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Communicating and interacting: An exploration of the changing roles of media in CALL/CMC

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Abstract

The sites of learning and teaching using CALL are shifting from CD-based, LAN-based or stand-alone programs to the internet. As this change occurs, pedagogical approaches to using CALL are also shifting to forms which better exploit the communication, collaboration and negotiation aspects of the internet. Numerous teachers and designers have created multimedia applications to help learners understand and make meaning from not just the aural and written language of the target culture, but also some of the visual, social and cultural nuances. Previous studies of the use of visual and multimedia in language learning have shown promising results. However with a major shift to the internet as the site for learning, we need to re-evaluate what constitutes communication and interactivity in this new context, particularly with the introduction of newer technologies such as WebCams as well as more 'traditional' media such as video, audio and still images. This paper discusses the characteristics common to CALL and CMC implementations, some of the distinguishing features of each and aspects of the teaching and learning contexts in which we find each being used. Conclusions are drawn that in order to make the most from the use of these new sites of media interaction in language learning, we need to develop flexible and adaptive learning environments which can incorporate more traditional forms of Instructional CALL as well as the newer communication, collaboration and exploration forms.

Keywords: multimedia, CMC, learning environments, collaborative learning, exploratory learning

Introduction

As the media we use to communicate in and teach languages matures, it is time we in the profession took stock of what the current research literature is telling us. What are we doing right and which areas do we still need to address and refine? While multimedia development was predominantly CD or LAN-based, the technology had stabilised enough for us to investigate various aspects of the effectiveness and usefulness to students of these media in language learning. However, since we have been moving into web-based language learning incorporating multimedia as and when this is possible or appropriate, the contexts have changed. We can now, for example, add other channels such as audio and video to computer mediated communication (CMC) for language learning which had previously been restricted to the use of text only. In many cases, the technology we use in these new contexts has not yet sufficiently stabilised for us to design sufficiently well-structured investigations of what effects the technology has on language learning. Communications technologies have multiple applications in both our daily lives and teaching. Research into the nexus between multimedia and language learning with CMC at the moment therefore, seems in many cases to be more driven by the technology, the environment in which it is used and the associated constraints than on pedagogical and learning factors.

In this paper I argue that the shape of multimedia applications was previously focused in three major directions, but that with multimodal CMC for language learning, these have changed or been replaced. By multimedia I am referring generally to any combination of video, text and sound delivered by or through the use of technology, though this will be refined later. Multimodal CMC includes the media employed to communicate and the channels learners use to interact with and within the media. Until the emergence of multimodal CMC, the following three areas represented the major focus of the use of multimedia for language learning:

1. the **media** available or used (what could be done with it and activities based around it)

2. **skill development** (listening and viewing comprehension and the related sub-skills)
3. media as **illustration or enrichment** – bringing authentic aspects of the real world into the classroom to promote target cultural and language awareness.

However, with the shift in mode of delivery and access to the internet, this earlier focus has changed. The very distributed nature of the internet, the uses to which we put it, and the purposes for which we use it *in non-educational settings* have strongly influenced how we view the capacities of the internet and the teaching and learning opportunities it can make available. Point 3 above: **media as illustration or enrichment** has become the major focus of our use of multimedia on the internet in language teaching and learning. This shift in focus has, in turn, affected the educational approaches to language teaching and learning that we employ using this medium. Thus we now have greater emphasis on and use of the media for:

4. **exploratory learning** such as webquests, virtual tours, and task- or project-based approaches;
5. **learning through communication** involving negotiation of meaning as exemplified in the e-Tandem project and various keypal endeavours, discussion lists, forums and chat groups around the world, in various languages, and using a variety of text, audio and video media combinations;
6. **collaborative and negotiative learning**, often problem-based, such as CMCL (computer mediated collaborative learning) or WSCL (web supported collaborative learning) projects which bridge geographic locations and time differences; as well as:
7. composite forms which are derived from or built on instructionally-oriented CALL, but now employ features of these three newer approaches (4-6).

While points 1 and 2 above are still, for the most part, actively used, they have now been conflated into one, which I will call here ‘instructed CALL’ (one form of Skehan’s ‘support software’; 2003: 408), whether this be CD-, Local Area Network (LAN)-, or web-based. In Skehan’s terms, such support software is used in conjunction with the exploratory, communication and collaborative learning tasks, to supplement areas identified or *noticed* by teachers or learners themselves as gaps in learning. Ideally this type of instructed CALL is used post-task and fulfils the dual purpose of providing effective pedagogic materials to support previous learning and helps learners keep a record of their progress in interlanguage development.

Background to the newer approaches

With the changes in focus mentioned above, it is timely to refresh our understanding of the findings of earlier research studies done on the uses and pitfalls of multimedia in language teaching. These can then be incorporated into our planning, teaching, and curriculum and instructional design decisions. Through this process, it is hoped that we can make the best possible decisions about what technologies to employ with which student populations. It is therefore necessary for us to have, at the same time, very clear understandings of the possibilities and constraints of the media in relation to pedagogy and learner needs *and* remain flexible and creative in our view of what can and could be done. Teachers have, after all, shown themselves to be perennially adaptive!

As Jonassen has commented:

Technologies do not directly mediate learning. That is, people do not learn from computers, books, videos, or the other devices that were developed to transmit information. Rather, learning is mediated by thinking (mental processes). Thinking is activated by learning activities, and learning activities are mediated by instructional interventions, including technologies. Learning requires thinking by the learner. In order to more directly affect the process, therefore, we should concern ourselves less with the design of technologies of transmission and more with how learners are required to think in completing different tasks.

(Jonassen, 1992: 2)

So whether students like it or not – and sometimes they don't – teachers should and do require them to think, even when using technology as the medium of learning, including such personal communication technologies as e-mail and video/voice enhanced chat.

The nature of our use of technology changed with the adoption of internet tools in our daily lives. Now, with the addition of multimodal capacities and the change in emphasis to the use of technology to mediate communication in second language learning, the roles of teachers and learners are also changing. Felix, for example, makes the following observations in relation to internet use for language learning and teaching:

One thing that it is essential to realise is that the most interesting part of what is happening on the Web is not visible to the observer. What really matters is what is taking place in the communication between users of the Web ... the critical difference ... between content and connectivity.

A realistic assessment of Web-based teaching is that it is not a time-saving approach, but rather a time-shifting one. Teachers will save on the time they would otherwise spend preparing elaborate materials, but they will also have to invest time in assisting in the organization of tasks and projects, moderating communication, and creating sound assessment strategies.

(Felix, 2002: 12)

As we increase our reliance on electronic communications technologies in both the personal and professional or educational spheres of our lives, we can therefore expect changes to continue to unfold in the nature of the work we do as teachers, the materials that constitute pedagogic tasks, and the roles teachers and learners have in these new educational environments. In subsequent sections, this paper will explore how our learners process and use the information that they acquire and convey while using the newer technologies for language learning and what this tells us about the range of pedagogical approaches we can employ to achieve different goals. As mentioned earlier, this entails a shift also in the range of pedagogical approaches we choose – a shift in the very exciting direction of intentional, flexible, active, experiential, learner-shaped pedagogy.

The Information/Knowledge Society

In examining the concomitant changes in our daily lives and work that communication technologies have brought, I approach the role of changing pedagogy from the concern of previous authors in the area of the role of information, knowledge and educational change. In his discussion of the interaction between knowledge, education and technology, in the context of the 'Information Society' or the

‘Knowledge Society’, Chen (1992: pp. 161-2) claimed that ‘the impact of information technologies on the social institutions responsible for knowledge production and distribution such as universities and schools is far less significant’ than on other social arenas such as industry, business or international relationships. From his examination of the historic timeframes and characteristics involved in the gradual Ontogenic and Exogenic evolution of knowledge, Chen concluded that ‘information technology is mainly involved in the social fabric concerned with the creation, accumulation, preservation, and distribution of Exogenic (public) knowledge ...’ (*ibid* p. 166). That is, exogenic knowledge refers to ‘all public knowledge accumulated by mankind since the beginning of civilization by complex social processes’. On the other hand, for Chen, ontogenic knowledge is ‘the knowledge that grows in the individual’ consisting of both innate and learned knowledge.

In fact, it was not until individual or ontogenic technologies such as the internet, e-mail and chat (see also Murray, 2000) became ubiquitous in our daily lives – and that of our children, parents and even grandparents, that technology became an acceptable and accepted partner in learning. The advent of uses of technology for human-human communication and ontogenic knowledge acquisition therefore mark the watershed for the change from the previous exogenic manifestations of information technology as defined above, to the current personal and individual applications, including language learning applications. By this stage, of course, it was the internet and CMC incarnations of CALL that had become the norm.

Media & multimedia literature

A survey of the literature relating to media and multimedia reveals discussions of the past and present uses of media, attempts to define terms and elucidate characteristics, studies of effectiveness, exploration of the concept of interactivity, as well as specific studies of features found only in CMC environments. An analysis of publications relating to CALL in such major journals as *CALICO*, *System*, *CALL*, *Language Learning and Technology* and *ReCALL* over the last five years, reveals a trend *away from* the uses and roles of multimedia in the facilitation of second language learning and *towards* the communication and interactive elements of CALL, commonly known as computer mediated communication or CMC. Since the major issue under discussion in this paper is the nature of changes in media use for language learning being brought about through technological advances, the argument as to whether or not CMC actually should be incorporated into the field known as CALL, will be put aside for another time. However, there remains the question of whether multimedia is still important in CALL, or indeed, in language learning in general. An essential adjunct to the discussion of multimodal CMC and multimedia CALL is the concept of interactivity. CALL programs have always been described as ‘interactive’. In the context of communicative pedagogy, why otherwise would we want to use them? However, no clear explanatory definition of this term has been forthcoming in recent years. In the absence of a clear definition, it is difficult to make comparisons among different CALL applications or uses of CMC – or indeed, between different methods of language teaching and learning using technology. The concept of interactivity in the CALL/CMC context is therefore also explored below.

Past and present multimedia applications

Multimedia seems to have had its heyday in the 15 years between 1985-2000. However, towards the end of this period, our fascination with ‘real’ person-person

communication seems to have overtaken our research, reflection and practice with the use of multimedia to enhance our learners' learning of language. At the same time, as has happened frequently in the past, the technology has not yet reached the level of sophistication and transparency that would make it easy and convenient for our learners to make use of the (still embryonic) multimedia capacities of CMC. Very few examples are yet available of internet-based multimedia language learning or teaching resources, and the resources or language programs that are being studied are either LAN-based programs that have been converted and modified for web-based access (Hoven, 2003), hybrid models involving sometimes quite radical changes to our earlier approaches to language teaching and learning, (Kötter *et al.*, 1999; Hogan-Brun & Lauz, 2001; Lontas, 2002; Khine & Lourdusamy 2003; Parks, *et al.*, 2003), or purpose-built web-based language learning materials (Shawback & Terhune, 2002; Weinberg, 2002).

In order to find specific academic discussion of the changes in forms, roles and applications of multimedia and language these days, we need to examine literature in the fields of instructional design, New Media and communication studies. The focus of studies involving multimedia applications has changed from whether and to what extent multimedia enhances learning (Brett, 1995), to techniques and approaches for maximising the learning (Hoven, 1997; 2003; Gibson, 2002; Love, 2002; Kabata & Yang, 2002), and the perennial dilemma of how to find common ground for making meaning between the technical or instructional design experts and the teachers of a subject or content area (Keppel, 2001; Sinclair, Aldred & Smith, 2002). This latter remains a problem as teachers work towards creating the more flexible environments their learners expect, often requiring the provision of CD- or DVD-based multimedia learning materials, which are quite technical to create. The re-directed focus on pedagogy has also meant a move away from the language interactionist approaches to instructed CALL research originating in the second language acquisition research area of Chapelle (1998) among others.

Definition of multimedia and its characteristics

Hartman and colleagues in 1992 (p. 176) defined interactive multimedia as a 'synthesis of computers, video, text, and sound' and as combining 'the best parts of *multimedia* – the integration of various forms of information – and *hypermedia* – the non-linear linking of information to create applications that both stimulate and respond to the individual'. Others, such as Ashworth (1996: 81), have preferred to separate multimedia from hypermedia by defining hypermedia as multimedia with links. However, for the sake of simplicity the term multimedia will be used here in the form its use takes on the internet; that is, to include linked hypermedia (see also Hoven, 1997, section 1.3.2). Obviously, when we begin to look at the range of media that are found within multimedia and hypermedia, some discussion is then necessary of how learners use these media: which learning styles are more compatible with which media and what are the features of different media currently available under the rubric 'multimedia'? When these media are employed for language learning, the features of each need to be taken into consideration, as well as the effects these might have on learners with different learning style preferences. In addition, teachers also need to be aware of their own preferred teaching and learning styles in order to be able to select learning resources and communication technologies for learners that *cover a range of styles*, not necessarily just looking for the best fit between the technology and preferred styles (Hoven, 1997, Chap. 3). As Summerville (1999), for

example, found in her study of cognitive style and hypermedia, ‘support does not always correlate with structure’ and, regardless of cognitive style, learners want or prefer to interact with an instructor. Her study also showed that, regardless of cognitive style, learners achieved better when more resources (channels and suggestions for instructional paths) were provided. As Bickerton has commented:

The multi-modal aspects of cognition have long been documented in cognitive science and there is good experimental evidence for considering that learning processes vary with the mode of communication (visual graphics, visual reading, sound). The specificity of multi-modality in language learning is less well researched, in particular the degree to which links between the modes must be planned and executed in order to maximise pedagogical benefit.

Bickerton (1999: 75).

In the next section, therefore we review the literature on the relationship between the presentation and exploration of learning material in different modalities as employed in CALL and online, and the strategies learners and teachers use to structure and make meaning of such material. This review aims to summarise what we have found over the last several years about the interaction of learners with multimedia materials, to shed light on what features to highlight in our development of such materials, and to discover which cognitive and learning strategies are useful in helping learners take best advantage of these materials. This information will then inform our discussion of the shape and characteristics of the learning environments which can enhance second language learning using multimedia.

Effects of multimedia or hypermedia on language learning

A recurring theme running through the studies undertaken in the area of CALL and multimedia is the various effects of including media of different kinds in language learning materials, in the development of skills such as reading. Plass and colleagues, for example, examined the effects of individual differences on the ability of learners to integrate verbal and visual learning using specific characteristics of multimedia. They found that students remembered individual word translations better when they had selected both visual and verbal annotations during the learning phase (1998). Similarly, Baltova (1994) and Raphan, (1996) found that learners who were highly visual in preferred sensory mode of perception may comprehend a reading passage more readily if video or multimedia were used to set the scene. However, when Plass and colleagues went on to investigate the relationship between specific learning preferences and word recall (2003), they found that the visual annotations were the least effective for all learners and that the visual annotations also disadvantaged low-verbal and low-spatial ability learners. In his study based on Slatin’s (1990) user-browser distinction, Ganderton (1999) noted the strong influence of learning styles and the use of online reading strategies, including information classification and activating background knowledge for inferencing. He also observed, however, that learners often focused on finding and following hyperlinks before – or indeed *rather than*, engaging in paragraphs or longer passages of text when reading online. These findings, together with student comments about focus on subordinate features of a topic without the superordinate big picture also indicate that online reading of hypermedia may actually disadvantage holistic, top-down learners.

Also in the area of learners’ actions using hypertext, Son (2003) studied the attitudes and perceptions of a group of Korean as a Foreign Language (KFL) learners working

on three different text formats: paper-based (PF), non-hypertext computer-based (NHF), and computer-based hypertext (HF). Overall, learners found the HF and NHF modes to be the most and least helpful respectively while the technical clumsiness of having to move between screens in the NHF modes seemed to have a negative effect on their responses on all measures. Their reactions to PF on the other hand were more positive in many cases, because of their stated familiarity with that format. This effect may, of course, change in a few years as computer screens are increasingly used as the site to find and read information. Son also noted that individual learning preferences influenced some learners' attitudes towards the usefulness of the audio and visual modes, with some in fact deciding not to use the alternative modes at all. In his conclusions, Son pointed out the importance of training learners to take full advantage of the additional features offered by hypertext environments (see also Hoven, 2003) and that the ability to search for information in hypertext multimedia environments and structure it effectively for learning will soon become essential skills.

Working memory, cognitive load and familiarity with the field also play critical roles in determining the usefulness of information presented in different modes. As Kalyuga (2000: 170) found, 'concurrent duplication of the same information using different modes of presentation increases the risk of overloading working memory capacity and might have a negative effect on learning'. In conclusion, Kalyuga offers three suggestions for improving the efficiency of the use of multi-modal materials. These include: presenting explanations aurally rather than in writing, delaying written explanations until *after* the aural explanation is complete, and providing more experienced learners with the facility to turn off or skip textual explanations when auditory or visual material is already available.

As Oliver and Herrington (1995) describe it, the effectiveness of hypermedia learning materials depends on the nature of the material (focus on higher order skills or knowledge acquisition), content presentation, and learner characteristics (Hoven, 1997). As several researchers have found, learner perceptions of the value of their learning experience using technology and multimedia also depends on the transparency and robustness of the technology (see also Downes, 2000). In other words, if the technology frequently breaks down, takes too long to load or change between programs, or programs crash, learners will become dissatisfied and lose the interest and motivation necessary to continue learning using these media (Herrington & Oliver, 1997; Felix, 2003; Hoven, 2003).

In addition, the research literature on learner interactions with hypermedia, on-line texts employing a range of media and the use of the World Wide Web for language learning, in general points to the changes in literacy needs and the sites of literacy that are occurring with the broadening possibilities that increasingly fast and sophisticated technology is offering us (Constanzo, 1992; Selfe & Hilligoss, 1994; Tuman, 1996; Murphy-Judy, 1997; Murray, 2000). One of the critical aspects of literacy in these contexts is the more active role that learners play in interpreting what they read, see and hear. Essential to an understanding of the mediating role that technology plays between learners and language is the concept of interactivity that is commonly cited as an intrinsic feature of CMC and contemporary multimedia CALL. In the next section we will examine this construct of interactivity.

Interactivity and CALL

As mentioned earlier, interactivity is a critical feature of the use of CALL in general and multimedia in particular. Numerous software and web-based applications cite interactivity as one of the important features of those applications, but very little investigation or examination has taken place into what exactly the term ‘interactive’ refers to in the context of technology-mediated language learning, including the use of multimedia. Some explication of the term therefore seems necessary. In addition, as several researchers in New Media in information technology (Kiouisis, 2002), instructional design (Sims, 2000), and general applications of ICT in education (Rose, 1999) have recognised, in order to be able to evaluate the effectiveness of the use of interaction in software applications it is necessary to have some way of operationalising the terms ‘interactive’ and ‘interactivity’ such that they can be investigated. That is, for informed academic discussion and investigation of a feature or group of features to take place, researchers need to know that they are using common terms of reference. On this topic, Sims (2000: 45) poses the question: can (or should) computer-based applications attempt to replicate a level of communication equivalent to real life learner-learner or teacher-learner communication? Clearly this question is much less an issue with uses of CMC, particularly audio and video-enhanced CMC; but what of other multimedia applications? Sims identifies the following dimensions as characteristic of interactivity in learning theory:

- Learners – the *who* of the learning process
- Content – the *what* of the learning process
- Pedagogy – the *how* of the learning process
- Context – the *when* and *where* of the learning process

(Sims, 2000: 47)

While concluding that ‘computer based interactivity is not a promise unfulfilled, but rather a promise not yet realised’, Sims seems to imply that interactivity is a construct deriving more from our pedagogical viewpoints and interpretations of learning theory than any constructs manifest by or through the technology we use. Certainly if we review his dimensions of interactivity above in light of the work of Jonassen (1992), Hartman and colleagues (1992) and Felix (2002) mentioned earlier, uses of technology would seem to fit best within both pedagogy and context, though feasibly also playing a role within the content. We can assume, therefore, that in the field of CALL, the extent to which the term ‘interactivity’ can be applied to a computer mediated activity depends at least on the pedagogical approach, the content and the context, as well as the learners, with various slippages and exchanges occurring within these dimensions. We could imagine, for example, a traditional gap-fill discrete item grammar activity on the Web (not particularly interactive), designed by a teacher to fit into a series of activities involving pre-task individual inductive work (either face-to-face or computer mediated), and post-activity discussion of correct and incorrect answers, with learners articulating their conclusions about how the rules for that point actually work, in their experience of working through the previous two activities. As Hoven (1997: 11) has defined it, interactivity ‘can also be taken to mean the capacity the package [CALL/CMC] provides for the learner to **interact** with, **interpret**, **negotiate**, and **make meaning** from the texts available, whether these are orthographic, audio, audiovisual, or visual texts’.

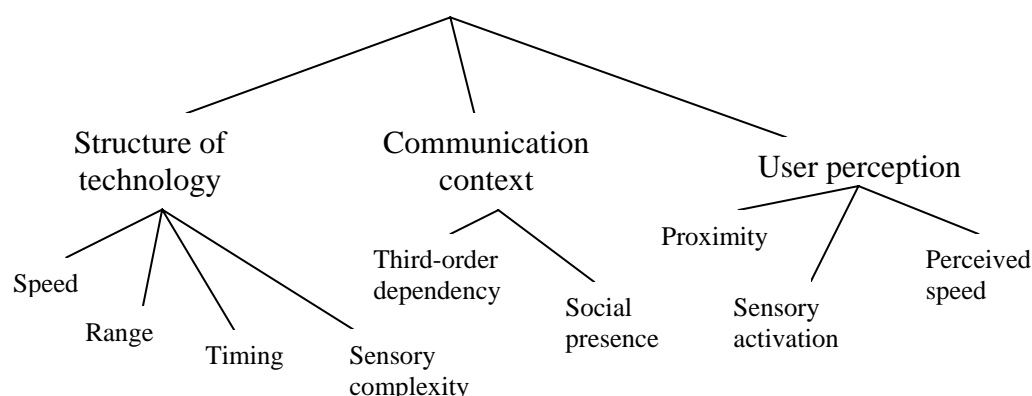
Kiouisis (2002) takes the explication of interactivity further in the direction of learner or user perceptions in his definition as it occurs in CMC contexts below.

[Interactivity] ... can be defined as the degree to which a communication technology can create a mediated environment in which participants can communicate (one-to-one, one-to-many, and many-to-many) both synchronously and asynchronously and participate in reciprocal message exchanges [...]. With regard to human users, it additionally refers to the ability of users to *perceive* the experience to be a simulation of interpersonal communication and increase their awareness of telepresence.

(Kiouisis, 2002: 379 – italics in original)

This relationship between the various aspects of the components of interactivity in communication mediated by technology, namely: structure of technology, communication context, and user perception is represented diagrammatically as follows:

Figure 2: Interactivity (Kiouisis, 2002: 378)



While some research work in CALL has included investigation of aspects of the Structure of technology above, studies in our field have focused have been principally in the areas of Communication context and User perception. With increasing moves in CALL towards internet-based siting of language learning and the shift further towards exploratory and communicative uses of the internet, we are moving away from instructed CALL. We now seem to be at a point in the evolution of CALL, and CMC implementations of CALL to posit the claim that, depending on the pedagogy employed, the term *interaction* is more appropriate to these communicative uses of CMC than is the term *interactivity*. Since interaction occurs in human-human communication via the mediation of technology, we therefore no longer require the term *interactivity* to apply to CMC in language learning.

In light of the discussion above about aspects of interactivity, it is important now to look at the interdependencies between interactivity and the environment from which it derives, including elicitation of learner perceptions and investigation of the pedagogy creating or surrounding it. An emerging approach to this kind of investigation into dynamic interdependencies is found in the ecological paradigms advocated by researchers such as Freeman (1998), van Lier (2000) and Tudor (2003). Such qualitative paradigms may be the most appropriate approaches currently available to us for investigating the learning environment as a whole. When numerous studies have been completed in different environments, it should then be possible to identify those aspects of the communicative context (among learners, among learners and teachers and among learners, teachers and the mediating technology), and learner perceptions that represent the essential or desirable features of effective technology-mediated learning environments.

As discussed above, CALL-inclined language teachers are increasing their use of communications technologies in the teaching and learning of language, whether these technologies be synchronous, 'delayed synchronous' or asynchronous. We now turn, therefore, to an examination of how learners are using these technologies to communicate in their second languages and what differences are emerging among these different modes of human-human and human-computer interaction. The following section also aims to further our understanding of the changing areas to investigate in learning environments incorporating the use of CMC.

CMC modes, means and manifestations

Generally descriptions of these electronic means of communication are divided for simplicity into *synchronous* ('real-time') such as chat, MOOs and some Virtual Reality (VR) environments and *asynchronous* (subject to a time delay while the sender waits for the receiver to access the message or some other mediation or moderation of the message takes place) such as in forums, bulletin boards and e-mail. However, in spite of the term *synchronous*, a delay is still experienced by users since the message must first be typed in and then sent using the Enter key on the keyboard. In addition, now that many students and classes, in industrialised countries at least, have access to broadband connections, more direct communication involving more media is possible. Because of the rapid advances in technology coinciding with this wider availability of broadband telecommunications producing some of the newer incarnations of CMC now in active use, I suggest that the term *synchronous* should now be restricted to communication through these newer forms, while keyboard-based communication delayed by the Enter key be termed *delayed synchronous*. The term *asynchronous* can still be maintained as the classifier for those forms of electronic communication such as e-mail which are constrained by time delays due to moderation, response times or time-zones differences.

Synchronous CMC using multimedia

As mentioned above, this use of communications media is still an emerging technology. Examples of this media include 1-to-1, 1-to-many, or many-to-many communication using webcams, headphones, and microphones as well as text and images through keyboards and computer monitors, as found in environments such as Webheads, or TappedIn. In the Webheads environment, for example, participants can choose to use an audio-supported webcam (which would fall into the synchronous category) or limit their participation to keyboard-only input, audio-only input or combinations of any 2 or 3 of these media. While the keyboard input is still dependent on hitting the Enter key for transmission, the audio and video channels, once activated, are not. Participants login to a pre-publicised session at a particular time and can exchange ideas, information (and of course jokes) with other participants in real time, with audio and video (see also Stevens, 2002; 2004). The teacher perspectives or technology-oriented reflective testimonials associated with TappedIn are very informative with regard to the view that seems to prevail among these (now-converted) technology-using teachers. Most prominent among these views, which reinforce our own experiences and intuitions, is the principle that the technology is a resource or a tool to be used and that the pedagogy remains paramount.

An early model of audio-only 'hybrid multimedia CMC' is also described by Kötter *et al.* (1999) in which a combination of audio and email in a distance learning program

was used for French and German languages. In this study, learners' initial approaches to use of the technology were slow, particularly in determining turns and taking risks. However, after some familiarity and practice within the environment, and written electronic communication and task activity in e-mail, learners appreciated the opportunity to discuss in real time, using an audio channel, some of the issues arising from the e-mail communications and tasks.

Delayed synchronous and asynchronous forms of CMC

Numerous language teachers and projects around the world have been using e-mail as the means for intercultural communication and second language learning for many years. The fact that such organizations as the E-Tandem Project exist is evidence of the usefulness and popularity of this use of CMC technology (<http://www.slf.ruhr-uni-bochum.de/>). Through such partnering arrangements, teachers are able not just to provide target language speakers with whom their learners can interact, but also to enrich the language learning environment by providing the opportunity to participate in the formation and maintenance of learning communities.

Another form of predominantly text-based CMC that has become popular with language learners and teachers for its immediacy, fostering of a sense of community, and level of interaction and creativity possible is the MOO application, derived from Multi-user domain (MUD) Object Oriented. Over several years, many different manifestations of this application have been created for the purposes of learning and practicing language in real time, as well as practising creative thinking and writing. The MOO was one of the first collaboratively constructed environments for this purpose and one of the longest running MOO is for ESL/EFL called SchMOOze.

At the site of SchMOOzeU itself, apart from information on the history of MOOs and how to use them, there are several links to useful 'classroom' activities – whether the classroom is real or virtual. From the LinguaMOO site, through the EnCore MOOs portfolio is a range of MOOs around the world in different fields that are operating at the moment. For an excellent discussion of the uses of text-only MOOs, including some of the drawbacks, see Backer (2001). Research into the uses and efficacy of MOOs for language teaching and learning seem to indicate that learners must be involved in the design of learning environments and that they need to be made aware of and trained in the use of learning strategies appropriate to a self-directed or autonomous learning environment, particularly the metacognitive strategies of planning, monitoring and reflection (Schwienhorst 2003). In addition to these, Shield and colleagues (2000) emphasise the capacity for MOOs to break down barriers among learners and between learners and teachers, thereby promoting more collaborative problem-solving. Further findings relating to discourse show that, while there are medium-specific features of MOO discourse in both L1 and L2 exchanges (augmentation of written medium by various means), participation in MOO interactions can promote L2 oral production, in spite of the written/oral production differences (Weininger & Shield 2003). This finding has also been supported in a larger-scale study of L2 oral development through participation in electronic chatroom discussions (Payne & Whitney, 2002). Both these latter studies have also shown the advantage over face-to-face (f2f) communication that CMC offers learners, for some reflection time during interaction, which improves the quality of their language output.

In their recent study of the extent to which the quality of communicative exchange is affected by the use of CMC rather than f2f negotiation in collaborative decision-making tasks Cornelius and Boos (2003) found that only with specific training could users approximate their performance in f2f conditions. This training has to aim to raise users' competencies to high levels in both the communication and media areas. More specifically, this training needs to include:

1. explicit references to topics of other group members (directly addressing key words: coherence)
2. establishing communication sequence by asking and answering questions
3. direct use of partners' names and
4. grounding processes established through the preceding training

However, while cautioning us on the preliminary nature of this untangling of the threads of conversational coherence, mutual understanding and convergence in this study, Cornelius and Boos also mention that 'mutual understanding based on conversational coherence does not foster the frequency of consensus' but that 'coherence can readily be substituted by interpersonal attraction' (*ibid.* p. 173). In other words, when participants like each other, they can overcome the lack of coherence of the computer-mediated conversation to reach consensus. Clearly interpersonal factors other than those examined in the study are in play here. These findings of 'rogue factors' are also supported by tandem e-mail studies showing the importance of first establishing personal relationships between tandem partners before pedagogic tasks can be successfully undertaken (Appel & Gilabert, 2002). Haythornthwaite (1999) and Söntgens (1999) have both found that personal relationships and the more private 1-1 communication media (telephone and e-mail) facilitate information sharing and are more frequently preferred by more successful learners. Some explanatory power could also be derived from the personal nature of the original uses of these media as discussed earlier.

In her 2001 study of the range of social roles learners adopt in synchronous CMC compared to pencil-and-paper group journal writing, Abrams found that in CMC, learners not only adopted 'a larger variety of participant roles during CMC than in group journals' but that 'these roles were also more interactively negotiated in the CMC environment' (Abrams, 2001, 489). This evidence forms a compelling argument for further studies of the social aspects of language learners using CMC. However, in order for a fuller picture to emerge of the opportunities and constraints of learning environments incorporating or relying on CMC, much more work needs to be done in the area of the strategies that effective learners use in different CMC contexts, whether these strategies are linguistic, paralinguistic, social, or some other kind. It would also be informative to improve our understandings of how learners help each other in these contexts (negotiation of meaning and scaffolding), and the roles of teachers in the interactions, including the effects of these roles on language learning.

Learners and teachers as social beings: some cautions

A theme that seems to be emerging from many of these studies then, is the importance of the social dimensions. However, with this social dimension of CMC also come the complications (for language teachers) or opportunities of other aspects of our lives as social beings, mostly prominently the political. These can range from the disruptions to on-line class communities produced by flame wars among online learners, to the destruction of the careers of unwary on-line teachers (Hailey *et al.*, 2001). As can be seen from the proliferation of listservs and newsgroups in developing countries, a

history already exists of people using the internet and CMC to voice their opinions and concerns, to find others with similar concerns, and to form themselves into politically-motivated groups, thereby raising solidarity. More recently, Rheingold predicts more pervasive political waves to emanate from the uses of these technologies – waves affecting our societies as a whole. He makes the assertion, for example, that:

‘(o)nlne social networks are human activities that ride on technical communications infrastructures of wires and chips. When social communication via the internet became widespread, people formed support groups and political coalitions online. The new social forms of the last decade of the twentieth century grew from the Internet’s capability for many-to-many social communication. The new social forms of the early twenty-first century will greatly enhance the power of social networks.

[...] ...citizens will discover new ways to band together to resist powerful institutions. A new kind of digital divide ten years from now will separate those who know how to use new media to band together from those who don’t.

Rheingold, 2003 xviii-xix.

From a rather different perspective, Reeves and Nass (1996) have produced quite persuasive evidence from a range of studies to show the extent to which we now treat computers and New Media like real people and places. They set out to apply the same research methods used in human-human and human-environment studies in the social sciences to studies of human-computer and human-media interactions. Instead of using all human subjects, their groups of subjects were studied with computer partners or using different features of media delivered by means of computers. On a range of social reaction measures from politeness to interpersonal distance, flattery, praise and criticism, from personality judgements and simulations, to emotions, social roles, gender, and voice, they found that ‘people’s responses to media are fundamentally social and natural’ (*ibid.* 251).

In the educational context, Davies *et al* (1998) have pointed out that ‘(t)eachers must be concerned with what the students are doing with themselves rather than with the language, which is the students’ concern’. One role of teachers using CMC for language learning then becomes to help learners navigate between their social and educational goals in such a way that their learning aims are achieved while not compromising their personal or social selves. Finding the appropriate path is often a balancing act between discovering and allowing for different personalities, learning styles and preferences, and accommodating strategies for interacting and dealing with negative encounters, which inevitably occur. And all of this must occur through the medium of technology which will often be unfamiliar to many learners. As discussed earlier, much of the CMC interaction to date has been through the medium of text, with audio and visual modes only recently becoming available. For some years, however, there have been some forums where graphical user interfaces (GUI) and have been implemented. These developments will be outlined in the section below.

Graphical and visual manifestations of CMC

Originally created by science fiction writers and computer engineers to create personalities or characters to interact in virtual worlds and electronic roleplay games, *avatars* can be described as the wrapping of a form of human personality around an electronic presence. Avatars have been adopted enthusiastically by certain language

learners – typically those whose learning style is predominantly visual and those for whom having a different persona behind which to operate gives them the necessary confidence and impetus to express their ideas and opinions. In this respect, the use of avatars and electronic communicative or social roleplay interactions provide shyer, less-vocal learners with an opportunity to participate at a level of (inter-)activity which they would otherwise find difficult to envisage. Users of avatars in such spaces as Avatar Palace, for example, can create their own avatars if they have the technical skills, or buy, trade or clone avatars created by others, with their permission and then re-dress or modify them (<http://www.thepalace.com/palace/avatars/>).

In terms of multimedia and learning styles, these graphical characters provide more visual learners with the necessary stimulus to make the otherwise very text-based medium more user-friendly. However, unless teachers or learners create their own ‘palace’ or chat space, these graphical chatrooms can be a little overwhelming for L2 learners. Some creative and hard-working language teachers have created graphical simulations to provide a supportive and appropriate environment for language learners, particularly those whose learning styles are more visually oriented to participate in realistic interactions (Coleman & Kessler, 2004). However, since this sort of development requires considerable programming and design skills, such projects are very rare, slow to develop, and often language- or culture-specific.

Multimedia, multimodal learning environments

Having examined the various aspects of contemporary uses of media in CALL and CMC, it is time to return to the pedagogic shifts outlined at the beginning of this paper to see if a clearer picture now emerges of the current roles of media in language learning mediated through the use of technology. Specifically, we now look at some of the features of language learning environments that foster learning through exploration, communication and collaboration presented in points 4-7 at the beginning of this paper.

A learning environment comprises not just a physical space, in which the human resources such as teachers, learners and other resources, including technology come together. However, while these are essential features, it is also much more than this. A learning environment is rather the essentially intangible conflux of *teachers*, their pedagogy, beliefs, and roles, their prepared materials and resource lists; also of *learners*, with their needs-driven goals, competencies, learning styles and strategies, as well as the *physical resources*, technology, libraries, and the virtual or ‘*soft*’ *technology* represented by software, internet facilities and resources and the *networks among all of these* in which learning takes place (see Figure 3 below).

One example of ‘soft’ technology to supplement a learning environment is found at The Learning Place <http://education.qld.gov.au/learningplace/>) created by Education Queensland. This resource comprises ready-made courses, tools for teachers and learners to create their own materials, on-line communities, various communication tools, re-useable learning objects, useful links, and on-line as well as f2f workshop activities. Although this site is not specifically designed for language learning, since it has been created with flexible use in mind, the task of using or repurposing the resources is quite feasible.

External **Environment**

Networks

Communication

Teachers \longleftrightarrow Learners

Exploration **Collaboration**

Physical resources \longleftrightarrow Soft resources

Instructional CALL

An excellent example of an on-line learning environment for a single subject area (Modern Greek) which incorporates exploration, collaboration and communication as well as instructional CALL is Hellas Alive ©. Within this environment, learners can access Playspaces which include specific language activities (form-focussed as well as interactions) and culture and language learning exploratory activities. This environment also provides some visually rich environments which the designers have named a Virtual Interactive Cityscape and a Virtual Classroom. These spaces also provide the common support features of dictionary facility and chatrooms.

Conclusion

As mentioned at the beginning of this paper, it is only when the technology becomes stable that we are able to conduct sufficiently rigorous investigations of the effectiveness, usefulness and appropriateness of the use of that technology in improving the learning experience of our learners. Therefore, while the technology continues to develop, change and expand its uses so unpredictably fast, teachers employing technology to mediate teaching and their learners' learning, need to work on developing a flexible and adaptive pedagogy that suits their teaching philosophies and fits with the teaching and learning environments within which they work. As part of this flexibility and adaptability, we need to examine and reflect on the new personal and learning strategies that both learners and teachers themselves need to develop.

As we move towards offering an increasing range and variety of on-line, technology-mediated, and self-access language learning materials, it is important to remember and consider the needs of learners in actually utilising these materials. In particular, learners' awareness of their own learning styles and strategies and how appropriately they can apply them are critical to their success in using CALL/CMC materials for language learning. This entails a strong need for informed pedagogy in the design of learning environments incorporating technology (on-line, LAN-based and stand-alone) and the importance of developing learners' language learning strategies, particularly on the metalinguistic and metacognitive side, to assist them in maximising their use of this technology.

From a pedagogical perspective in the field of CALL, we, as teacher-authors, are faced with great heterogeneity among their learners, and in the teaching environments in which we will find ourselves at any one point in time, and during our careers. Within these contexts of variable platforms, environments and learners, we are constantly trying to implement the best possible programs, while operating under curriculum, institutional, financial, time, technical, and skill constraints. Teachers using CALL/CMC or planning to use some form of on-line provision of language learning materials, therefore need to be able to find, evaluate, and use whatever resources and programs are available. At the same time, however, it is important to heed the findings of past experience in the area of media, particularly multimedia-related CALL.

References

- Abrams, Z. (2001). Computer-mediated communication and group journals: expanding the repertoire of participant roles. *System*, 29, 489-503.
- Avatar Palace: <http://avatarpalace.net/>
- Appel, C. & Gilabert, R. (2002). Motivation and task performance in a task-based web-based tandem project. *ReCALL*, 14 (1), 16-31.
- Ashworth, D. (1996). Hypermedia and CALL. In Pennington, M. C. (Ed.) *The Power of CALL*. Houston, TX: Athelstan, pp. 79-95.
- Backer, J. (2001). Using a modular approach to schMOOze with ESL/EFL students. In *The Internet TESL Journal*, VII, (5), May 2001. URL: <http://iteslj.org/Lessons/Backer-SchMOOze.html> (accessed 2/6/04).
- Baltova, I. (1994). The Impact of Video on the Comprehension Skills of Core French Students. *The Canadian Modern Language Review* 50 (3), 507-531.

- Bickerton, D. (1999). Authoring and the academic linguist: The challenge of multimedia CALL. In Cameron, K. (Ed.) *Media, design and applications*. Lisse: Swets & Zeitlinger, pp. 59-79.
- Brett, P. (1995). Multimedia for listening comprehension: the design of a multimedia-based resource for developing listening skills. *System* 23, 1, 77-85.
- Chapelle, C. (1998). Multimedia CALL: lessons to be learned from research on instructed SLA. *Language Learning & Technology* 12 (1). URL: <http://llt.msu.edu/vol2num1/article1/>
- Chen, P. (1992). An epistemic analysis of the interaction between knowledge, education, and technology. In E. Barrett (Ed.) *Sociomedia: Multimedia, hypermedia, and the social construction of knowledge*. Cambridge, Mass. The MIT Press, pp. 161-73.
- Coleman, D. & Kessler, G. (2004). The Langland Project. Presentation at the CALICO Symposium, June 8-12, *CALL: Focusing on the learner*. Carnegie-Mellon University, Pittsburgh.
http://coarts_faculty.utoledo.edu/dcoleman/Langland/
- Cornelius, C. & Boos, M. (2003). Enhancing mutual understanding in synchronous computer-mediated communication by training. *Communication Research*, 30 (2), 147-177.
- Costanzo, W. (1992). Reading, writing, and thinking in an age of electronic literacy. In Tuman, M. C. (Ed.) *Literacy online*. Pittsburgh, PA: University of Pittsburgh Press, pp. 11-21.
- Davies, L.B., Shield, L. & Weininger, M.J. (1998). ReTOOLing MOOs. *Teaching in the Community Colleges (Electronic) Journal*, 3, Spring. URL: <http://leahi.kcc.hawaii.edu/org/tcon98/paper/davies.html> (accessed 30/5/04).
- Downes, S. (2000). Nine rules for good technology. *New Media* 03/07/00
<http://www.newstrolls.com/news/dev/downes/column000307.htm> (accessed 26/9/00)
- e-Tandem Project: <http://www.slf.ruhr-uni-bochum.de/>
- Felix, U. (2001). *Beyond Babel: Language learning online*. Melbourne: Language Australia.
- Felix, U. (2002). The web as a vehicle for constructivist approaches in language learning. *ReCALL*, 14 (1), 2-15.
- Felix, U. (2003). Teaching languages online: Deconstructing the myths. *Australian Journal of Educational Technology*, 19 (1), 118-138. URL (accessed 2/6/04): <http://www.ascilite.org.au/ajet/ajet19.felix.html>
- Freeman, D. (1998). *Doing teacher research: From inquiry to understanding*. Boston, MA: Heinle & Heinle.
- Ganderton, R. (1999). Interactivity in L2 web-based reading. In Debski, R. & Levy, M. (Eds.) *WORLDCALL: global perspectives on computer-assisted language learning*. Lisse: Swets & Zeitlinger, pp. 49-66.
- Gibson, S. E. (2002). Using a problem based multimedia enhanced approach in learning about teaching. *Australasian Journal of Educational Technology*, 18, (3), 394-409. URL: <http://www.ascilite.org.au/ajet/ajet.html>
- Demo URL: <http://www2.atl.ualberta.ca/project/detail.cfm?id=58> (accessed 2/6/04).
- Hailey, D., Grant-Davie, K. & Hult, C. (2001). Online education horror stories worthy of Halloween: A short list of problems and solutions in online instruction. *Computers and Composition*, 18, 387-397.

- Hartman, A., Diem, J. D. & Quagliana, M. (1992). The many faces of multimedia: How new technologies might change the nature of the academic endeavour. In E. Barrett (Ed.) *Sociomedia: Multimedia, hypermedia, and the social construction of knowledge*. Cambridge, Mass. The MIT Press, pp. 175-92.
- Haythornthwaite, C. (1999). Networks of information sharing among computer-supported distance learners. Paper presented at the *Computer Supported Collaborative Learning Conference 1999 (CSCL 1999)*, Stanford University, Dec.12-15.
http://sll.stanford.edu/projects/CSCL99/papers/monday/Caroline_HaythornthwaitA79.pdf (accessed 8/6/04)
- Hellas Alive ©: http://www.hau.gr/hau/en/edu_hellasalive.html
- Herrington, J. & Oliver, O. (1997). Multimedia, magic and the way students respond to a situated learning environment. *Australian Journal of Educational Technology*, 13 (2), 127-143. URL:
<http://www.ascilite.org.au/ajet/ajet13/herrington.html> (accessed 26/5/04)
- Hoadley, C. M. & Enyedy, N. (1999). Between Information and Communication: Middle Spaces in Computer Media for Learning. Paper presented at the *Computer Supported Collaborative Learning Conference 1999 (CSCL 1999)*, Stanford University, Dec.12-15 1999: URL (accessed 8/6/04)
http://sll.stanford.edu/projects/CSCL99/papers/monday/Chris_Hoadley_242.pdf
- Hogan-Brun, G. & Laux, H. (2001). Specialist gateways through chaos: a changing learning environment. *System*, 29, 253-265.
- Hoven, D. (1997). *Improving the management of flow of control in computer-assisted listening comprehension tasks for second and foreign language learners*. Brisbane: Unpublished doctoral dissertation, University of Queensland. URL:
<http://www.users.bigpond.net.au/cryptsoft/dlh/thesis/> (accessed 2/6/04).
- Hoven, D. (2003). Strategic uses of CALL: What learners use and how they react. *Australian Review of Applied Linguistics*, Series S No. 17, 'Asian Languages and Computers', 125-147.
- Kabata, K. & Yang, X. J. (2002). Developing multimedia lesson modules for intermediate Japanese. *CALICO Journal* 19 (3), 563-570.
- Kalyuga, S. (2000). When using sound with a text or picture is not beneficial for learning. *Australian Journal of Educational Technology*, 16 (2), 161-172. URL:
<http://www.ascilite.org.au/ajet/ajet16/kalyuga.html> (accessed 6/12/00)
- Khine, M. S. & Lourdusamy, A. (2003). Using *Conversant Media* as a collaborative learning tool in teacher education. *Australasian Journal of Educational Technology*, 19 (2), 260-274. URL:
<http://www.ascilite.org.au/ajet/ajet19/khine.html>
- Kiousis, S. (2003). Interactivity: a concept explication. *New Media & Society*, 4 (3), 355-383.
- Kötter, M., Shield, L. & Stevens, A. (1999). Real-time audio and email for fluency: Promoting distance language learners' oral and aural skills via the Internet. *ReCALL* 11 (2), 55-60.
- LinguaMOO: <http://lingua.utdallas.edu/>
- Liontas, J. I. (2002). CALLmedia Digital technology: Whither in the new millennium? *CALICO Journal* 19 (2), 315-330.
- Murphy-Judy, K. (1997). Literacies for foreign language learners in the information age. In Murphy-Judy, K. (Ed.) *NEXUS: The convergence of language teaching*

- and research using technology. Durham, Nth. Carolina: CALICO Monograph Series Vol. 4, pp. 133-144.
- Murray, D. (2000). Changing technologies, changing literacy communities? *Language Learning and Technology* 4 (2), 43-58.
- Oliver, R. & Herrington, J. (1995). Developing effective hypermedia instructional materials. *Australian Journal of Educational Technology*, 11 (2), 8-22. URL: <http://www.ascilite.org.au/ajet/ajet11/oliver.html> (accessed 26/5/04)
- Parks, S., Huot, D., Hamers, J. & H.-Lemonnier, F. (2003). Crossing boundaries: Multimedia technology and pedagogical innovation in a high school class. *Language Learning & Technology*, 7 (1), 28-45. URL: <http://llt.msu.edu/vol7num1/parks/default.html>
- Payne, J. S. & Whitney, P. (2002). Developing L2 oral proficiency through synchronous CMC: Output, working memory, and interlanguage development. *CALICO Journal*, 20 (1), 7-32.
- Pellettieri, J. (2000). Negotiation in cyberspace: The role of chatting in the development of grammatical competence. In Warschauer, M. & Kern, R. (Eds.) *Network-based language teaching: concepts and practice*. Cambridge: Cambridge University Press, pp. 59-86.
- Plass, J., Chun, D., Mayer, R., & Leutner, D. (1998). Supporting visual and verbal learning preferences in a second-language multimedia learning environment. *Journal of Educational Psychology*, 90 (1), 25-36.
- Plass, J., Chun, D., Mayer, R., & Leutner, D. (2003). Cognitive load in reading a foreign language text with multimedia aids and the influence of verbal and spatial abilities. *Computers and Human Behavior*, 19, 221-243.
- Raphan, D. (1996). A Multimedia approach to Academic Listening. *TESOL Journal* 6 (2) 24-28.
- Reeves, B. & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. CSLI Stanford, California: CSLI Publications & Cambridge University Press.
- Rheingold, H. (2002). *Smart mobs: The next social revolution*. Cambridge, MA: Perseus Books Group.
- SchMOOzeU: URL: <http://schmooze.hunter.cuny.edu/>
- Selfe, C. & Hilligoss, S. (Eds.). (1994). *Literacy and Computers: The complications of teaching and learning with technology*. New York: The Modern Language Association of America.
- Shawback, M. & Terhune, N. (2002). Online interactive courseware: Using movies to promote cultural understanding in a CALL environment. *ReCALL*, 14 (1), 85-95.
- Shield L., Davies, L.B. & Weininger, M.J. (2000). Fostering (pro)active language learning through MOO. *ReCALL*, 12 (1), 35-48.
- Sims, R. (2000). An interactive conundrum: Constructs of interactivity and learning theory. *Australian Journal of Educational Technology*, 16 (1), 45-57.
- Skehan, P. (2003). Focus on form, tasks, and technology. *Computer Assisted Language Learning*, 16 (5), 391-411.
- Smith, B. (2003). The use of communication strategies in computer-mediated communication. *System*, 31 (1), 29-53.
- Son, J-B. (2003). A hypertext approach to foreign language reading: Student attitudes and perceptions. *Australian Review of Applied Linguistics*, Series S No. 17, 'Asian Languages and Computers', 91-110.

- Söntgens, K. (1999). Language Learning via E-mail – Autonomy Through Collaboration. Paper presented at the *Computer Supported Collaborative Learning Conference 1999 (CSCL 1999)*, Stanford University, Dec.12-15, 567-574. URL:
http://sll.stanford.edu/projects/CSCL99/papers/wednesday/Kirsten_Sontgens_567.pdf (accessed 8/6/04)
- Stevens, V. 2002. A day in the life of an online language educator. *TESL-EJ*, 6 (3). URL accessed 27/10/04:
<http://www-writing.berkeley.edu/TESL-EJ/ej23/int.html>
- Stevens, V. 2004. The skill of communication: Technology brought to bear on the art of language learning. *TESL-EJ*, 7 (4). URL Accessed 27/10/04:
<http://cwp60.berkeley.edu:16080/TESL-EJ/ej28/int.html>
- Summerville, J. (1999). Role of awareness of cognitive style in hypermedia. *International Journal of Educational Technology*, 1 (1). URL: (accessed 10/12/99)
<http://www.ao.uiuc.edu/ijet/v1n1/summerville/index.html>
- TappedIn: URL: <http://ti2.sri.com/tappedin/>
- Tudor, I. (2003). Learning to live with complexity: towards an ecological perspective on language teaching. *System*, 31 (1), 1-12.
- Tuman, M. (1996). Literacy online. *Annual Review of Applied Linguistics*, 16, 26-45.
- van Lier, L. (2000). From input to affordance: Social-interactive learning from an ecological perspective. In Lantolf, J. P. (Ed.) *Sociocultural theory and second language learning*. New York : Oxford University Press, pp. 245-259.
- Webheads: URL:
<http://www.geocities.com/Athens/Olympus/4631/papers/evonline2002/webheads.htm>
- Weinberg, A. (2002). Virtual misadventures: Technical problems and student satisfaction when implementing multimedia in an advanced French listening comprehension course. *CALICO Journal* 19 (2), 331-357.
- Weininger, M.J. & Shield, L. (2003). Promoting oral production in a written channel: An investigation of learner language in MOO. *Computer Assisted Language Learning*, 16 (4), 329-349.

Biostatement

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