COMMUNICATION IN VIRTUAL WORLDS AND VIDEOCONFERENCE

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Abstract

This is a comparative study of two virtual environments, which can be used in distance education: Virtual World (VW) and Video Conference (VC). Previous studies have examined these two environments based on Social Presence Theory. Using media theories, the current study investigates the fundamental differences between these two synchronous environments. From the theoretical analysis it is shown that VW, contrary to VC, creates a rather "compact" environment for its users and it can support "dynamic" learning activities. These two media properties have to be explored in further research with qualitative and quantitative methods.

Introduction

During the last few years, online education is increasingly becoming a large part of education delivered in the world. Theories of distance education and theories of learning have highlighted the importance of communication and collaboration for the educational process to make online learning efficient, indicating that synchronous media enhance online interaction and collaboration. In this paper, the impact of two synchronous media in online education is studied.

A lot of studies (for example Walther, 1996) not only examine whether communication has an effect on collaboration, but also look at how the medium itself influences behavior. The theories, trying to explain the influence of the media on behavior, are focusing either on technical richness (e.g., possibilities of a communication medium to transport speech, tone, gesture, etc.), or subjective richness (i.e. experience with the medium) or media naturalness, i.e., degree of similarity of the medium with the face-to-face medium (Kock, 2004).

This study is a follow up of a previous study on the use of Second Life (SL) for distance education (Tapsis & Tsolakidis, 2011; 2012). This study showed that in a VW, as opposed to a two-dimensional (2D) virtual environment (e.g., Learning Management Systems [LMS]), students developed a higher sense of social presence and they were happy with the learning environment in which they worked. Nevertheless, it was not clear which features of the media were more essential for that difference. Previous researchers also found differences in social presence when they compared 3D with 2D Virtual Learning Environments (VLEs), but they didn't find essential differences among synchronous media. So,

there is a need for more research that will explore one by one the characteristics of VW in comparison with another synchronous medium, such as VC.

Media Theories

Each media theory sets an evaluation criterion for the media and classifies them according to this criterion. Media Richness Theory (MRT) sets as criterion the richness of the medium, Media Synchronicity Theory (MST) the synchronicity of the medium, and Media Naturalness Theory (MNT) the naturalness of the medium. In order to evaluate the communication performance, MRT focuses on the communication task, while MST on the communication process and MNT on the communication preferences of the communicants.

Media Richness Theory

According to MRT, the richest medium for a certain communication task is the one that provides best the set of capabilities needed for a situation, that is the individuals involved, the task, and the social context within which they interact (Dennis & Valacich, 1999). Daft and Lengel (1986), developers of the theory, define information richness as the "ability of information to change understanding within a time interval" (p.560). Rich communication is associated with quick understanding. The faster the understanding of a message, the richer the communication channel. The richness of a medium depends on:

1. Language variety (the ability to convey natural language rather than just numeric information)
2. Multiplicity of cues (the number of ways in which information could be communicated),
3. Personalization (the ability to personalize the message)
4. Synchronicity (the ability of the medium for immediate/fast feedback)

The MRT classifies communication tasks into two main categories: uncertainty tasks and equivocality tasks.

Uncertainty exists when, within the framework for the interpretation of the message, there is lack of information for processing. Hence, someone has to provide the missing information either finding or creating it. If the system has uncertainty, then less rich media have to be preferred.

Equivocality exists when there are multiple (and possibly conflicting) interpretations of the information or the interpretive framework. When there is equivocality, a discussion among the members is necessary to agree on a meaning. In the case of fuzzy tasks, rich media are preferred (e.g., face-to-face). Depending on their technical characteristics, media can achieve the aim of the communication task in a different time; so they differ in the degree of understanding that can be achieved at a particular time. The faster you reach understanding, the richer is the medium for this type of task. Dennis & Valacich (1999) state that no medium can be characterized as rich in all applications.

Media Synchronicity Theory

Synchronicity is a state of the communicants, while media synchronicity is a medium's property. Synchronicity is "the degree to which individuals work together in the same activity, with the same information and at the same time, with a common focus" (Dennis & Valacich, 1999, p.5). Medium synchronicity is "the ability of a medium to create the sense that all participants are concurrently engaged in the communication event" (Carlson & George, 2004, p. 192).

MST argues that the communication performance depends on the capability of the medium to support the communication process during a task function (Dennis & Valacich, 1999). So the medium should be matched with two fundamental group communication processes: conveyance or convergence.

Conveyance is the transmission of new information and its processing by the recipient, so that she/he can create hers/his own mental model for the specific situation. Conveyance is a usual advantage of low synchronicity media.

Convergence is the process where two or more people involved in communication, agree (or not) in the meaning of information. The convergence process usually requires less background knowledge than the conveyance process. Convergence is a usual advantage of high synchronicity media.

MST supports that media can be classified according to five main characteristics:

1. Immediacy of feedback, the capability of the medium to support bidirectional communication.
2. Communication techniques that include symbols and information variety, i.e., different ways to symbolize the various messages. Symbolic communication helps humans store knowledge for future use. It can affect communication and understanding of the messages because of: (i) ease of transfer of information in a certain format, (ii) possibility to include extra information (in addition to text) to the message sent (e.g., verbal and non-verbal symbols), (iii) cost of delay (Reinsch & Beswick, 1990) or cost of production of the message (Clark & Brennan, 1991), both in its composition, and in its reading, (iv) lack of verbal and non-verbal symbols.
3. Parallelism, the ability for multiple conversations to occur simultaneously.
4. Rehearsability, the ability to practice and edit a response before transmission
5. Reprocessability, the ability to replay and refer back to previous parts of the communication.

Media synchronicity is affected positively from: (a) transmission velocity, that is how fast the message is transmitted and (b) symbol sets, that is in how many ways the information can be encoded. Media synchronicity is affected negatively from (a) parallelism, (b) rehearsability and (c) reprocessability.

MST claims that there is no perfect tool for any situation. The efficiency of a communication performance depends on the degree of matching the synchronicity of a medium with the needs of the communication task. The ideal choice may not be a single medium, but a method that combines several media, taking into account the positive and negative characteristics of each chosen medium, as it is shown in Table 1.

Table 1.

Relative Trait Salience of Selected Media

	immediacy of feedback	symbol variety	parallelism	rehearsability	reprocessability
face to face	high	low-high	low	low	Low
Video conference	medium-high	low-high	low	low	Low
Synchronous groupware	low-medium	low-high	high	medium-high	High

Source: Dennis & Valacich, 1999, p.3.

For the VWs the immediacy of feedback, the symbol variety, parallelism and rehearsability are medium-high, while reprocessability is low.

Media Naturalness Theory (MNT)

The term communication overload has over the years been referred to as cognitive overload (Vollmann, 1991) or information overload (Eppler & Mengis, 2004). Cho et al. (2011), studying the way in which synchronicity affects communication overload, found that the communicants felt higher load with low synchronicity media, than with high synchronicity media. For this reason, Kock (2005) argues that due to the long experience of people with face-to-face communication, they are more likely to choose to communicate through a high synchronicity medium, since it is closer to face-to-face experience.

The negative effects of the non-naturalness of a medium can be balanced by what is referred to as "schema alignment" and "cognitive adaptation." The ***schema alignment*** construction refers to the similarity between the mental schemas of an individual and those of other participant(s). The ***cognitive adaptation*** construct refers to an individual's level of schema development associated with the use of a particular medium.

MNT suggests four propositions. The Speech Imperative Proposition states that the support of oral communication is more important than the support of other elements of communication. The other three propositions say that, in order to decrease the cognitive effort required from an individual to use a medium to accomplish a collaborative task in communication, it is necessary to increase: (i) the naturalness of the medium (Media Naturalness Proposition), or (ii) the

cognitive adaptation to the medium (Cognitive Adaptation Proposition), or (iii) the schema alignment between two individuals using the medium (Schema Alignment Proposition).

Medium Naturalness. It was proposed that the degree of naturalness of a Computer Mediated Communication (CMC) medium can be assessed based on the degree to which it incorporates five key elements of face-to-face communication:

1. The **space-time dimension**, which comprises the degree to which a medium supports:
   a. **Co-location**, that allows individuals engaged in a communication interaction to share the same context, as well as see and hear each other
   b. **Synchronicity**, that allows individuals to quickly exchange communicative stimuli
2. The **expressive-perceptual dimension**, which comprises the degree of support for the use of:
   c. Facial expressions
   d. Body language
   e. Speech

Presence in a Virtual Environment

There are several definitions about virtual environments. Calleja (2008, p.14) provides a definition that fits mostly with the 3D environments. According, "**Virtual environments** are computer generated domains which create a perception of space and permit modification through the exertion of agency." This definition separates the 2D virtual environments, like chat rooms and web pages, from 3D virtual environments, like VWs.

The users of an environment are represented within the environment by a virtual agent (avatar). An avatar is not just any neutral object, but a virtual object with behavior, motion in space and having a semantic meaning. Finally, an avatar is a personal virtual object of the user. User behavior can be influenced by its indirect interaction with other online users; interaction through avatars. Moreover McCreery, Krach, Schrader, and Boone, (2012) found that people's personality and the personality of their avatar, influence behaviors in virtual environments.

Some researchers approach the concept of "presence" as a property of the communication medium, while others as a property of the user of the communication medium. For example according to Lee, presence represents "a psychological state in which the virtuality of experience is unnoticed" (Lee, 2004, p.32). In general, researchers agree that the construct of presence relates to a sense of being there or being connected.

There are many kinds of presence that have been suggested. Bulu (2012) found that some specific kinds of presence are related with satisfaction and immersive

tendencies of students. Social presence, place and co-presence affected students' satisfaction in the VW. Immersive tendencies of the students were related to their place and co-presence but not to their social presence. According to Wheeler (2005), social presence is essential in any pedagogical situation, but mostly in online programs.

Kawachi (2013, p.26) supports that social presence has four dimensions:

1. Time: Duration of engagement, integrating rhythm, synchronization performance and making moments to signify.
2. Place: It has to do with body sense, the emotional space, the material impact and the situated agency.
3. Action: It is connected with tuning, reciprocity, negotiation and quality of deeds.
4. Relation: It relates with communion, engagement, reputation and use.

Each kind of presence has a different role in each stage of the educational process. Social presence is important in the early stages of the learning process carrying the student from being an outsider to becoming an insider in the online community. Social presence integrates the outsider into the target community, and there serves to reduce anxiety (Kawachi, 2013). For the next stages of the educational process cognitive presence is essential, helping student to reach collaborative learning.

Interaction, Collaboration and Learning in Virtual Environments

According to Ward and Sonneborn (2009), the key technical features of VWs that affect collaboration and learning are: (i) the possibility to modify one's avatar, (ii) the possibility to import, modify and interact with 3D objects, (iii) physical cues, and (iv) the possibility for individuals to personalize their group work experience. They also consider that the special characteristics of VWs can enable the development of new forms of collaboration and learning, such as use and modification possibilities of avatars, import and modification of 3D objects and specific clues of the virtual environment.

Research shows that the actions of individuals within an environment are connected to the degree that the users feel connected to the virtual environment (Banos et al., 2008). So the feeling of the user for the environment may affect his/her interaction within the virtual environment. Van der Straaten (2000) considers that the interaction depends on the capabilities of the medium. If the medium transfers a small amount of information to and from the user, it can reduce the opportunities for interaction and perception. Some theoreticians suggest that online communication cannot transfer as much information as face-to face-communication. For example, Bulu (2012) considers that the online interaction loses in non-verbal aspects (e.g., emotionality), although it wins in time flexibility, space flexibility and content continuity. Biocca (1997) considers that the nature of the interface affects the adaptability of the mind and body of the

human and finally the way she/he interacts with other people or objects through the CMC, since there is a close association of perception and action.

The role of interaction for the online communication can be better understood through three dimensions in interactivity recommended by Liu (2003) that is: active control, two-way communication, and synchronicity. Through these dimensions the user attempts to gain control over communication. This objective may result in a greater social presence, which in turn can lead to greater satisfaction from the educational process.

Another issue concerning communication is the issue of security and trust that can develop among interacting students. Often it is considered that in online communication there is not the necessary transparency required to cultivate trust. Nonetheless, Bente, Ruggenberg, Kramer, and Eschenburg, (2008) argue that VWs enhance trust and this is a VW's specific benefit for distributed collaboration and learning (Hanonen & Bosch-Sijtsema, 2012).

So it seems that some researchers' skepticism towards distance education is rooted in the following beliefs:

1. The mediated communication, as compared to face-to-face communication, hinders the transmission of emotional messages,
2. The mediated communication hinders the development of trust.

The learning model in 3D VLEs developed by Dalgarno and Lee (2010) considers that the learner interaction in 3D VLE is achieved through: (i) embodied actions, (ii) embodied verbal & non-verbal communication, (iii) control of environment attributes and behavior, and (iv) building/scripting of objects and behaviors. Their model argues that "learner interaction" and "representational fidelity of the virtual environment" can affect: (i) the construction of identity of the user and (ii) the sense of presence and that (iii) the co-presence influences the afforded learning tasks, and in turn it affects the efficiency of the learning model applied, resulting in better learning benefits.

It seems that students preferred online interactivity to balance work and lifestyle needs with their education. They appeared less concerned about learning benefits (Ladyshewsky & Taplin, 2013). Therefore, online learning appears to be successful, not only on physical distance, but also on the issue of limited free time for studies, due to the modern lifestyle obligations.

Discussion

To compare the performance of VW versus VC, over a communication task, one has to examine the degree to which their corresponding characteristics affect communication.

Oral speech transmission. Observing the way VW and VC handle the elements of a message (spoken code, written code, nonverbal communication), it is obvious that the two media transfer the oral speech in the same way, but they differ in the

transmission of other elements of a message. It is worth mentioning that VW supports 3D audio conference, giving an immersion sense to users.

Virtual environment. (Compact or "broken" space? continuous or puzzle-like space?). VWs create an integrated environment in which users coexist through their avatars. In a VC, the space is "broken" and it is composed by smaller pieces, like a puzzle. The compactness of the space of the VW favors synchronicity and collaboration among users in order to fulfill their communication/educational task. The compact space creates the conditions for incorporation of the user in it, which can lead to immersion in the environment and to activities that are carried out within it. For example, Skype's interface (a typical VC example) is constructed from real pictures from the private space of each user, while SL (a typical VW example) creates a simulated compact environment.

Real or symbolic image. VW give, as a counter to image transferred via a camera, a constructible 3D virtual environment, i.e., a virtual reality environment, engaging the user through a real 3D audio conference. Actually the VW environment is a complex reality environment, composed of the actual physical user speech and symbolic elements that users project into the environment. In that way the VW establishes a symbolic communication.

The two environments differ in the way they treat the ability to convey and observe facial expressions and body language. VC transfers facial expressions and body language of online users, while VW transfers a simulation, i.e., symbolism. So VC creates a more natural communication, according to the picture of the user, but VW creates a symbolic communication, where the user has a feeling of freedom in movement.

Semiotics and metaphors. Each virtual environment provides its users with tools for expression and communication. As tools of expression, VWs provide symbol sets, such as for the appearance and motion of the avatar, gestures, or other predefined behaviors of the avatar. But the effectiveness of use of these elements depends on the degree of familiarity of the user with the use of this communication code. As very often the users are not aware of this communication code, VW has a very high learning curve, compared to other media that do not use such communication codes. In recent years some VC systems (such as Google plus) offered some additional accessories, as image or audio morphing, emoticons, etc.

Scale of medium. The two media differ in the size of the communication group they can support efficiently. VC is used more often for personal communication or for communication in small groups. Unlike that, SL is a medium of social networking, offering tools for mass communication and cooperation. For this reason it has several organizing levels of the user's contacts: (i) personal contacts (friends), (ii) group participation (groups) and (iii) nearby residents. It is characteristic that the space is used as one of the criteria for grouping online

users. Through this common space (area), users are grouped around the specific content of the environment. There is a difference in the ergonomy of the two interfaces. The interface of VC offers more personal information with less flexibility and the interface of VW the opposite. Due to the difference in medium scale, VWs can support collaboration of larger groups than VC.

Content saving. Transfer and storage of content are important when group communication process is a conveyance procedure. A Multi User Virtual Environment (MUVE), depending on its nature, can save some kind of content that is necessary for the activities of its users. VWs are not intended to create standard content files (like doc, pdf, etc.) and therefore they don't have the appropriate tools to create and edit them. Instead they have tools to create and edit simple text, three-dimensional objects and programming scripts. All other types of content can only be projected into the environment. Videoconferencing is not provided to create and store any kind of content, but only for delivery and viewing. Due to the possibility of viewing content, a VW user can only study the content when she/he is online, something which enhances synchronicity. However, as this content is displayed as part of the overall environment, (e.g., webpages projected onto the surfaces of the objects), reading is not as easy, as when a user looks at a webpage.

Communication procedures. It should be noted that often the opportunity for local saving gives a greater sense of security to the user, since he/she can study the content offline, more autonomously, i.e., in the time she/he wishes. As the content is constantly into the VW, the user can come back again to study individually the information. Therefore, VW can support conveyance procedures, provided the users are online. Some other environments offer better support to the conveyance procedures than VWs, as they offer options of printing.

Following MRT's approach, VW is considered "too much" for the transmission of simple messages, while it can be more efficient for the transmission of complex messages, i.e., equivocality tasks. VC is better for the transformation of raw personal information, while VW is better for more coded symbolic information. SL has an advantage in convergence procedures, because it facilitates user interaction, visually and acoustically. Users have a strong sense of the "other's presence" into virtual space, something that facilitates not only communication, but also concentration of the users on it, resulting in a mutual understanding. This feature enhances the synchronicity of the medium.

In previous research it was observed that students were more satisfied with the VW environment, or that they found it more pleasant. This shows a positive attitude towards VW since it provides a game-like condition, which reduces the emotional stress. Based on MNT (Kock, 2005), VW is considered more natural communication medium.

Conclusion

Although VW and VC are both synchronous media, they have remarkable differences. VW offers an integrated and compact environment, with 3D audio conference, supporting communication in large groups, as in a full classroom and customizable symbol set of 3D objects, useful for the non-verbal communication. VC offers a very ease of use (low learning curve) and the real image from the private place of the users (good for facial expressions and body language). Both media are considered rich media due to their high synchronicity, suitable for collaborative tasks.

Each communication task asks for a different level of media richness, or media synchronicity. VC is advantageous for transmission of the real-physical picture from the user's private space, while VW is advantageous for the transmission of a symbolic picture constructed by the user. The physical experience from the face to face communication asks for a complete environment which gives us rich information. VW is compatible with the first, while VC with the second. So each communication task demands a different combination of media, according to their characteristics, i.e., richness, synchronicity and naturalness.

Future studies will explore how teachers and educational institutes can fit the media properties with the activities and tasks needed in the educational process.

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