

Is presence a relevant or useful construct in designing game environments?

Dan Pinchbeck

University of Portsmouth
0.19 Buckingham Building
Portsmouth, UK
44(0)2392 838198

dan.pinchbeck@port.ac.uk

ABSTRACT

Presence is a defining phenomenon in the experience of virtual environments. This paper questions whether presence is a useful construct to consider when examining the effectiveness of game environments, and their relationship to virtual reality. It is argued that game environments fulfill all the identified criteria for inducing presence and, furthermore, that the establishment of player/game contracts is a powerful tool for its induction. The relationship between presence and the notion of reality in games is discussed, and suggestions for why presence may be a valuable conceptual tool for games designers are offered.

Categories and Subject Descriptors

H.5.1 Information Interfaces and Presentation---Multimedia Information Systems---Artificial, Augmented and Virtual Realities, K.8.0 Personal Computing---General---Games, H.1.2 Information Systems---Models and Principles---Human Factors

General Terms

Human Factors, Theory

Keywords

Presence, virtual reality, gaming

1. INTRODUCTION

Steuer defines virtual reality as “a real or simulated environment in which a perceiver experiences telepresence” [1]. An exact definition of presence remains contested but current debate focuses upon a multidimensional construct leading to “a perceptual illusion of non-mediation” [2,3]. In other words, a system that provokes a subjective lack of recognition of its role as a mediator in the act of perception can be considered to be a virtual reality. This model of presence has been criticized for being too expansive, and allowing the concept of presence to be confused with other psychological effects of stimulation by synthetic environments: selective attention, empathy, emotion [4,5]. A

cursory glance at the literature reveals the number of alternate conceptualizations of presence that attach the construct to one or several of these pre-defined factors [6,7,8,9,10]. It will be argued here that what makes presence distinct is the locating of the self within the stimuli-set comprising the environment. According to this model, the other psychological factors contribute to a pre-dispositional state, a particular set of schema that manage self/environment relationships. Presence is an outcome; a measure of the subsequent method of information and experience management. Nevertheless, the traditional model does enable a map of media experiences to be drawn up, illustrating their ‘proximity’ to virtual reality. Davide & Walker’s [11] is reproduced below, though Steuer [1] is also recommended.

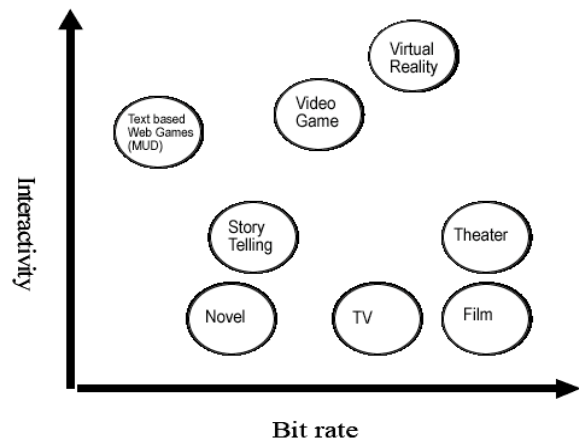


Figure 1. A Map of presence techniques and technologies

According to this map, video games are distinguished from virtual reality systems in terms of presence inducing capabilities. This distinction is problematic, however. For example, it is pertinent to ask how much of this is due to specialist interface devices (the ‘bit rate’ axis), in other words, whether an environment realized as a virtual reality is only distinguishable from an environment realized as a video game by virtue of data glove, CAVE or head mounted display. If this is the case, then what of the increasing number of commercial HMD and motion tracker devices that can be utilized as interface devices for currently available games? It should also be questioned whether the gap between the two technologies as represented by the interactivity axis is due to a fundamental difference in allowed or expected user behaviour. These two

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

Conference '04, Month 1–2, 2004, City, State, Country.
Copyright 2004 ACM 1-58113-000-0/00/0004...\$5.00.

questions may be thought of as form- and content-orientated in nature and beg several further pertinent inquiries: can video games induce a sense of presence; should presence be a target of video game environments; what would an enhanced sense of presence contribute to gaming?

2. PRESENCE

An overview of presence research will serve to place these questions in context and avoid criticisms such as Mortensen's [12] that presence simply replicates existing phenomena, or demands a too exclusive set of factors to be useful. Of particular interest here are first-person game worlds, such as Half Life, Quake or Unreal Tournament, as they offer the greatest potential for reducing the physical and symbolic mediation necessary in order to translate the actions of the user into actions within the synthetic environment. In other words, there is a more direct mapping of perspective and expectations of actions in these games.

Freeman [3] identifies three dimensions to presence: sense of physical location, engagement / involvement / attention and naturalness / realness. These dimensions may be applied to six conceptualizations identified by Lombard & Ditton [2]: social richness, realism, transportation, immersion, social actor within medium and medium as social actor, which are used to underpin a singular explication: "the perceptual illusion of non-mediation". This explication can be found in the majority of the presence literature and rests upon the premise that presence appears when awareness of mediation vanishes, or perception of mediation fails. Lombard & Ditton demand a medium be present for this to occur; elsewhere only a mediating technology is required [13]. Heeter [14] makes much of the role of agency in presence, whilst Zeltzer [15] argues that presence should be seen as simply the total number and fidelity of sensory input/output channels. Steuer [1] likewise makes little reference to agency, semantics or the content of VEs. Thus, a divide is evident between research focused on either of the two axes of Davide & Walker's [11] chart. Slater [5] goes so far as to claim that content has nothing to do with presence. Others disagree: Waterworth & Waterworth [16] state that "maximal presence arises from an optimal combination of form and content"; Shapiro [17] also makes the case that reality is a combination of thought and sensation.

Huang & Alessi [8] suggest that a lack of attention to the role emotion plays upon cognition, behavior and perception is a flaw in most presence models. Prothero et al [7] focus upon presence's role in maintaining a background perceptual field and thus assisting orientation and positioning. Nicovich et al [10] argue that the underlying principles of empathy and presence are the same and go on to offer evidence that highly empathic individuals may experience higher levels of presence. Others place more emphasis on cognition, and the mediation of stimuli by cognitive representation [18,19]. Models have also been proposed that use Gibson's ecological theory of perception as a basis [20]. According to this theory, organisms exist in an informational array, from which invariances and affordances are picked up by a dynamic perceptual system. Zahorik & Jenison [6] put this succinctly thus: "a hammer in the environment is perceived as affording the action of hammering, not as a collection of properties such as size, color or mass". They bypass any question of objective and subjective realities, or external and internal

representations, and state instead that presence may be seen as "successfully supported action in the environment". Mantovani & Riva [21,22] build upon this to offer a cultural model of presence, which brings the question of meaning and agency back into the heart of the debate. However, Biocca [23] argues that this is based upon a misunderstanding of Gibson's theories and comes dangerously close to solipsism, confusing an epistemological problem with an ontological one. Regardless of these criticisms, the ecological model does enable an alternate framework for the relationship between perception and cognition to be deployed, which allows for content and form to be explored in conjunction, rather than either opposition or orthogonality. [24,25].

It has been argued that presence is a means of organizing information; of establishing a particular relationship between the organism and its environment [26]. At core, presence locates a self within an environment deemed to be of significance. This does not necessarily mean elements within the environment are directly attended to, nor does it specifically tie presence to emotional reaction or investment. In other words, presence is fundamentally linked to spatial consciousness. An individual feeling presence has identified a set of stimuli that comprise "the environment" and included the self within this, an inferred relationship that bears all the hallmarks of distal attribution [27]. Such a model subsumes all other models into being a set of component factors, all playing some part in the generation of this set. It bridges interactivity and bit rate, by allowing both sensorial input and schema to function, in tandem, in the generation of presence. This perspective also has the advantage of demonstrating clear evolutionary benefits: an organism that can establish relationships and attach significance to the informational array has a survival advantage over one that does not. It also encompasses the both the ISPR and Lombard & Ditton's explications of non-mediation, as it suggests that a subject experiencing presence is attaching a greater degree of significance to the array presented by the medium than the array containing the medium. Essentially, as with the ecological model, it focuses upon what perception/action couplings are currently deemed significant to the organism. A greater degree of presence, therefore, should be linked to task related outcomes, such as performance or spatial memory. Here results are somewhat mixed, but the positive correlations are in the majority. Youngblut [28] details all studies examining task related and the reader is referred there for more details. Linked factors such as enjoyment, investment and empathy can be seen from an evolutionary perspective to be related but distinct constructs. However, as suggested by Barfield [19] presence and enjoyment may well be closely linked. This, together with potential correlations between presence and such factors as empathy [10] and arousal [29], suggest that eliciting a sense of presence in a game environment may have effects that are advantageous to both users and designers. Before addressing these in more detail, it must be determined whether game environments are capable of inducing presence.

3. PHYSICAL INTERFACES

It is pertinent to ask whether all that separates virtual reality from video games is the degree of immersion engendered by the system interface. Immersion is distinguished from presence in that it comprises the extent to which the interface replaces sensory cues from the outside world [5]. A fully immersive interface would completely isolate the user from

any signals exterior to the system. Whilst this does not guarantee an illusion of non-mediation, it is generally agreed that immersion is conducive to higher levels of presence. Many component factors of immersion relate to the modality and fidelity of the interface. In essence, the interface will be more effective if it supplies multi-sensory information of high fidelity, responds quickly and accurately to user actions, and maps virtual actions coherently and intuitively across to them. Empirical studies have confirmed much of this: Turner et al [30] demonstrated that audio cues are capable of inducing presence as well as visual ones. Dinh et al [31] found that increasing number of modalities did indeed increase presence. However, they also found that increasing visual fidelity had no effect upon presence, something borne out by Zimmons & Panter [32]. Interactivity factors are clearly important, with issues such as field of vision, frame rate, head tracking and update rates all showing significant correlation to presence. It may be inferred that the fidelity of visual signals is less crucial to presence than extending the system's modal breadth and the degree to which the whole body is used in interaction. Once again, the reader is referred to Youngblut [26] for a full list of these studies.

There is little doubt that increasing immersion is conducive to presence. However, most gamers are still some way from home CAVE systems and, although HMDs and motion trackers are commercially available and compatible with some games, the majority of game environments are accessed using interfaces with much lower immersive capabilities. Axelsson et al [33] found that use of a CAVE environment certainly yielded more presence than a desktop and monitor system, but presence was nevertheless induced in the latter. Lessiter et al also found games using conventional interfaces were capable of generating presence [34].

4. SYMBOLIC INTERFACES

It thus appears that presence may be induced even with the relatively poor immersive capabilities of contemporary game interfaces. It is therefore appropriate to turn to non-technological factors. As has been noted, although investment, attention and empathy can be justifiably distinguished from presence, they are frequently associated with it. Coherence and naturalness of interface have been recognized as factors in inducing presence; this is a symbolic issue as much as a physical one. The semantic content of VEs has also been found to supplement perceptual and technological factors [35,25]. Heeter [14] speculates that "a good story can cover for a lack of perceptual richness". Slater et al [36] argue that top-down cognition plays an important role in determining what is actually perceived. Furthermore, this process can lead the perceiver to attribute non-existent information to the environment. In other words, the perceptual process alters the subjective set of environmental information available to the organism. This has resonances with Gibson's ecological theory of perception and Neisser's dynamic perception cycle [37], which postulates the existence of perceptual schema as organizing principles embedded within a feedback loop of exploration and perception.

Neisser's model provides a useful link between content and the study of presence, as it enables cognition, emotion, empathy and reality judgment to all play an central role in perception, thus enabling presence to be anchored within the perceptual process. Perceptual schema, dynamic organizational structures that attach meaning and significance to the

environment's contents, provide the link between socially constructed knowledge and memory, and more sensory factors, such as judging distance, speed or direction.

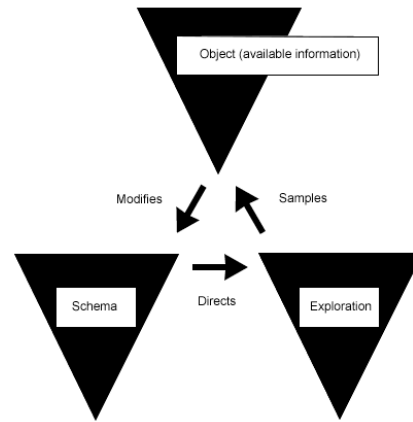


Figure 2. Neisser's dynamic perceptual cycle.

Game environments, which utilize a whole empire of cultural and semantic cues, signifiers and archetypes, should therefore be in a good position regarding inducing or, at the least, supporting presence. The use of such cues to drive perception are commonplace in architecture, design and the arts. For example, propaganda posters are obvious and highly effective manipulators of emotions and scanpaths, targeting a very specific set of responses in an equally specific target audience. Games use a combination of sensory clues, embedded within the features of the environment, and culturally established conventions in order to steer the player through a controlled set of responses. Atkins [38] refers to the narrative contract established between author and reader, a mutually agreed set of rules by which a novel delivers its contents, and argues that much the same process takes place in games. This contract establishes the boundaries of play in terms of expectations of physics, agency and context. All first person shooter games, for example, utilize identifiable narrative conventions in order to maximize play experience and minimize necessary processing capacity. This includes establishing the set of objects open to manipulation such as the now ubiquitous exploding barrel, or setting environmental boundaries, such as an incline too steep to climb. A combination of narrative and graphical cues keep the player on a more or less linear track through the environment without appearing to restrict exploration overly, thus filling in the gap between virtual reality and games positions on the interactivity axis. This contract between player and game should, therefore, contribute to a sense of presence, as it is a means of controlling the expected level of environmental interactivity and the degree of freedom of movement and action within the environment.

5. APPROPRIATE REALITIES

It has been established therefore, that the symbolic and physical interfaces used by games are either conducive or non-prohibitive to presence. It is argued therefore, that presence is a relevant construct to discuss in the context of games environments; it remains to answer the question of its usefulness.

Pietro [39] argues that although games designers strive for a degree of realism in game environments, many factors make a full recreation of reality undesirable, if it were achievable. Altered physics allow for a greater degree of play: Pietro offers 'rocketjumping' in Quake II deathmatches as an example of this. Clearly, many games require realism to be suspended or manipulated in order to deliver maximum experience. Provided there is consistency – that the player/game contract is not violated – these diversions from expected laws of reality can be taken in the player's stride. However, this raises some issues as far as a more traditional conception of virtual reality is concerned. As has been discussed, one of the key factors identified by all presence models and theories is the naturalness of the interface. Contradictions and unexpected outcomes to user actions as represented in the environment may hamper or break presence. Thus not only are some in-game physics extremely difficult to represent through the interface, but manipulations of expected reality potentially hinder any chance of maintaining presence.

However, in the model of presence described here, the construct is defined as the state of perception where the interface becomes non-significant in terms of schematic processing. In other words, the user processes the environment in a way that allows an inference of non-mediation. In fact, Heeter [14] argues that presence is entirely compatible with full consciousness of the mediating technology or medium; Nunez [40] likewise suggests that realism should be replaced with expectation as a variable. This has clear relevance to the concept of game/player contracts. To put this in the context of perceptual schema, the player establishes a methodology for perceiving and exploring the environmental array. A correlation may be made to other media schema consciously deployed to gain maximum enjoyment; cinema audiences can still be startled, saddened, roused and otherwise emotionally and empathically connected to the content even with full knowledge of the unreality of the stimuli. Suspension of disbelief has long been recognized and utilized, and there is no reason why, given an active set of perceptual schema that operate according to the rules of the game world rather than 'reality', players should not feel a greater sense of co-location with the environmental stimuli.

For a player to feel present in a game reality, therefore, implies particular perceptual methodologies and behavioral responses. Returning to Neisser's cycle, one could argue that a present player's perception is operating according to the rules of the game environment, rather than according to the limitations of the interface. The dominant schema, in other words, are linked to the affordances of the landscape, rather than the action of manipulating mouse, joystick or keyboard. Presence creates a disposition towards a particular set of stimuli/response couplings within the dominant frame of spatial consciousness. This is something that can be used by game developers to both manage and to predetermine player experience. Presence, as a theoretical construct, can be used to formalize the question: what kind of experience do you want your players to have? Do you require empathic proximity or distance? Do you want them to operate according to environment's internal stimuli, projecting themselves into the world, or do you want the playing of the game to remain the dominant factor? Moreover, presence research provides an established theoretical and empirical base from which to test the extent to which this positioning is successful.

6. CONCLUSION

If presence is understood to be the extent to which an organism structures its interactions with an environmental array without regard to mediation, then inducing a sense of presence in a game environment can be seen as both advantageous and distinct from other psychological outcomes of play. Presence forms part of a feedback loop of perception, knowledge processing and action, alongside empathy, suspension of disbelief and unconscious motor reaction to stimuli. Presence, by definition, suggests an effective relationship between user and environment, via interface, has been established. In other words, a player feeling presence in a game is concerned less with the mechanism of playing than with behaving within the game environment according to what are perceived as environmental, rather than functional rules. This acceptance of the environment as significant in itself, rather than as a set of stimuli emerging from an interface, suggests a greater degree of empathy, attention and emotional investment. This, in turn, heightens the game reality and reinforces schema, thus maintaining presence and potentially inducing higher levels.

To put this simply, a game that induces presence, it is argued, should be effective in these other identified outcomes as well. That is not to say, of course, that games require presence in order to be effective. Rather, those games which utilize a mix of cultural and perceptual cues to create unreal-real worlds in which to embed narrative, empathic involvement, player commitment to an ludological contract, and a sense of in-game semantic context should examine ways of testing whether the interface is reducing in importance, allowing players to enter into closer psychological proximity with their avatars, and be 'there' for the game, not its engine. Presence, it is argued, is one such means of doing so.

7. REFERENCES

- [1] Steuer, J. Defining Virtual Reality: Dimensions Determining Telepresence. *Journal of Communication* 42, (1992) 73-93.
- [2] Lombard, M. and Ditton, T. At the Heart of it all: The concept of Presence. *Journal of Computer-mediated Communication* Volume 3 (1997)
- [3] Freeman, J. Implications for the Measurement of Presence from Convergent Evidence on the Structure of Presence. *(Tele-)Presence Panel ICA 2004* (2004)
- [4] Floridi, L. The Philosophy of Presence: From Epistemic Failure to Successful Observability. *Presence: Teleoperators and Virtual Environments* (in print)
- [5] Slater, M. A Note on Presence Terminology. www.presence-connect.com (2003)
- [6] Zahorik, P. and Jenison, R. L. Presence as Being-in-the-World. *Presence: Teleoperators and Virtual Environments* 7,1 (1998), 78-89
- [7] Prothero, J. Parker D. Furness T. and Wells M. Towards a Robust, Quantitative Measure for Presence. *Proceedings of the Conference on Experimental Analysis and Measurement of Situational Awareness*, Datona Beach, FL, USA, (1995) 359-366.
- [8] Huang, M. P. and Alessi N. E. Presence as an Emotional Experience. in *Medicine meets Virtual Reality: The Convergence of Physical and Informational Technologies Options for a New Era in Healthcare*. Westwood, J.D., Hoffman, H.M., Robb, R.A. & Stredney,

- D. (eds), Amsterdam, IOS Press (1999), 148-153.
- [9] MacIntyre, B. Bolter J. D. and Gandy. M. Presence and the Aura of Meaningful Places. *presented at 7th Annual International Workshop on Presence (PRESENCE 2004)*, Polytechnic University of Valencia, Spain . (2004).
- [10] Nicovich, S. G. Boller G. W. and Cornwell T. B. Experienced Presence within Computer-Mediated Communications: Initial Explorations on the Effects of Gender with Respect to Empathy and Immersion. *Journal of Computer-mediated Communication* 10,2. (2005).
- [11] Davide, F. and Walker R. Engineering Presence: an Experimental Strategy. in *Being There: Concepts, effects and measurements of user presence in synthetic environments*. Riva, G., Davide, F. & Ijsselsteijn, W (eds.), IOS Press, Amsterdam, (2003), 42-59.
- [12] Mortensen, T.E. Online Games – response to ICA Panel. Thinking with my Fingers - (May 2005) <http://torillsin.blogspot.com/2005/05/online-games.html>
- [13] International Society of Presence Research. Explication Statement. <http://www.temple.edu/ispr/> (2000)
- [14] Heeter, C. Being There: The Subjective Experience of Presence. *Presence: Teleoperators and Virtual Environments*. 1,1, (1992)
- [15] Zeltzer, D. Autonomy, Interaction and Presence. *Presence: Teleoperators and Virtual Environments* 1,1, (1992)
- [16] Waterworth, J A and Waterworth E L. The Core of Presence: Presence as Perceptual Illusion. www.presence-connect.com. July (2003).
- [17] Shapiro, M. Presence and Reality: Making Media Experiences Conceptually Real by Getting Beyond Sense Perceptions. *Proceedings of Presence at ICA 2004, New Orleans, USA*, 2004.
- [18] Schubert, T. and Crusius J. Five Theses on the Book Problem: Presence in Books, Film and VR. *presented at 5th Annual International Workshop on Presence*. Porto, Portugal . October 2002.
- [19] Barfield, W. Zeltzer D. Sheridan T. and Slater M. Presence and performance within virtual environments. In, *Virtual environments and advanced interface design*, W. Barfield and T. A. Furness, III (eds.), Oxford University Press (1995) 473-513.
- [20] Gibson, J.J. *The Ecological Approach to Visual Perception*. Houghton Mifflin Company, USA, 1979
- [21] Mantovani, G. and Riva G. "Real" Presence: How Different Ontologies Generate Different Criteria for Presence, Telepresence and Virtual Presence. *Presence: Teleoperators and Virtual Environments* 8,5, (1999) 540-549.
- [22] Mantovani, G. and Riva G. Building a Bridge between Different Scientific Communities: On Sheridan's Eclectic Ontology of Presence. *Presence: Teleoperators and Virtual Environments* 10,5 (2001) 537-543.
- [23] Biocca, F. Inserting the Presence of Mind into a Philosophy of Presence: A Response to Sheridan and Mantovani and Riva. *Presence: Teleoperators and Virtual Environments* 10,5 (2001) 546-566.
- [24] Nunez, D. & Blake e. Conceptual Priming as a Determinant of Presence in Virtual Environments. *Proceedings of the 2nd International Conference on Computer Graphics, Virtual Reality, Visualisation and Interaction in Africa (AFRIGRAPH)*, (2003), 101-108.
- [25] Banos, R. M. Botella C. Guerrero B. Liano V. Alcaniz M. and Rey B. The Third Pole of the Sense of Presence: Comparing Virtual and Imagery Spaces. *Psychology Journal* 3,1 (2005) 90-100.
- [26] Pinchbeck, D. & Stevens B. Schemata, Narrative and Presence. *Proceedings of the 8th Annual International Workshop on Presence (PRESENCE 2005)*, London, UK. (2005) 221-226
- [27] Loomis, J. M. Distal Attribution and Presence. *Presence: Teleoperators and Virtual Environments* 1[1]. 1992.
- [28] Youngblut, C. *Experience of Presence in Virtual Environments*. IDA Document D-2960[Log H 03-001849], September 2003.
- [29] Dillon, C. Keogh E. Freeman J. and Davidoff J. Aroused and Immersed: The Psychophysiology of Presence. *presented at Presence 2000*. (2000)
- [30] Turner, P. McGregor I. Turner S. and Carroll F. Evaluating soundscapes as a means of creating a sense of place. *Proceedings of the 2003 International Conference on Auditory Display*, 6-9 July 2003. ICAD03-148-151
- [31] Dinh, H. Q. Walker N. Song C. Kobayashi A. and Hodges L. F. Evaluating the Importance of Multi-sensory Input on Memory and the Sense of Presence in Virtual Environments. *Presented at IEEE Virtual Reality 1999, Houston, Texas, US* . 1999.
- [32] Zimmons, P. & Panter A. The Influence of Rendering Quality on Presence and Task Performance in a Virtual Environment. *Proceedings of the IEEE Virtual Reality 2003*.
- [33] Axelsson, A-S. Abelin A. Helda I. Nilsson A. Schroeder R. and Widestrom J. Collaboration and Communication in Multi-User Virtual Environments: A Comparison of Desktop and Immersive Virtual Reality Systems for Molecular Visualization. *Proceedings of 6th UKVRSIG Conference*. Salford, UK, (1999) 107-117.
- [34] Lessiter, J. Freeman J. Keogh E. & Davidoff J. A Cross-Media Presence Questionnaire: The ITC-Sense of Presence Inventory. *Presence: Teleoperators and Virtual Environments*, 10,3 (2001).
- [35] Darken, R. P. Bernatovich D. Lawson J. P. and Peterson B. Quantitative Measures of Presence in Virtual Environments: The Roles of Attention and Spatial Comprehension. *Cyberpsychology and Behaviour* 2,4, (1999) 337-347.
- [36] Slater, M. Steed A. and Chrysanthou Y. *Computer Graphics and Virtual Environments: from real to real-time*. London, Addison-Wesley, 2002.
- [37] Neisser, U. *Cognition and Reality: Principles and Implications of Cognitive Psychology*. W.H. Freeman and Company, USA, 1976 [38]
- [38] Atkins, B. *More than a Game: the computer game as fictional form*. Manchester University Press, 2003
- [39] Pietro, G. Virtual Unreality of Videogames. *Psychology Journal* 1,1, (2002), 57-70.
- [40] Nunez, D. How is presence in non-immersive, non-realistic virtual environments possible? *Proceedings of the 3rd International Conference on Computer Graphics, Virtual Reality, Visualisation and Interaction in Africa (AFRIGRAPH)*, (2004), 83-86