to language teaching, instructors in face-to-face settings frequently rely on nonverbal cues to convey messages, deliver knowledge, correct errors, manage a classroom, and offer extra contextual information associated with words. Multimodal **CVE** empowers language teachers and learners by providing multimodal interaction, becoming an innovative tool for students to learn and practice nonverbal communication in **CVEs**.

This research links three developments, including multimodal communication, task-based design, and **CVEs** through pedagogical innovation and implementation of this new system. Experiencing roles in simulated real-life situations constructed in **CVEs** encourages **EFL** learners to acquire the target language. The current work presents the **CALL** task-based design and **CVE** implementation. Integrating the task-based design and multimodal communication in **VEC3D 3.0** exemplifies the implementation. This paper describes its threefold purpose: implementing **CVE**, multimodal communication, the task design features and several representative tasks.

Virtual environments as learning platforms

Wikipedia defines a virtual world (also known as a virtual environment) as “a computer-based simulated environment intended for its users to inhabit and interact via avatars. These avatars are usually depicted as textual, two-dimensional, or three-dimensional graphical representations, although other forms are possible.” The advances in Internet-based technologies and computer graphics have caused a shift from text-based virtual worlds, such as **MOOs** (**MUD** Object Oriented), to Internet-based **VEs** incorporating voice-based chat such as Second Life (**SL**, secondlife.com) integrated **VoIP** that allows users to communicate with their voice. Current Internet-based **VEs** integrating online collaboration and social networking design bring a promising future for e-learning and distance education. Collaborative virtual environments (**CVEs**) support multi-user interaction through embodied avatars representing users’ interactive behaviors. A growing number of **CVEs**, e.g. different worlds in the Active Worlds Educational Universe (**AWEDU**, www.ActiveWorlds.com), such as Quest Atlantis (Barab et al., 2005, 2007), River City (Clarke & Dede, 2005; Ketelhut, 2007) and SciCentr (Corbit & DeVarco, 2000) have been created for educational purposes. Over 300 universities worldwide use Second Life (Wikipedia), another popular platform, for instructional purposes covering subjects such as language, literature, fine art and design, and applied science.

Recent developments for using **VEs** in language education have attracted theoretical, practical and commercial interests in research, design, implementation, and evaluation. **CVEs** incorporating synchronous voice chat provide language learning potential. **SL**, for instance, has opened doors to language schools and their online courses. The online courses offered by LanguageLab (www.languageLab.com) in **SL**, via voice-based chat, for **ESL** (English as a Second Language) courses cover subjects such as pronunciation, grammar, vocabulary, and conversation, and immerse **ESL** learners in real life situations. The online language school, Avatar Languages (www.avatarlanguages.com), offers English and Spanish currently in **SL**. Language United, a **UK** language school, has also constructed a

virtual school¹ in **SL** for learning English language. Many virtual spaces,² such as the British Council in **SL** for Teens, Goethe Institute in **SL**, Mi Casa Es Su Casa, Second Life Chinese School by the Confucius Institute, and Institute Cervantes in **SL**, have also been created to nurture language learning.

A number of research projects, such as the **VITAAL** project (Koenraad, 2008), **AVALON** (Access to Virtual and Action Learning live **ON**line) project and **EVO** (Electronic Village Online) project of **TESOL**'s (Teachers of English to Speakers of Other Languages Inc.) explore 3D virtual environments for language education. Interest groups, such as the **CALL** Interest Section (**CALL-IS**) and **CALICO** Virtual Worlds Special Interest Group, have been formed. The **CALICO** 2009 Workshop on Virtual Worlds and Language Teaching and the online conference **SLanguages** (2007–2009) have focused on issues relative to virtual environments in language learning.

Researchers have studied applying **VE** in language learning with a series of research reports on discourse analysis of chat communication for second language acquisition in 3D virtual environments. Toyoda and Harrison (2002) investigated communication difficulties occurring in text-based chat in Active Worlds (**AW**) between learners of Japanese as a Second Language and native speakers of Japanese. Peterson (2005) conducted a preliminary study to examine the communication features of undergraduate English language learners' avatars and interactional strategies used in Active Worlds, concluding that "the application of virtual worlds in **CALL** offers new opportunities to engage learners in the kind of interaction that may facilitate the development of second language competences" (p. 38). Molka-Danielsen et al. (2007) developed a language course entitled "Social English for Doctoral Students" in Second Life, and proposed an evaluation framework for the courses taught in **SL**. The preliminary results show that "students are motivated to participate and may wish to spend even more time in-world. It shows the setting is believable enough, that the role play can be related to real life situations" (p. 105). The **VITAAL** project (Koenraad, 2008) explored the possibilities of building voice-enabled, 3D virtual environments in **AW** for Modern Language Education in secondary schools, and designed task-based activities and role-plays for oral proficiency.

Multimodal perspectives on language learning

Language learning is multimodal, arising from the interaction of visual, aural, linguistic and nonverbal communication. The multimodal user interface found in **VE** allows instructors to communicate with students using natural modalities, including gestures, facial expressions and lip motion. The new 3D Virtual Environment (**VE**) synthesizes to connect key technologies: Internet, 3D chatting, and graphical embodiment of users (Avatars). The newest trends in 3D **VE** are more attainable and affordable to learners scattered across the world than ever before. Based on these new trends, the current research team has produced virtual language learning designs and environments for learners and educators using 3D Virtual Reality technology.

This project is intended to engage learners and place language learning in a meaningful context within which authentic learning experiences, real communication, and interaction occur. Teachers of English to Speakers of Other Languages (**TESOL**) indicates,

Language is learned most effectively when it used in significant and meaningful situations as learners interact with others to accomplish their purposes. Language acquisition

takes place as learners engage in activities of a social nature with opportunities to practice language forms for a variety of communicative purposes (TESOL, 1997, p. 7).

Furthermore, multimodal interaction such as text messaging, voice communication, lip contour extraction and gestures effectively improve learners' interaction and communication efficiency when communication occurs over the Internet. The whole communication process consists of the interplay between two modes: verbal and nonverbal communication (Allen, 1999). Communication difficulties typically arise because people receive relatively limited aural or visual sensory input. Speech is well-perceived through audio-visual integration and multimodal communication (Massaro, 1998; Massaro & Stork, 1998; Chen & Rao, 1998). Both verbal and nonverbal CSs help language learners compensate for communication breakdowns (Canale, 1983; Swain, 1984; Canale & Swain, 1980). With emerging advanced 3D VR, tracking, and animated technologies, natural human communication and sophisticated language occur in 3D virtual multimodal environments.

Virtual English Classroom (VEC3D)

The VEC3D, which is accessible via the Internet, is a CVE developed by the Computer Vision and Virtual Reality Laboratory (CVVR Lab), launched in 2003 at National Dong Hwa University. The overall aim of the VEC3D project is to support collaborative and situated language learning in an immersive environment. The VEC3D enables EFL learners to interact with each other through user-controlled avatars, and team up in groups to participate in various task-based activities and goal-based scenarios. The VEC3D 1.0 performs within the framework of the AWEDU of AW, mainly for text-based communication. Research in VEC3D 1.0 focuses on conducting a pilot study and needs assessment (Shih, 2003) to inform future implementation priorities through identifying EFL learners who are using virtual environments for follow-up implementation. The VEC3D 2.0 is a client-server application using Java as the primary language for system development (Lin, Shih & Yang, 2005). Users in the VEC3D 2.0 conduct real-time interaction via text and voice in a classroom-like setting. The research team conducted a one-year ethnographic study of FLA in VEC3D 2.0 (Shih & Yang, 2008). The results showed "the effectiveness of motivating advanced EFL undergraduate students...acquiring communication strategies ... autonomy in virtual communication through integrating goal-based design, role-play, and 3D VR" (p. 66).

As part of ongoing development, the project team attempts to overcome communication restrictions such as text-only chat and missing paralinguistic clues, such as gestures and tone of voice, which are provided by previous versions of VEC3D. With the help of computer vision and graphics technologies, VEC3D 3.0 (see Figures 1 and 2) provides a multimodal environment with sophisticated and natural communication for EFL students. The VEC3D 3.0 allows users to use nonverbal communication conveyed through real-time audio and video as well as the avatars and slide shows. To process sophisticated communication, a live lecture is captured using a digital camcorder in a typical classroom. The instructor is segmented from the background via computer vision techniques. The segmented foreground is combined with a virtual classroom via computer graphics techniques (See Figure 2). For networks with limited bandwidth, traffic can be reduced by transmitting only the foreground in video. The VEC3D 3.0 offers additional options for communication with enhanced user freedom in displaying paralinguistic information such as gestures.



Figure 1. Video conferencing and avatars to complement the lack of nonverbal cues in VEC3D 3.0

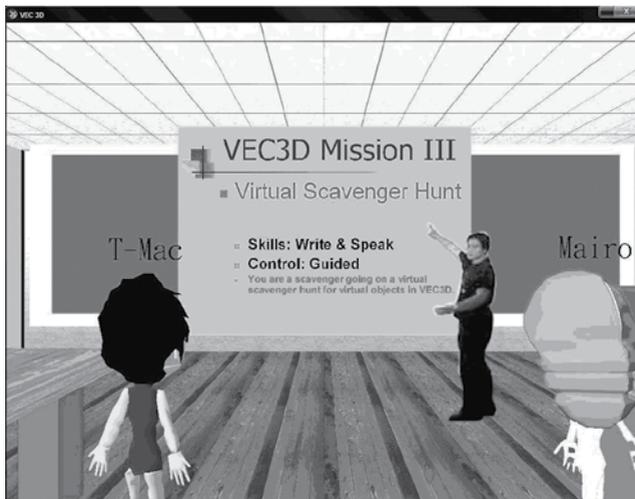


Figure 2. An instructor experimenting with the use of multiple communication channels (slide, gesture, voice, and text)

Nonverbal communicative factors, one of the components of socio-cultural competence, relate to how and what is appropriate in socio-cultural contexts (Celce-Murcia, Dornyei, & Thurrell, 1995). Table 1 summarizes the four categories of nonverbal communication supported by **VEC3D 3.0**: (a) body language, (b) paralinguage, (c) personal-interpersonal space, and (d) object communication for nonverbals (Bachman & Palmer, 1996; Celce-Murcia, Dornyei, & Thurrell, 1995; Manninen & Kujanpää, 2002). The **VEC3D 3.0** is constructed to

maximize flexibility and responsiveness to evolving research and educational purposes. New features have been developed to generate and stimulate multimodal communication in virtual reality.

Table 1: Nonverbal communication forms in VEC3D 3.0

| | Nonverbal Communication | Area/Example | VEC3D 3.0 allows... |
|---|--|---|--|
| 1 | body language: kinesics facial expressions oculesics | body movement, gestures, posture facial movement eye contact | - gestures - posture - facial expressions - eye contact |
| 2 | paralanguage (non-verbal parts of speech): nonverbal vocalizations paralinguistic factors | nonverbal vocalization acoustical sounds voice volume pitch and rate of speech | - voice-to-voice communication |
| 3 | personal-interpersonal space: proxemics (how space used and interpreted by people) | proximity orientation territorial behavior movement | - virtual space - use of space - distance - direction |
| 4 | object communication: physical appearance environmental details | clothing artifacts appearance of surroundings | - avatar appearance - objects - virtual space |

(Partly adapted from Bachman & Palmer, 1996; Celce-Murcia, Dornyei, & Thurrell, 1995, p. 24; Manninen & Kujanpää, 2002)

CALL tasks for VEC3D 3.0

VEC3D 3.0 is a language acquisition platform that uses a web-based 3D interactive multi-user environment to build a virtual connection between a native English speaking instructor and **ESL** or **EFL** students. The primary purpose of this project is to attract students by offering opportunities for foreign language acquisition (**FLA**). As an ongoing project, the activities in **VEC3D 3.0** require students to participate in both real-world and virtual activities, such as exploration, on-line discussion, and role-plays. The research team also constructed a version **VEC3D 1.0** that is embedded in **AWEDU** of **AW**, and used **SL** as a gateway to allow participants to teleport to other virtual 3D online communities and meet other target language speakers around the world. Project implementations feature the assembly of **CVEs** and web 2.0 tools, including Wikipedia, Skype, YouTube, Google Maps and Google Earth.

The **VEC3D** instructional design principles and theories are based on collaborative learning (**CL**), communicative language teaching (**CLT**), virtual community building (Renninger & Shumar, 2002), and Chapelle's (2001) criteria for **CALL** task appropriateness. The task design includes seven activity types proposed by Pattison (1987): (a) questions and answers, (b) dialogues and role-plays, (c) watching activities, (d) communication strategies, (e) pictures and picture stories, (f) puzzles and problems, and (f) discussions and decisions. These tasks have been expanded for multimodal communication tools, moving **EFL** learners toward goals of communicative, socio-cultural, learning-how-to-learn, and language and cultural

awareness, as indicated by Clark (1987). The tasks include activities for verbal communication, target cultural understanding, nonverbal expressions, and pronunciation practice (lip motion). All tasks are carried out within a 60–120 minute class period. Activities engage **EFL** learners and build a virtual community of practice for **FLA**.

Task design is based on Chapelle's (2001) criteria for **CALL** task appropriateness. Chapelle proposes six **CALL** task evaluation criteria: (a) language learning potential; (b) learner fit; (c) meaning focus; (d) authenticity; (e) positive impact; and (f) practicality as it pertains to **SLA** research and theory. The research team assessed innovative task appropriateness, and presents procedures based on the criteria outline (see Table 2). The first criterion, "language learning potential," plays the most critical role (p. 58) among the six criteria in promoting **L2** ability, as well as "focus on form" (p. 55). Teaching and learning goals, social identity in the target culture, computer literacy, cultural awareness, and language learning strategies are expected to be attained via **CALL** tasks. (p. 58)

Table 2: Criteria for **CALL** task appropriateness

| | |
|-----------------------------|---|
| Language Learning Potential | The degree of beneficial opportunities available from focus on form |
| Learner Fit | The number of opportunities for engagement with language under appropriate conditions of given learner characteristics |
| Meaning Focus | The extent to which learners' attention is directed toward the meaning of the language |
| Authenticity | The degree of correspondence between the CALL activity and target language activities of interest to learners outside of the classroom |
| Positive Impact | The positive effects of the CALL activity on those who participate |
| Practicality | The adequacy of resources which support the use of the CALL activity |

(Adapted from Chapelle, 2001, Table 3.4, p. 55)

All of these activities that use cooperative learning are conducted in a national university in Taiwan. Previous experiences demonstrate that group size, ranging from three to five, positively affects learners' participation, group productivity, and member satisfaction in **VEC3D**. The tasks are therefore intended for a small group format, forming a community of practice, and constituting an effective virtual learning environment. Three undergraduates and two graduates who passed the **GEPT** (General English Proficiency Test) intermediate level joined the small group. They attended events held one to two hours per week for one year, depending on the task goals.

Students participating in **VEC3D** 3.0 can choose from four available options. The first option extends the virtual English classroom to students at different locations. Students can log in to **VEC3D** 3.0 and verbally or nonverbally interact with the distance instructor, either via an embedded text chat window or voice chat. A webcam captures the actual face or body movement of the remote users and transmits it over the Internet. The learners can see the avatar representing the instructor and the video showing the instructor's face or body movement from his or her computer screen, while the instructor monitors student avatar(s) as well as the video from his computer screen (see Figure 1). The second option is suitable for an activity held in a meeting room, where a group of learners sits together in front of a projection screen. The learners can interact with the distance instructor over the

Internet in a way similar to the first option. In the third option, the instructor is segmented from the background as an **ROI** (Region of Interest) combined with the virtual classroom (see Figure 2). Students see the instructor's body language from their screens. The fourth option allows participants to join in a virtual "face-to-face" meeting held in **VEC3D 3.0** with live facial images (see Figure 3).

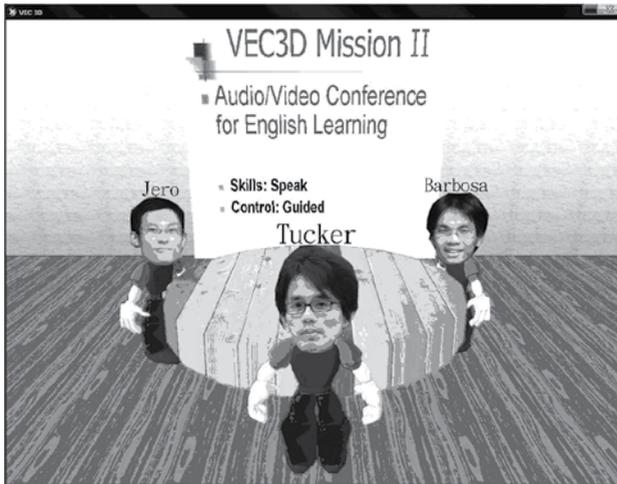


Figure 3. Group discussion through audio/video conferencing

The following paragraphs and Tables 3–5 describe several task types, procedures, and practices, according to Chapelle's framework for analyzing tasks (2001), giving examples of how activities are conducted in **VEC3D 3.0**. The procedure description provides a step-by-step guide to how tasks are carried out, and how **EFL** learners and the native-speaking English teacher interact in **VEC3D 3.0**. The media and modality chosen to complete the activities are incorporated to encourage multimodal, authentic communication, cross-cultural understanding, and comprehensible input in various interactive settings.

"The Trip to Banff" (see Table 3) is a cross-cultural activity that aims to develop both cross-cultural understanding and communication strategies by planning a family trip to Banff National Park. Pattison's (1987) "dialogues and role-plays," "communication strategies," and "discussions and decisions" are incorporated into this activity. This task extends **VEC3D 3.0** through integrating **WWW**, YouTube, Google Earth, Google Map, and avatar movement. Participants role-play with brief information, and complete the mission, guided by an instructor from Canada.

Before participating in the virtual event, students are assigned to read information on Banff National Park via websites for a follow-up virtual classroom discussion, and then download Google Earth. The mission starts in **VEC3D 3.0** by asking students to play a daughter or son role. Under the guidance of the instructor, who plays a father role, participants plan for a family trip from Vancouver to Banff National Park, and use voice chat to determine how to reach the destination with a limited budget. They visit the official websites for Banff and Lake Louise Tourism, explore the natural mountain scenery on YouTube, reserve

hotels, rent a car, explore the instructor's hometown Vancouver via Google Earth, and plan the trip with Google Maps. In the **VEC3D** 3.0 debriefing stage, the family members discuss their upcoming road trip plan, things to do, weather conditions, and so on.

The task is designed to focus students' attention on the meaning of form, text, and comprehension of information related to the trip. Guided by the fluent native-speaking English instructor who supplies comprehensible help, learners acquire the target language. When communication breakdowns occur, the instructor provides certain information in response to student requests for repetition, spelling, definitions, and meta-linguistic explanations in written or oral mode. The instructor also directs their attention to linguistic forms, contextually appropriate utterances, and communication strategies, whereby students then modify their interaction and output.

Studying abroad is a dream for many students, highly motivating them to learn how to plan and book a trip on their own. This motivation makes the task of planning a trip highly relevant to their future needs. For the learners, the positive impacts of the task include experience in planning a trip, finding reliable website resources, fostering cross-cultural understanding, and developing communication strategies.

Table 3: Cross-Cultural Task: The trip to Banff

| | | | |
|---|--|---|--|
| Mission 24 Cross-Cultural Role-Play | Task:  The Trip to Banff | Duration: 90 minutes first-person 3-D view | Participants/Roles: Father (Teacher Jason), Son(s)/Daughter(s) |
| Rules/Story Instruction/ Description | <ul style="list-style-type: none"> - You are planning and booking a family trip. From: Vancouver Destination: Banff, Lake Louise, Alberta Budget: US\$8000 Arrival: 08/04/2008 Departure: 08/14/2008 Adults: 1 Children: 3 - You will discover the protected wilderness surrounding Lake Louise, Banff (and Jasper) where you will explore spectacular natural mountain scenery and abundant wildlife in a protected National Park setting. - Discuss and plan communication strategies and language to use with your family members. - Play out the scenario using the strategies and language you and the other members planned. | | |
| Reference Materials | <ol style="list-style-type: none"> 1 The Banff, Lake Louise Tourism Official Website http://www.banfflakelouise.com/ 2 Google Earth 4.2 http://earth.google.com/intl/en/download-earth.html#no_redirect 3 Google Maps http://maps.google.com/ 4 Explore the Earth (Jason's home town/Vancouver/) on Google http://earth.google.com/ 5 Car Rental in Canada http://www.wheelsabroad.com/index_ca.php | | |

"That's an unusual view!" (see Table 4) is an instructor-guided visual activity where learners locate objects in virtual worlds for the purpose of inspiring practice, describing features, asking questions, and making comparisons. The slides, pictures, and objects located in **VEC3D** 1.0 and **VEC3D** 3.0 offer stimulation and opportunities for communication and discussion. This task is also intended to extend **VEC3D** 3.0 through integrating **AW** or **SL** with the addition of rich features and objects.

The “pictures and picture stories” from (Pattison, 1987) is incorporated in this task. The task draws learner attention to grammatical forms, comparative and superlative adjectives, language use, naming objects, question raising, describing, and making comparisons. The instructor exposes learners to vocabulary in context, and modifies their interaction and output both in written and oral modes. Learners have positive learning experiences describing, comparing, and naming objects in the virtual worlds. Moreover, language is used authentically outside of the classroom, and vocabulary acquired in the virtual environments becomes useful and functional in their daily lives.

Table 4: Visual Activity: That’s an unusual view!

| | | | |
|--------------------------------|---|----------------------|---------------------|
| Mission 7 | Task: | Duration: 60 minutes | Participants/Roles: |
| Visual Activity | That’s an unusual view! | first-person 3D view | Teacher & Students |
| Rules/Story | - Name and identify features and objects in pictures. Each learner identifies and describes the features, objects, and differences between pictures in each room. | | |
| Instruction/Description | - The task provides opportunities for describing, asking questions, and making comparisons. The teacher asks the students to describe the features they see in pictures.. | | |

The task “Gesture in Western Culture” (Table 5) fosters cross-cultural understanding by introducing and demonstrating western culture-specific gestures in **VEC3D 3.0**. **VEC3D 3.0** provides four options for the instructor to demonstrate body language, and for students to complete the task. The task begins by visiting websites named “Gesture in Western Culture” and “Finger Gesture.” The instructor introduces western culture-specific gestures, which are used as a replacement for words to convey information in different situations to students. By paying attention to the body language used in this activity, learners use non-linguistic means such as miming to avoid and minimize breakdowns in future communication processes outside the classroom.

Table 5: Cross-Cultural Task: Gesture in Western Culture

| | | | |
|--------------------------------|---|----------------------|---------------------|
| Mission5 | Task: | Duration: 60 minutes | Participants/Roles: |
| Cross-Cultural Body Language | Gesture in Western Culture | first-person 3D view | Teacher & Students |
| Rules/Story | - Gestures, a form of nonverbal communication, are used to emphasize or convey information in various situations. | | |
| Instruction/Description | - The teacher will introduce several western culture-specific gestures, and use them as a replacement for words. | | |
| | - Students visit the website “Gesture in Western Culture.” | | |
| | - Students guess what the gesture means. | | |
| | - Students visit the websites “Finger Gesture” and “Asian Gesture.” | | |
| | - Students are encouraged to use gestures to decrease communication breakdowns. | | |
| Reference | Gesture in Western Culture: http://international.ouc.bc.ca/cultureshock/gesture.htm | | |
| Materials | Finger Gesture: http://en.wikipedia.org/wiki/The_finger | | |
| | Asian Gestures: http://www.csupomona.edu/~tassi/gestures.htm | | |

Conclusions and expectations

VEC3D 3.0 aims to reinforce authentic communication by offering opportunities for multimodal communication and social situations in **CVEs**. The forms of communication in **CVEs** are largely text-based and language-based, which translates into a lack of communication cues that support social interaction and sophisticated communication. With the advent of synchronous voice-based communication tools, the communication shift from text to talk in **CVEs** is progressing. Possible benefits may include more natural communication and synchronicity, and increased visual and paralinguistic clues.

Currently, **VEC3D 3.0** task design and implementation are mainly based on theory and results obtained from previous needs assessments and experiences. While implementation continues, investigations have expanded to research how **CVEs** with a multimodal communication context affect the process of developing communicative competence. Specifically, future studies will focus on (1) the interaction patterns of the virtual community in practice, (2) the role of multimodal communication, (3) how paralinguistic is acquired by **EFL** learners, and (4) the possible development of socio-cultural competence and cultural awareness in **VEC3D 3.0**.

Current research has shown implications for follow-up design, and has brought about a tentative task design model that elicits multimodal communication in **CVEs**. In addition to continuing to promote the success of **CALL** tasks, the project team is beginning to expand the study into areas that include user socio-cultural experiences, cross-cultural understanding, and nonverbal behaviors. These new research areas will be studied by forming a virtual community of language practice where pedagogical research can be conducted in a multimodal **CVE** setting.

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Notes

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1. Language United provides online language courses in Second Life. Additional Information is available on the Web at <http://www.languagesunited.co.uk/learning-on-line.html> (Retrieved March 28, 2009)
2. The presentations and videos related to the virtual spaces, including the British Council in **SL** for Teens, Goethe Institute in **SL**, Mi Casa Es Su Casa, Second Life Chinese School by the Confucius Institute, and Institute Cervantes in **SL** can be found at <http://www.slanguages.net/publications.php> (Retrieved March 28, 2009)

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