DEVELOPMENT OF SOCIAL MEDIATION AND EMOTIONAL REGULATION IN VIRTUAL LEARNING ENVIRONMENT RESEARCH

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ABSTRACT

This paper puts forward a series of theoretical underpinnings and design considerations for embodying emotional and aesthetic aspects of virtual (reality) learning environments (VLEs) in support of ubiquitous teaching, studying and learning. The authors assert that a VLE should be considered as an interactive and sensation-producing affordances and instruments, as well as a mediator of communication and learning. Furthermore, a VLE should be valued as a tool for emotional and socio-structural mediation, as well as for the psycho-social regulation and control over the communication situation that the environment makes possible by allowing users to regulate psycho-social distances.

Researchers in studying and learning have too often neglected emotional and aesthetic factors, especially in the context of network-based learning environments. These factors are examined here in terms of seven levels of observation forming a continuum from the individual subconscious/conscious inter-personal level to the social, cultural, cross- and transcultural levels. The continum is mapped onto learning architectures, offering a greater understanding of their value as starting points and design considerations for VLEs in regulating learning. The most critical issue to take into account is the users, the human individual(s), and the social nature(s) of using the technologies involved.

Keywords*: Emotions, Virtual reality Learning Environments, Network-based Learning.*

INTRODUCTION

What is specific to a virtual environment as compared to any information space is that it is *populated.* The users of the environment are inside an information space and see a representation of themselves and/or others in that space. As soon as students see who else is interested in which information, the space becomes inherently social. Researchers have introduced the notion of *place* to emphasise that a space has a social impact. Places are *social settings in which people interact*.

In the broadest sense, we can step into highly *experiential* and emotionally *engaging* "virtual worlds" using different media and media affordances, for example, audiovisual media, such as television and cinema, or even books. Such media in minimal formats stimulate only a few senses; the key is the users' *imagination*, which fills the emotional-sensory gaps of the media in conjunction with the aesthetic and social dimensions of such environments (Steuer 1992; Huang, & Alessi 1999; Peltoniemi and Tammi 1999). The advances in computer technology that have contributed to this changed reality offer great potential for developing a dynamic aesthetic factors that includes "real" looking and *interactive* solutions.

Novel technologies such as computer-based virtual learning environments (VLE) (see Lanier and Biocca 1992) and other network-based tools (Gredler 2004; Lehtonen *et al.* 2005; Page *et al.* 2006) have become very popular in *educational research and development* or *design-based research* (Lehtonen *et al.* in press; McLellan 2004; Steuer 1992). Nevertheless, it must be noted that emotional and aesthetic factors are every bit as significant as the more commonly studied cognitive and rational aspects of such environments when it comes to willingness to use them and the success of the activity for which they are used (Norman *et al.* 2003). Norman *et al.* note that how a particular VLE or managed learning environment designed can profoundly impact on whether it constrains or facilitates the use of a wide variety of pedagogical approaches. The present study seeks to highlight the

psycho-social and emotional considerations which must be afforded in the design of VLEs.

These environments may provide an interactive and sensation-arousing place where people can build social bonds and structures, sense their own and others' presence, feel situational pleasure and experience *embodied* things with all their senses. They can then *regulate*, or *adapt*, these elements into the proper forms and on the appropriate levels in different situations (Madell, & Muncer, 2007). The authors argued that until recently research has been lacking on the embodied emotional, aesthetic, and socio-structural dimensions of the development of VLEs. Present research on human socio-emotional activity in those environments should be explored more fully to elicit design considerations that will make the environments better suited for teaching and learning (see also Laurel 1992; Lehtonen *et al.* 2005; Vuorela and Nummenmaa 2004).

The emotional, aesthetic and socio-emotional factors on different observational levels of emotionality (see Table 1) can be seen as key factors in creating environments, where the embodiment of emotionality as well as presence and imagination play an active part. Another key factor, in addition to emotionality, is immersion in the virtual worlds through virtual presence, which creates engaging learning activities (Huang & Alessi 1999; Baños, Botella, Alcañiz, Liaño, Guerrero, Bey, 2004). As Norman (2003) has observed, emotional factors influence and change the operating parameters of cognition: positive emotions, eg. *situational pleasure, enhance creative, breadth-first thinking, whereas negative emotion, e.g. situational anxiety/frustration or fear, focuses cognition, enhancing depth-first processing and minimising distractions.* Therefore, it is essential that the tools and systems designed for use under stress, such as that encountered in difficult learning situations, should follow human-centred design principles.

Therefore the authors assert that where VLEs are concerned, emotional and aesthetic factors are at least as important to consider as cognitive and rational ones (e.g., knowledge creation) (Lehtonen *et al.* 2005). We should study the entire social, interacting human being, not merely an individual's cognitive dimensions.

1. Theoretical starting points

The theoretical starting points for considering emotions are mapped out in this section, then discussed in terms of the learning architectures and pedagogical approaches in which VLEs give rise to. A feeling is a state of mind with a connection to both psychical and somatic experiences and strongly anchored in physical experience and bodily feelings (Damasio 2001/1994; Ihalainen 2004). Emotion is referred as a mental activity that is comparable to perception, thinking, language and learning and that also produces feelings (Damasio 2001; 2001/1994; Nathanson 1992; Tomkins 1991, 1992; Huang & Alessi 1999; Baños, Botella, Alcañiz, Liaño, Guerrero, B.Rey, 2004; Steuer, 1992). The crucial importance of emotions and social cognition for interaction and collaboration is obvious (Damasio 2000/1999a, 2000/1999b; Pitkänen 2003; Siegel 1999). A person's emotions and the so-called manifestations of embodiment may also be seen as significant factors for the processes of teaching, studying and learning.

Emotions and the tendency to assess experiences on the basis of how pleasurable or disagreeable they are (for more details, see Siegel 1999; Simonov 1981, 1997; Sinkkonen & Kalland 2001) more than background factors for the inclination to study and motivation; they bear on how one studies, how one experiences one's surroundings, what one studies, whether one learns anything and whether one remembers what one has learned (Damasio 2000/1999a, 2000/1999b; Pitkänen 2003; Siegel 1999; Huang & Alessi 1999; Baños, Botella, Alcañiz, Liaño, Guerrero, B. Rey, 2004; Steuer, 1992). The body, brain, intellect and emotions are inseparable parts of us. The physiological-psychological activities labelled in "the mind" are generated in a functional way where the whole consisting of the body and its environment, not only in the brain or its data processing (Alanen et al. 2003; Damasio 2000/1999a, 2000/1999b).

Social interaction on the level of feelings, *virtual group dynamics* and the manifestations and interpretations of

embodiment must all be considered when planning the implementation of VLEs and network-based learning environments (Huang & Alessi 1999; Baños, Botella, Alcañiz, Liaño, Guerrero, B. Rey, 2004; Steuer, 1992). The present interactive facilities, mostly text based, place great demands on interaction. Both the technology used teaching and studying arrangements influence by what emotions are evoked and conveyed by studying? and by what students experience through VLEs ?, on the other hand, entail possibilities for psycho-social regulation, one example being the protection afforded by technology whereby one can withhold one's true emotions and feelings. This experiential possibility for emotional protection may make collaboration on the level of feelings easier in a group and lead to greater openness, even to an extent rarely encountered in personal interaction.

How are social activity, social ties and communities created when the participants do not meet each other? Personal interaction is not always necessary for establishing social ties; what is necessary is reading or understanding by various means, that is, *a meeting of the minds in* VLEs. Imagination, the ability to empathise, entering into another person's role and emotional reciprocity are essential factors for generating a shared mutual emotional state (Chayko 2002; Damasio 2000/1999b). How is an emotional and social connection made and maintained in VLEs? For creating and maintaining socio-mental connections, human memory and experienced emotions are crucial. When interacting, participants evoke emotional states through various symbols, pictures, rituals, spoken sentences, and written texts, as well as through mental imagery and thinking. These emotions serve to create a shared emotional state, to "carry" the other participants and stimulate the states of mind of others. For generating socio-mental connections, people utilise a human mode of action called embodiment. In a dialogue, for example, one interacts not only with information but also, on the individual level, as a member of a group. The connections are strongly emotional and cognitive (Chayko 2002; Damasio 2000/1999b; Hari 2003; Siegel 1999).

2. Implications of emotions for the processes of teaching, studying and learning

A theoretical structure comprising multiple observational levels for emotionality (Table 1) is very beneficial in taking human emotion and psycho-social emotional activity into account in *teaching, studying and learning,* as well as in *creative problem solving* (Illeris 2003; Uljens 1997). Emotions and emotionality are seen on four levels of observation, or units of analysis (Table 1).

The different learning architectures inherent in a VLE can be mapped onto the observations and analyses of emotional activity. The first level relates to learning as understanding and processing, embracing elements from cognitive load to past learning experiences, which will translate into subconscious ways of learning particular to the participant. This is a consideration that could affect

1. Emotionality and social processes seen on the inter - or Transcultural level in global - level social interaction between teachers, students and learners with different cultural backgrounds.	**Inter - or Transcultural (IC/TC) layer** in global - level mixing national and organizational cultures between teachers, students and learners with different national cultural backgrounds.
The inter - or transcultural (IC/TC) layers on the global level involve i. National (NC), ii. Ethnic (EC) and iii. Organisational (OC) cultures	**National/ethnic culture layer (NC/EC).** The emotionality and social processes seen on the level of a certain country or ethnic group which hasits own culture.
between teachers, students and learners with different national and organisational - cultural backgrounds in technology - mediated situations.	**Organisational cultural (OC)** emotionality. Emotionality and social processes seen on the organisational-cultural level in technology - mediated situations.
2. Dyadic/social shared or mixed technology-mediated emotionality and social processes (social emotions, emotionality and network group dynamics in social interaction between teachers, students and learners as subjects) in joint pursuits through technology in technology-mediated situations. Dyadic means that social situations in their typical form actually consist of separate, small dyadic (n(n-1)) communication situations in which two people meet at the time but in rapidly changing and interrelated social situations.	
3. The emotional aspects of the behaviour of individual subjects The emotional aspects of individual behaviour where the subject is interacting with the technology and expressing and experiencing emotions in interaction with technology and environmental factors.	
4. The subject's internal, underlying (socio-)emotional mechanisms. The subject's (subconscious) internal, underlying emotional (neural) mechanisms (studied by psychology, neuropsychological / cognition science) in relation to the technological and social environment..	

Table 1. Four observational levels of emotional activity. Source: Lehtonen, *et al.* 2005.

the way that a VLE is designed in so far as it appeals to past learning metaphors and previous experiences.

For example the aesthetic dimensions provide highly emotional relations with the environment in a dynamic user process; on second level, this occurs in direct interaction with the environment. On the second level, in dyadic or social interaction with others (*in every group, there are n(n-1) different dyads*), individuals are represented as environment characters (avatars) and situations. The learning architecture changes to a network-based theory of how information is disseminated and learned. Different emotions may come into play with communication situations that arise in this social/dyadic sphere. Level one deals with emotions within a national cultural context. The learning architecture is more dependent on the differing ways of imparting knowledge within the sphere of cultural norms and barriers.

It is essential to examine *emotionality* and *emotion media*tion. This research seeks to identify how a situation can be emotionally experienced in interactive, socially formed VLEs and network-based learning environments and to determine the attributes of the situation vis-à-vis the processes it is meant to sustain, i.e., the teaching, studying and learning processes. An attribute, in this context, is a property of an object or situation (e.g. communication or interaction situation) or a feature of the immediate environment that indicates how that object, situation or feature may/can be interfaced with or, in the case of network collaboration, *interacted with*, in changing situations (McLellan 2004; Gibson 1979). Technology-mediated communication, seen in terms of emotions as attributes, demonstrates what can be done or achieved in a certain situation. Such attributes can and should be made noticeable (dominant), for example, through proper technologies, to facilitate and mediate emotionality in ways suitable to the particular situation, the aim being fully to realise a human being's potential as a committed, self-directed creative and productive member of a group.

3. Method

The focus of this work is to conceptually and in part empirically seek potentially important elements that empower or weaken emotionality and thus might influence the success or failure of network-based virtual reality, participant presence, satisfaction with the learning environments, the design and the use of environments. Also *cognitive mediation*, *emotional mediation* and *socio-structural mediation*, are considered as important aspects of social and organisational activity in virtual reality (VR) environments. The research draws on a literature review and partly on an empirical design created by the authors. The authors have tried to develop some conceptual tools through which design-based research on virtual reality and social simulation-based learning environments could improve and investigate those environments better.

4. Results

4.1 Toward Emotions

Emotions are defined in this article as consciously or subconsciously generated processes with negative or positive tones that help to estimate the significance of artifacts, situations and actions and their value for the self (cf. the information theory of emotions, (Siegel 1999; Simonov 1981; Tomkins 1991, 1992). According to this contemporary neuropsychological view, emotions are based on activities occurring throughout the brain and different bodily systems (e.g. hormonal, motor and sensory ones), (Siegel 1999).

It may be claimed that emotional processes and emotionality serve to provide overall direction and impetus for relations with environments and human activities that appear are said to be rational. Learning and studying in and via online networks, VLEs and network-based learning environments are no exceptions in this regard (Brod 2000; Damasio 2001/1994; Siegel 1999; Huang & Alessi 1999; Baños, Botella, Alcañiz, Liaño, Guerrero, Rey, 2004; Steuer, 1992). As Damasio (2000/1999b) observes, the concept of consciousness may even be totally reversed; *consciousness (as well as presence) is a strongly emotional experience, a feeling of what is happening (and where)* (p.257-258). Emotions are experienced as episodes and mental states of various

types, such as mood, happiness, sadness, hatred or anxiety, and it should be noted that these all affect our decisions and actions. Moreover, a large number of emotional processes *are barely conscious or subconscious* (see Table 1; Damasio 2000/1999a; Oatley & Jenkins 1996;

Siegel 1999).

Emotions can therefore be considered as processes with identifiable stages: first, events are evaluated in merely subconscious ways for their relevance to what is important to us; this is followed by an evaluation of the context, an appraisal of what can be done about the event (Oatley & Jenkins, 1996; Simonov 1997). Furthermore, emotions may be considered as mental stages of readiness for action, setting priorities and prompting plans. Emotions, as authors claim, are more than merely one background factor in the inclination to study and motivation; they also bear directly on how we study, what we study, whether we learn anything and whether we are capable of recalling and later using knowledge from the areas we have been studying (Damasio 2000/1999a, 2000/1999b; Siegel 1999; Simonov 1981, 1997; Lehtonen *et al.* 2005; Norman *et al.* 2003).

Despite their considerable importance, emotional and aesthetic factors have too often been paid little attention or overlooked by researchers studying learning, especially in VLEs and network-based learning environments (Huang & Alessi 1999; Baños, Botella, Alcañiz, Liaño, Guerrero, Rey, 2004; Steuer, 1992). Emotions and experience are essential in other respects as well. For example, Prensky (2001) states that the present generation of students and the games generation of children is quite different from older generations: they do not want a passive role with different media but active participation and emotional engagement; they want to manipulate the objects presented and expect a degree of emotion and interactivity, as opposed to merely watching and listening passively. It can be proposed that the traditional way of thinking and learning has shifted from deploying established media, such as literature and print, to using considerably more interactive media, such as virtual realities and interactive digital video and audio. McLuhan (1997) predicted that the information environment in this case a virtual reality - or simulation-based environment and related effects engendered *by the computer are as inaccessible to literate vision as the world is to the blind*. The present generation of students in fact learn to use the different forms of digital media "as a second language".

4.2 Psycho-social regulation, socio-structural and emotional mediation in social settings

The *emotional and socio-structural mediation* between the participants in different forms and using different means provides very interesting phenomena in the consideration of the benefits and the disadvantages of technology-mediated communications. Virtual (reality) systems and the parallel VR-based multimedia-mediated communications (VRMMC), in contrast to face-to-face communication, allow us possibilities for *psycho-social regulation*; we can regulate social and psychological distance but we still maintain a certain amount of *presence* and special bonds, or *social structures*, in different, virtually represented ways (Page, Hepburn, Lehtonen, Thorsteinsson, & Arunachalam, 2007; Turkle 1995; Madell, & Muncer, 2007; Huang & Alessi 1999; Baños, Botella, Alcañiz, Liaño, Guerrero, Rey, 2004; Steuer, 1992). It has been noted, for example, that in networked games participants produce significantly more socio-emotionality than task content messages (Peña & Hancock 2006). If this modulation is not adequate or is essentially lacking, the distance easily remains too great and the social structures too weak, with collaboration then suffering in many ways.

Socio-structural mediation and social interaction, *network group dynamics* (Aulls 2004; Hargreaves 2000; Peltoniemi & Tammi 1999) and the *manifestations and the mediated interpretations of embodiment* may be seen as key considerations when planning the implementation of VLEs and network-based learning environments (Brave & Nass 2002). The interactive communication facilities used in most networked situations today, still predominantly text-based, are not only slower but very demanding when it comes in promoting interaction, especially in terms of emotion mediation.

The technologies used and teaching, learning and studying influence what emotions are evoked and mediated by studying and what students experience. The different communication and embodiment representations or simulated embodiments, such as avatars and multimedia communications (voice, video), may give a sense of emotional and socio-structural presence but at the same time it lets people to regulate social and psychological distances as well as the levels and ways in which they interact (Page, Hepburn, Lehtonen, Thorsteinsson, & Arunachalam, 2007; Turkle 1995; Madell, & Muncer, 2007; Peltoniemi 2004). Furthermore, in this way we may also mediate some of the real or simulated acts of socio-structural mediation and embodiment, presence, bodily representations and one-to-one attention, so that the shared feelings may carry the desired activity. In virtual worlds we may *go to someone* or *to some group* and *look at something together;* we may also engage in bodily ways which try to express something, e.g., *point* with our finger, or *look for something* by sending a facial signal.

On the other hand, online learning and studying provide the possibility for psycho-social regulation, for protection afforded by technological conveyance in the form of the option to withhold one's true feelings even whilst participating represented as an avatar. Written communication in particular, despite its limitations, also offers many benefits in such contexts. It allows time regulation, time shifts, accuracy of messages and the possibility to return to a message, as well as freedom in answering, more possibilities for psycho-social regulation (carrying less emotion mediation), which makes possible the easy regulation of psycho-social distance. It is not surprising that people seem to like written forms of communication, as the popularity of e-mail, SMS, net chat, and television chats indicates.

This experiential possibility for psycho-social regulation and emotional protection may also provide a way of handling difficult topics of discussion or the consideration of subjects which otherwise through face-to-face interaction for example might be very difficult. Such protection may also make collaboration on the level of feelings in some situations easier in a group and lead to an extended openness, one that might be rarely encountered in personal interaction.

However, in other forms of collaboration, such emotion mediation problems make collaboration difficult in certain situations and the lack of cues for or attributes of expected or typical meaningful behavioural reactions in certain situations makes the collaboration difficult and emotionally very draining. In such cases, there needs to be a possibility to regulate emotional mediation. This can be done, for example, by selecting the expected or typical behavioural gestures or ways of communicating from a set of VR-based multimedia-mediated communications (VRMMC) with alternatives that can be used in parallel ways (e.g. chat, voice over IP, video, avatar with lip and face sync etc.). This can be seen as an important provision from the socio-structural viewpoint (on the social level, see Table 1) as well as on the cultural and inter- and trans-cultural levels (see Table 1). Moreover, individual users may differ particularly when from different cultures in the ways in which they express and mediate emotional states and in their willingness to do so. Sometimes these differ very much and the systems should offer participants enough ways to express and mediate the emotional needs that are appropriate to their culture.

Socio-structural mediation together with mediated emotions serves to create a shared emotional state and social ties and "carry" the other participants, encouraging them to continue the collaboration and to simulate the states of mind of the others involved. Socio-structural and emotional mediation often benefits from a human mode of action called embodiment, where being and going somewhere as well as the bodily expressions particularly facial expressions and gaze which plays a significant role (Bowers *et al.* 1993; Erickson & Schulkin 2003). In a social situation and in a dialogue, not only one interacts with information but also on the individual level of emotions and cognition, as a member of a group at some level of psycho-social distance in relation to the social structures of that situation. All the (psycho-social) connections are strongly emotional and cognitive and by the way it always occur in a certain social structure and environment (Brave

& Nass 2002; Chayko 2002; Damasio 2000/1999a, 2001/1994; Lehtonen *et al.* 2005; Siegel 1999).

Correspondingly, it should be noted that (virtual) environmental factors and environmental aesthetics also influence our social structures and settings in a strong way. As Foucault (1984) states:

> *"Most modern institutes of education, despite the apparent neutrality of the materials from which they are constructed, carry within themselves implicit ideological assumptions [and affordances for social structures] which are literally structured into the architecture itself; thus, a whole range of decisions about what is and what is not possible within education have been made, however unconsciously, before the content of individual courses is even decided" (p.87).*

The authors argued that this is also true in virtual spaces and is to be encapsulated in the design of VLEs. A key notion of the Foucauldian perspective is how architecture structures social settings or how power works at the socio-structural levels of institutions, starting from birth with education. In the case of virtual reality environments, the architecture acts like an affordance for certain social settings and activities rather than others.

4.3 Emotional sense of presence and socio-structural mediation through avatars

As stated, this work concentrates on studying and learning within VLEs and network-based learning environments that use innovative technologies. There has been discussion about the presence and reality judgment in virtual realities (Baños, Botella, Garcia-Palacios, Villa, Perpiña, & Alcañiz, 2000). As Steuer (1992, 75) states: *"the key to defining virtual reality in terms of human experience rather than technological hardware is the concept of presence, which is defined as the sense, a feeling, of being in an environment as an active subject in a social setting."*

Emotions are a significant component of how presence is perceived and both immersion and affective content have an impact on presence.

Immersion is but more relevant for non-emotional environments than for emotional ones (Huang & Alessi 1999; Baños, Botella, Alcañiz, Liaño, Guerrero, Rey, 2004). There is a circular interaction between presence and emotions: on the one hand, the feeling of presence is greater in "emotional" environments; on the other, the emotional state is influenced by the level of presence (Huang, & Alessi, 1999; Waterworth, & Waterworth, 2001; Schuemie, van der Straaten, Krijn, & van der Mast, 2001; Jang, Kim, Nam, Wiederhold, Wiederhold, & Kim, 2002; Västfjäll, 2003; 2004; Baños, Botella, Alcañiz, Liaño, Guerrero, & Rey, 2004; Riva, Mantovani, Capideville, Preziosa, Morganti, Villani, et al. 2007). There is also evidence of different types of presence, i.e., *personal, social* and *environmental presence* (Mikropoulos, & Strouboulis, 2004).

VR is an affective medium: interaction with "anxious" and "relaxing" virtual environments has been shown to produce anxiety and relaxation. Indeed, it might be said that emotional and socio-structural mediation, the virtual presence and representation of team members and their collaboration with each other based on avatars inside a VLE may be seen as an especially important phenomenon in all, but especially in cross-cultural, communications (Lehtonen *et al.* 2005a, b). On the inter- and trans-cultural levels, where national organisational cultures meet, the related states of mind and other objects, such as external expression of emotions, clothing and external appearance, may differ greatly, as may gestures. Avatars and simulated game-like representations may offer the possibility of more equal representations for the actors in certain social structures , as networked games already do. They can also be used to represent individual characteristics such as appearance or gender and give users possibilities to regulate psycho-social distance in different ways.

This can assist students in concentrating on the VLE learning process without being distracted by personal, gender and cultural differences. Avatars may be seen as offering a representation of both presence and social structure inside the team and inside the VLE; however, at the same time, avatars provide the members of the team with a limited presence as human beings, allowing the

regulation of *psycho-social distance* and better control over the communication situation in several different ways. Thus, the use of an avatar is a way of offering role-based interaction as opposed to a face-to-face situation or purely video-mediated situations.

The VLE and avatar-based representation of team members may be seen as similar to the way in which avatars and VLEs have been used in different (networked) computer games and in popular VLE-based virtual worlds such as "The Habbo Hotel", "Sim City" and "Second Life" (Lehtonen *et al.* 2005a,b). It is also argued that the sense of presence and sufficient emotional and socio-structural mediation, enabled by the communications technologies used, form the basis for the ability to put oneself into another's place better. This in turn produces enough shared or mixed emotions and social structures to support and maintain the desired activity on the level of group dynamics (Lehtonen *et al.* 2005b). The shared social structures and shared emotions on the social level are also essential factors for generating a shared and trusting or sufficiently secure mutual emotional state for successful and motivating problem solving and innovation development (Chayko 2002; Siegel 1999). Emotional, study-related situations are discussed later in this article also in terms of the individual's *emotional load factors*, which may affect learning through situational anxiety and situational pleasure.

5. Discussion

5.1 Toward interactive aesthetics

Aesthetics is defined today as how we *emotionally react* and *feel* our presence and interaction with our technology-mediated social and technological surroundings. We define aesthetics as strongly connected with emotions. Among their users, aesthetic solutions have a connection to positive emotionality and to *pleasure*. A good aesthetic architectural design enables us to create potential affordances for people to meet, work and communicate together; we may create an aesthetic social environment where the socio-structural mediation allows the participants to meet in effective ways to conduct different activities somewhat like in physical environments but without some of their limitations.

The significance of aesthetics from the emotional viewpoint is that they determine how pleasurably empowering or disagreeable all experience an environment as being. Following the argument of Norman *et al.,* (2003), aesthetic design may help users to achieve more relaxed, pleasant situations, with the pleasure then enhancing the users' creativity and ability to use the systems. Aesthetics matter: *attractive things help us feel good and therefore work better*. In this sense, aesthetics may be viewed as a very important attribute of emotionality in general terms. Aesthetics matter, because situational anxiety frustration, fear and stress occur in most difficult situations, for example, in learning something quite difficult or complicated for the first time. Fear makes people less able to cope with difficulties and less flexible in their approach to problem solving.

Positive emotions afforded by *interactively aesthetic* design may even make people more tolerant of minor difficulties, and thus more flexible and creative in finding new or innovative solutions. Tools and systems that are designed for support and afford are more relaxed, pleasant occasions through pleasant, *interactively aesthetic* design may enhance the usability of the tools and facilitate the activity, e.g., teaching, studying and learning in more general terms. Aesthetics matter: attractive things that afford situational pleasure work better, (Norman *et al.* 2003). Furthermore, aesthetic and, in broader terms, more human-centred ways of design may afford the well-being of the individuals and organisations also in more general terms (see Table 1). The audio environment, too, for instance, 3D sound as a navigational aid, may be an important part of the interactional activity and aesthetics. It has, for example, been noted that both emotional reactions and ratings of presence increase with the use of spatialised sound (e.g. Gunther, Kazman, Macgregor, 2004; Västfjäll, Larsson, & Kleiner, 2002; Västfjäll, 2003).

The researchers' view is that the aesthetic dimension is in some respects very culture dependent; it may also be argued that individual variation is quite significant. Accordingly, the aesthetic dimension should always be

studied on multiple levels beginning from the individual learner's viewpoint to the cultural and organisational perspectives (see Table 1). The aesthetic dimension should be given a great deal of consideration; most likely the adaptation of aesthetic factors which is interesting in many respects and, the researchers claim it as an important factor. Indeed, aesthetics is as important a factor in learning as it is in other areas of activity, such as home decoration. In addition, the *interactively aesthetic* dimension should not be seen merely as a matter of visual art or visual design; instead, it should be treated or studied in terms of the kinds of *interaction* and *emotional* factors it *affords* when actively used, not when passively assessed as an object. The authors pointed out that such considerations are given little weight in research and design-based research on educational solutions.

The aesthetic dimensions of VLE applications should be understood as being part of *dynamic interaction processes* rather than essentially passive perception processes (McLellan 2004; Gibson 1979). The aesthetic environment may be seen to *afford* positive emotions and situational pleasure regarding the activity in *dynamic interaction*. Emotions and the tendency to assess experiences on the basis of how pleasurable or disagreeable they seem are not merely background factors contributing to the inclination to study and motivation but also bear directly on how one studies, what one studies, how successful learning is, whether one learns anything and whether what one learns is remembered (Lehtonen *et al.* 2005; Damasio 2000/1999a, 2000/1999b; Siegel 1999; Simonov 1981).

Human-centred design should always consider that the entire body, the brain, the intellect and emotions are inseparable parts of us as whole beings and that emotions belong very much to the psychological-environmental activities as we call the mind (Damasio 2000/1999a, 2000/1999b; Lehtonen *et al.* 2005). Aesthetics has a strong relation to emotionality, that is, to how pleasurable we find an object or situation. Accordingly, emotionality and the dynamic interaction process require aesthetics as a key aspect also in all network-based environments (NBE), including VLEs and network-based learning environments. It is important to take into account emotional factors in designing NBEs, which have a strong impact on the way one teaches, the willingness with which one studies and learns, and whether one remembers what was studied or taught and supposedly learned.

Conclusion

In network-based teaching utilising virtual realities and simulations and studying, there is a slow trend toward contemplating situations connected to technology-mediated networked interactions (and the current conceptions of the tools used therein) and toward more human-centred ecological views which take into account the emotional, social and even cultural views of group dynamics and technology usage. This is understandable, as the technological and cognitive points of departure emphasised in the early experimentations with network-based teaching and learning are proving to be inadequate where the goal is high-quality, functioning network-based teaching research, design and implementation.

It is very important to consider the mediation of social structures, emotionality and aesthetics, as well as the allowance for psycho-social regulation from this more ecological or holistic perspective. These are particularly important factors, because emotions in particular represent an individual-level system that provides us with valuable information about the state of our own bodies and the relationship of our bodies and ourselves with an ongoing activity; network-based studies are no exception. In all of our activities, the authors have constantly made emotional assessments of our knowledge, training and also all our actions even though we do not always notice it.

In this paper the researchers have brought out some important starting points for the discussion of taking aesthetics into consideration as one key source of emotionality. We have also presented some of the emotion-related concepts, such as situational anxiety, pleasure and mental load, that relate to the design and assessment of VLEs and network-based education. These,

at least, should be taken into account when developing and researching network-based education. Upon careful consideration of the all socio-mediated, emotional and cognitive aspects, we may argue that VLEs and network-based virtual reality environments may benefit us in many ways, providing the added value we expecting from such solutions.

In this paper Emotionality is seen to influence studying and learning transdisciplinarily when different theoretical viewpoints are applied simultaneously on different levels of theoretical research and understanding; these begin from the level of internal, emotional processes as understood in neuropsychology and cognition science, and link that level with the higher level theories of emotions and social cognition for human interaction and problem solving in ICT-mediated environments. Emotionality is seen simultaneously on the personal and social (inter-personal) as well as the cultural and inter- or transcultural levels. This perspective produces understanding where the micro- and macro-level theory of human emotional behaviour has been used to argue for learners' mutual support (see Tella et al. 2004; Lehtonen et al. 2003; Lehtonen et al. 2005). Network-based environments, VLEs and collaborative simulations (Gredler 2004) may be seen as essentially socially shared virtual spaces, ones which may provide socio-mental tools for collaborative activities. These are tools which in individual-level use and group settings may be used for co-creational visualisation and communication, for thinking and mental problem-solving, for presenting and sharing ideas and thoughts on the symbolic level to others, and for communication, creating distributed knowledge and sharing expertise in group settings. Such tools may engage us for two principal reasons.

The way in which those media are used is *interactive in nature* and *emotional (as well as socio-structural) aspects* are prominent in interaction with those tools. We may say that VLEs and virtual reality environments *afford* us more *emotionality* and socio-structural mediation than many other computer-based environments. These tools may be said to be *experiential*, pertaining more to *experience* or *personal observation* than to reasoning. In other words, the tools may be said to afford us interactive and sensation-arousing experiential teaching, studying and learning. In this sense, experiential always refers to a personal and *emotionally coloured reality* as seen by individuals. On the level of the social group (see Table 1), *shared emotional states* and socio-structural mediation may bring the participants together into certain structures or for using certain interactive resources (like a drawing table or a 3D-system) *together* and motivate them in the ideation process. These opportunities for using a VLE as a tool for socio-structural mediation and providing tools for shared attention and collaborative symbolic manipulation of problem-solving activities has established new and open ways for ideation using VLE and network-based solutions.

These environments, VLEs and novel *mediating* media, such as desktop virtual reality (VR), simulations and multimedia communication applications, are not the key elements in building a successful place to study and learn; neither the technology is the most important factor in that process. The truly critical issue to take into account is the users, *the individual(s) and the social nature of using the technologies* involved.

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