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8 Ethical education with Virtual Reality: immersiveness and the knowledge transfer process.

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Abstract. Computer Based Learning (CBL) is well known as a source of effective tools to aid learning processes. There is evidence that computer simulation can contribute to raise interest and motivation in students and to effectively support knowledge transfer. Virtual Reality Environments show potentialities as far as many educational domains are concerned, such as philosophical classes dealing with mainly abstract ethical issues, in that the learning process can be settled within an experiential framework. This chapter analyses the use of a life-simulation game to enhance the understanding and learning of the ethical principles found in everyday life. In the interaction with the virtual environments, personal immersive characteristics represent a very important factor to consider. To this aim, a case study was carried out in order to assess the influence of immersive subjective tendencies on the transfer of knowledge in the educational process mediated by VREs tools. The obtained results support the effectiveness of these environments in the learning process and provide a reference framework for teachers and designers interested in this area.

Contents

8.1 Introduction

As society grows in complexity, Information Technology developments are being incorporated in diverse aspects of human life, such as work and entertainment. Education must provide a variety of teaching methods to enhance the learning process using IT. Computer Based Learning (CBL) is well known as a source of effective tools to aid learning processes. Morever, it is becoming difficult for teachers to keep the attention and motivation of their students relying only on the traditional tools and the "teacher-student" context. Is it common nowadays to hear in the Media that teachers meet discipline problems in schools, at different levels. There are many possible explanations that could account for these problems, and a main one is certainly the lack of motivation that students have at school. In order to overcome some of these difficulties, computers are starting to being used more and more as teaching tools, to provide students with a variety of learning experiences. Multimedia presentations, computer questions and answer session and applications of Virtual Environments are normally included on the menu of CBL tools available at this time. Not only the issue of motivation, but also the strong link between educational theories and Virtual Reality justifies the implementation of Virtual Reality Environments (VREs) in education. Situated learning and Constructivism are clear examples. VREs provide quite realistic simulations of reality that we can bring to the educational setting without any risk.

New techniques are being developed for Virtual Reality Environments (VREs). The use of VREs extend to a wide range of activities, from training people to acting in dangerous environments to applications related to psychotherapy, entertainment and education. VREs have a high potential value for applications that in physical reality would be too expensive develop or too dangerous to work with, e.g. training for space missions or military interventions. The effectiveness of the interaction with VREs does not only deal with the quality of the technologies used to model the virtual environments but also with the transfer of this knowledge from one world to another. Bruner [1] suggested that performing the task enhances the learning process. When activities are too dangerous and expensive to reach this requirement of effective learning in the physical world, then VREs may work as a substitute for the situation which the trainee is to be trained and practice in. If the practice is trained within a VRE then it is also expected that this practice will develop expertise of use in the physical world. The link and transfer of knowledge between the two realities appears to be crucial.

VREs can be used in many educational situations such as ethical education, education about everyday relationships and the analysis of society. Ethical Education, especially, is and will be a costant requirement in any education curricula, as Ethics is, to some extent, the background for all human relationships. In the 21st century, it is becoming more important, as the Information Age expansion starts to show signs that the ethical guidelines from the previous stage of information society cannot cope with these changes, and needs to include ethics inside virtual worlds. It is not only a matter of laws and guidelines but also of understanding the emerging of new ways of communication, of manipulation of information, and of a new way of forming and maintaining relationships. It could be said that the information age absorbed society, but society did not absorb the changes as fast as they are happening. It is expected that more ethical dilemmas will need to be sorted out, not only by laws but by the personal decisions of subjects, as laws are not so effective in the virtual communities. This is not considered here to be a failure of the law or of the new cyberspaces: there are deep changes that we are facing and therefore different approaches should be tried. Since imposing restrictions over the electronics spaces is not useful, and is as well a deliberate modification of the nature of these spaces, the Ethical Education

approach presented here could represent a way of educating future citizens in the process decision-making when dealing with ethical dilemmas. Education should reinforce those spaces where students can develop and practice this kind of complex knowledge, which is the result of an analysis of a situation under the light of the consequences that that decision should have in Society. The purpose of this contribution is to investigate the possibility to support this activity by VRE softwares. The case study presented in the second part of this chapter was carried out in order to assess whether the use of a life-simulation game could enhance understanding and learning the ethical principles found in everyday life.

8.2 Virtual Reality Environments

Gaddis [2] defined Virtual Reality (VR) as:

"*a computer-generated simulation of the real or imagined environment or world*".

Cronin [3] brings us Kalawsky's definition of VE, but from the perspective of what it does:

"*Essentially when one interacts with a VE, they become engaged in the type of closed loop. On one hand the user interacts with the VE representation which in turn is based on a model. The effects of the user's interaction are then fed back through the modified version of the model and so the cycle begins again. Kalawsky notes that for the loop to have an educational dimension it must be controlled by a training or education program*"

It is becoming obvious that one important feature about VREs and education is the high level of interaction, in real time. Modifications introduced by the learner can be programmed and monitored for educational purposes.

We can say that VREs as computer generator of environments have a very promising future in educational fields. Meanwhile the level of interaction and the educational aims that underlie the VREs will allow to be described as "educational". At the moment, research is intensively focused on the application of VREs to training, teleoperation, medicine, psychotherapy, education and gaming.

Furthermore, it is not only a high level of interaction that defines the unique characteristics of VREs but also the sense of presence and the feeling of immersion.

Immersion is defined as an "intense feeling of self-location within the computer-generated reality with which the user interacts" [3]. It has to do with the feeling of being deeply involved "inside" and "around" the environment. It is important to remark here, that two aspects enrich this concept: we can say that immersion is produced by the encounter of the technologies which have certain qualities, which support the VREs with the subjective feeling of involvement experienced by the user of the computer in the interaction process. To sum up, immersion is defined and created by the features of the technologies and is also defined as a subjective feeling. On one side, immersion defined by technology is related with the features of the devices which is more known as fidelity. Knapp [4] defined fidelity as:

"the extent to which the VE and interactions with it are indistinguishable from the participant's observations and interactions with the real environment"

Is it known that increased levels of fidelity help immersion to arise. A high level of fidelity will increase the success of the learning process, as it enhances the transfer of

knowledge by reducing the dissimilarities between the real and the synthetic world. It is important to remark that, as fidelity deals with technology capabilities, it would be too expensive to reproduce the real world with all its characteristics using VREs currently available. Furthermore, it is not always necessary, especially for some knowledge areas, to reproduce the environment with high levels of fidelity. High levels of fidelity are needed when dealing with spatial knowledge training, such as flight simulators or fireman trainee, but others kinds of knowledge do not need a very high level of fidelity. Quoting Knapp [4]:

"Bliss, Tidwell and Guest, for example, were able to show with relatively low-fidelity interface devices that people can transfer spatial knowledge acquired in a VE".

The other perspective of immersion has to do with the subject, as a subjective condition. There are two ways to conceptualise this: one is what Knapp [4] has called "environmental fidelity" and concerns the psychological judgment of similarity, the other concerns the experience of involvement defined by Cronin [3] as a human factor:

"Effective immersion requires the ability on the part of the participant to control attention and focus on what is going on in the VE while simultaneously excluding all interference from the outside world".

In the same research line, Witmer [5] defines immersion as the real world behaviours and tendencies that may enhance the feeling of presence individuals will or can experience in a VREs.

It is possible to see how this is connected with the learning process: what is important here is that VREs can provide modes of experiential learning. More than from school, we learn constantly from the physical world scanning it with all our sensory system. The idea of learning from experiencing reality comes to be the paradigm of theories like Constructivism. That is why the use of VREs basically follows this principle. VREs as learning tools allow the student to have a more sensory experiential relation with information. Information is presented not only with diverse mediums but also in three dimensions. With the possibility of high levels of interactivity, which are handled in a more naturalistic way, the feelings of ownership of the learners in the knowledge and the quality of the development process are dramatically increased. Furthermore, design is not constrained by reality laws and that allows the use of different metaphors potentially increasing motivation and engagement. Immersion comes to be an important factor as far as both technical features and learner's subjectivity are concerned.

8.2.1 Categories of VREs

Cronin's [3] categorization of VRE divides VREs according to the principles of immersion and fidelity, "by the quality of immersion that the system provides". Therefore, he found three main groups:

- *Non-immersive (desktop) VRE.* The images are delivered by a screen even if there are 3D images. It is the most common and inexpensive form of VRE.
- *Semi-immersive (projected) VR.* Images and effects are projected on a wide big screen, immersion is increased but the level of interaction is affected.
- *Fully Immersive VR.* This is the most expensive and the most famous VR; it requires special interfaces devices as data glove and head couple visual displays unit.

8.3 Virtual Reality Environments for the teaching of ethics

Virtual environments appear to be a possible means for learning some basics about human life and interactions between people without any risk. Also the possibility to use this kind of software in more philosophical classes might bring motivation and a sense of practicality.

VREs applied to ethical education would be an effective application. As VREs have the ability to create worlds without repercussion for socially reprehensible acts, it would be an adequate scenario to experience and act on ethical dilemmas, observing potential consequences and take part in the decision making to solve concrete situations where ethical dilemmas need a response. And it will be increasingly noticed that ethical dilemmas will appear to be solved in the virtual worlds as well.

Ethical Education with VREs can use avatars, characters, agents and to some extent personalities which can be created with situations posing ethical dilemmas. This phenomenon is not unique inside VREs with educational purposes or gaming ones. It happens as well inside the virtual communities found upon the web. In these communities, the ethical and the legal status are just starting to be observed as a totally new arena [6]:

"Dede says that what people want from such societies is "magic", that by giving participants magical powers, it opens up learning in ways that educators are just beginning to understand. Perhaps this is also indicative of VR as an alternative environment in which to experience the myths that are a part of growing up—that instead of reading the story, you are in the story, that you can be scared, just as you are when you read, that you can be a hero/ine, or witch, or a monster, and still be you when you are finished" (p. 8)

And that is, for ethical education a unique goal and an early approach to achieve it. Someone can say that psycho-drama or role playing techniques could reach the category of experiential learning but they appear more suitable for situations where subjectivity is required to emerged and be analysed. (i.e. psychotherapy). Meanwhile a VRE as an educational tool allows the learner to create the avatar that represents him/her in the virtual world and develop a long-term experience where it is possible to track experiences repeated as necessary as is required. It is becoming obvious that Ethical Education will need to be reframed in order to provide the new members of these societies with a new set of ethical guidelines that can be useful and possible to use in many worlds. This becomes crucial, as there is a trend that in the near future our society will be living in a mixed world (of virtual and physical space). Quoting Osberg [6]:

"We are all biased. Our biases are based on our culture, our age, our experience, our sex, our religion, our political beliefs…but children are as yet unformed in most of these respects. Who do you want to be in charge of providing information to your child, the learner? And why? What is the end goal? What sort of socio-educational example do you want to set, or have set for you?" (p. 9)

The possibility of experiencing different selves in VREs has to be considered as a positive aspect. The very famous "golden rule" in ethics suggests that people should not do to others what they do not want others to do to them, or the common dilemma strategy that asks for people to place themselves in other people's situation. This possible interchanging of selves could be seen under the rules of transfer your questions and your intrigues to

different avatars, different situations, and this could help the learner to understand other positions and situations in the physical world.

Furthermore, the use of simulations like the one used in this case study have been in the commercial market-place for years. In this game-simulations people are challenged to construct cities, hospitals, airports and manage them in order to improve their features. In these contexts people, by gaming, can consider the best way to design. In the same line of development, the software used in the experiment is a simulation game. The intention is to use the simulation as an educational tool so that the game is seen as an environmental ethical arena where the learner can apply ethical behaviours life and society in order to test the implications of these ethical decisions inside an educational frame.Ethical Education appears to be more abstract than other educational activities where VREs are being used.

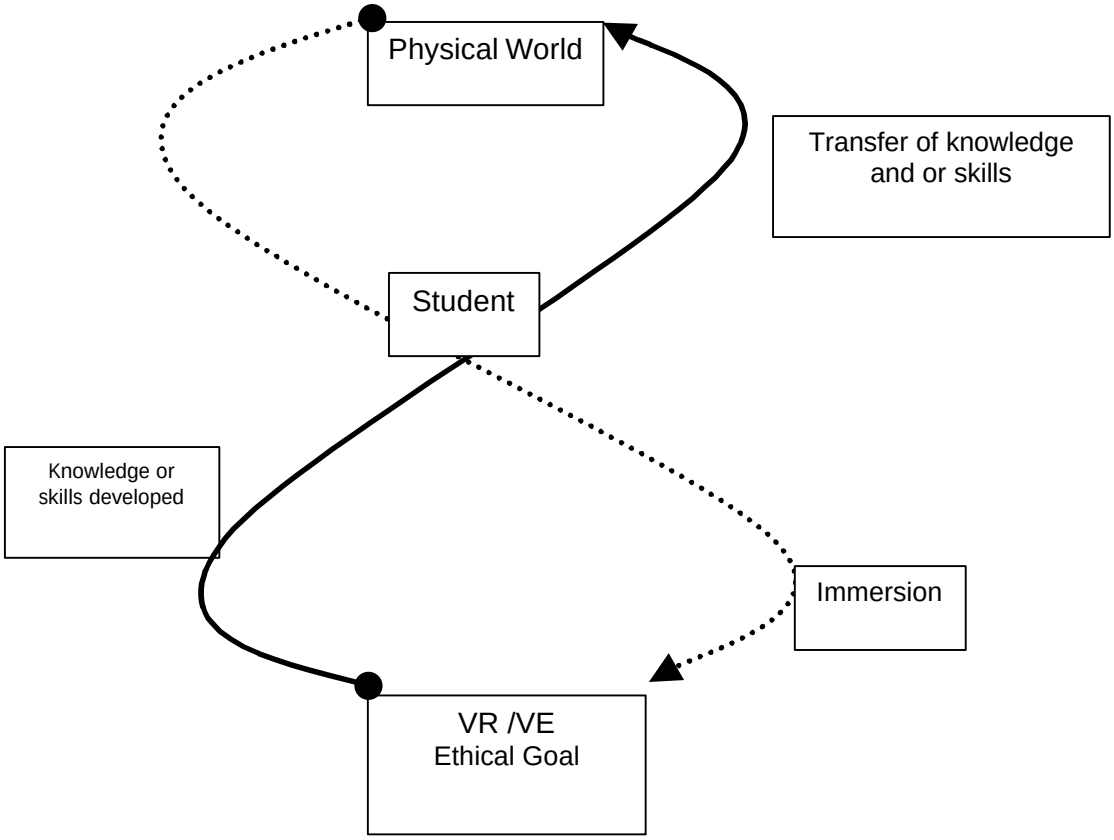

Figure 8.1 Transfers schema

8.4 The transfer of Knowledge

VREs transferability comes to be a key question: several transfers have to be done in order to generate a learning process and as well and transfer of knowledge is expected from the virtual world to the physical (See Fig. 8.1). Another kind of transfer refers to the movements of the learner from one world to another. The main analysis in the case study was related to the transfer of learning and knowledge. It is important to note that it is very difficult but not impossible to investigate the transfer process directly, but we can observe it easily if transfer is already done. In this section, three perspectives of transfer process are presented.

The learning process defined by Gagne [7] has four basic stages: apprehending phase, acquisition phase, storage phase and retrieval phase. It is in the last phase where transfer is needed:

"When retrieval is exhibited as the reinstallment of an intellectual skill, what is observed is a performance in a new situation. The elements of stimulus situation in which the skill was first acquired are altered, and the learner is required to perform in a novel context. Reinstallment in this sense, then, is one manifestation of learning transfer" (p. 77)

It is important for educational reasons to detect if learning transfer is done. Evaluation needs to focus on this process more than on knowledge retrieval, as transfer is needed to re-use the expertise. It is also important to say that transfer here has the dimension of space (from one situation to another) and of time (the acquisition of skill first, then transfer. Is this process affected by the use of VREs in Education? Since VREs ascribe for other kinds of transfers movements, are these other transfers beneficial to the transfer of learning?

Gagne [7] suggested that Education must provide pathways to promote transfer. The applicability of learning capabilities rely on the transfer process. Thus we can say as a first approach that other transfers could have an influence over the transfer of learning:

"Similarly, a goal of science instruction is not simply having the student state a concrete example of a scientific principle but also making it possible for him to apply this principle in novel situations, and perhaps even design an experiment to test a principle of his own devising". Obviously, instruction must include provisions for meeting such goals as these, which demand the transfer of learning" (p. 319)

It's becoming clear that this principle of the learning process could be applied to the use of VREs. Therefore the transfer of learning and knowledge from one world to another appears to be a property and a matter for consideration. For VREs designers, transfer could be enhanced by technology, and that has to do with the fidelity that a VREs have in relation with the physical world that is modelled. The transfer of knowledge becomes crucial when spatial learning takes place as the main objective, like in flight simulators or teleoperation systems. In other uses of VREs for education, spatial knowledge is not as important as other capabilities. In these cases the transfer of knowledge does not entirely rely on how technology simulates the environment but on the levels of interactivity and immediate feedback, as well as of educational instruction. For this kind of knowledge, that is not only spatial and can be considered as more abstract, we can say that VREs have the possibility to offer different perspectives to observe the same situation. Lackner and Dizio [8] also remark that this property enhances the sense of presence:

"A unique feature of virtual environments is the possibility of entering them in many different ways. One can "drop" in from above and assume any position within or in relation to the virtual environment. Such versatility of access has important implications for adapting to virtual environments, for using them as training models for real ones, and for expecting positive transfer of training and learning to real situations" (p. 108)

It was mentioned elsewhere that the feeling of ownership will have positive effects on the learner. Omnipresent or multiperspective features [9], present in VREs appear to contribute to this condition. Also, Romano and Brna [10] suggested that VREs provide navigational tools and commands (called "superpowers") that are not possible in the real world, but that could improve the learning process:

"This suggested to us that we should investigate the tools that could improve the learning experience and enhance reflection. We wanted some superpowers that would allow the learner to be in charge of their learning experience." (p. 3)

Finally, the third perspective of transfer presented here has to do with the learner. This is another issue that will need consideration, as technology will allow increasing levels of interaction. VREs will enhance the communication between humans and computers. Also VREs will enhance communication between humans [9], allowing for collective activities. Connections between the physical and the synthetic world will be increased and immediately incorporated in everyday life. Concepts as "transmedia" and "bridging" Aksson and Ljungberg [11] are being investigated. As it is expected that the virtual environments and the physical one will be intertwined more, the transfer of knowledge will be an increasingly important topic.

We can summarize this section with Gagne's [7] definition of transfer, which is considered here to be applicable for the three perspective discussed above:

"Transfer is the ability to map appropriate processes and analogies from one set of circumstances to another, developing a deeper understanding regarding the circumstances at hand. These are essentially a combination of pattern recognition and actions sequence skills, utilizing generalization, discrimination, proceduralization, and composition of sequences." (p. 5)

8.5 The case study

The purpose of the study was to investigate the possibility to support the activity of ethical education by the means of VRE softwares, assessing whether the use of a life-simulation game could enhance understanding and learning the ethical principles found in everyday life. Moreover, a specific focus was on the incidence of immersive subjective tendencies in the educational process mediated by VREs tools.

8.5.1 Participants

8 participants, 4 male and 4 female, took part into the experiment. All of them were university students of diverse levels and ages.

8.5.2 Materials

1. *Ethical Guidelines Form* for ethical research with human participants. It is a minimum requisite to have this form not only for legal and ethical reasons but also because the potential participant could have an idea of what is the experiment is about.
2. *Immersive Tendencies Questionnaire (ITQ).* [5]. It is a questionnaire of 34 questions attempting to identify and measure possible individual differences in the tendencies of subjects to immerse themselves in different environmental situations.
   According to Witmer and Singer's results, this questionnaire has a strong link with Presence. However, the intention here is to analyse immersion as a subjective tendency in relation to the transfer of knowledge. As the ITQ is a questionnaire, it relies on the direct answers obtained from the users, that is to say from the

psychological perspective, the "image" that each person has of him/herself. Quoting Witmer and Singer [5]:

"The ITQ attempts to identify and measure possible individual differences in the abilities or tendencies of subjects to immerse themselves in different environmental situations. It uses a 7-point response scale that in format is based on the semantic differential principle. Each item is end-anchored by opposing descriptors, but unlike the semantic differential, the scale includes an anchor at the midpoint." (p. 6)

The authors use clustering to divide the result into three subscales:

a. *Involvement subscale* deals with "the propensity to passively get involved in witnessing something" [5]. This subscale is, for the aims of this case study, the most pertinent to analyse. The basic aspect are: involvement with books and other medias like TV, cinema, etc., distraction when the user interacts with these mediums; awareness of events around the user; identification with characters represented in these media products.
b. *Focus subscale* concerns questions about how mentally alert the person feels, capacity to concentration and disconnection from external distractions.
c. *Game subscale* is used to find out the frequency on gaming and levels of involvement during the gaming session.

3. *A Simulation Game, The Sims.* This software, released by Electronic Arts at the beginning of this year, is a people simulator (see Fig. 8.2). Users can interact with characters and environments. One important feature of this simulation is that you have to create the characters from a set or menu of attributes, from body, gender, clothes to categories and distribution of biorhythms. As well as avatars, you have, if you want, to build up a house, refurnish, repair it, etc. Once the avatars and the environments are set up you have to interact with them and upon the relationships between them.

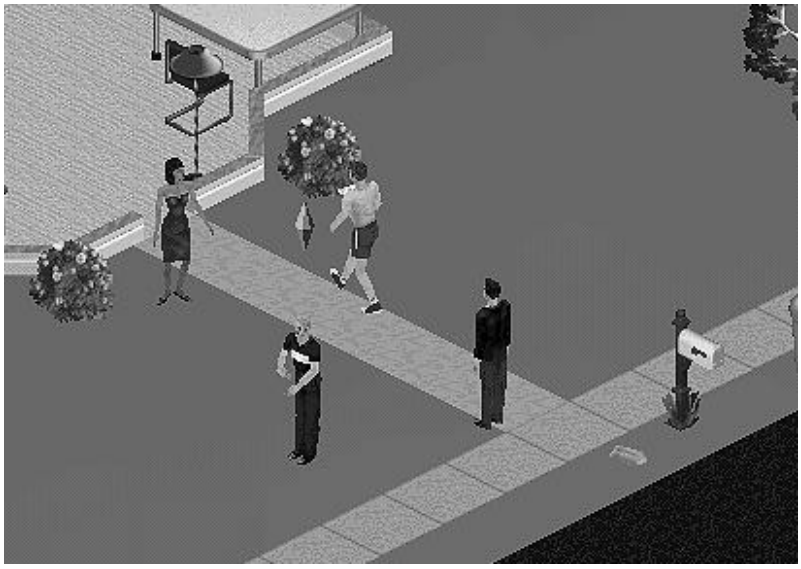

Figure 8.2 The Sims, in action

The simulation is divided into three sub programmes, one called “live mode”, another “buy mode”, and the third “built mode”. “Live mode” is the concrete simulation: time is running inside the game and you have to interact with your characters, attend to their needs and balance their activities, from developing relationships in between the characters to find them jobs and practicing skills, to prepare food and sleep.
A feature that brings educational potential to the game is that it is open ended. That means there is no predetermined ending. Finally in the game you are in control of the interfaces and that always means in control of all the commands and actions. In this simulation that is not entirely true, as the characters do not always obey your commands and have an element of “free will”; to some extent this means that the user’s commands sometimes are not executed by the characters, enhancing the motivation, generating surprise and concern, which leads to reflection. However, it is a non-immersive virtual environment. That is to say, is a three dimensional model presented on a two-dimensional screen, controlled through mouse and keyboard. It is important to say here, that the simulation is presented in the commercial market as a game-simulation, for the purposes of this research that means that the educational needs to be brought up into the game through educational activities. Bearing this in mind, we can assume that the results found in any research of these characteristics can be increased in the application of purely educational simulations. As mentioned above, the fact that this VRE is a non-immersive one, makes it easy to use and access, because it does not require special VR interfaces which are expensive for school installation. As well the price of the simulation is average.
Other features of the simulation that are believed to have a potential for educational purposes are, the possibility to create a database of images of the simulation sessions, called in the game “Camera Mode”, it is like a family photo album. The other educative potential relies on the web page of the game where users can “teleport” families, interchange tips, experiences, etc.
Finally, it is important to say here, that generally, simulations deal with practical activities, with the development of expertise in order to acquire spatial knowledge or how to manipulate object. This simulation is selected here for its potential as a tool for ethical education.

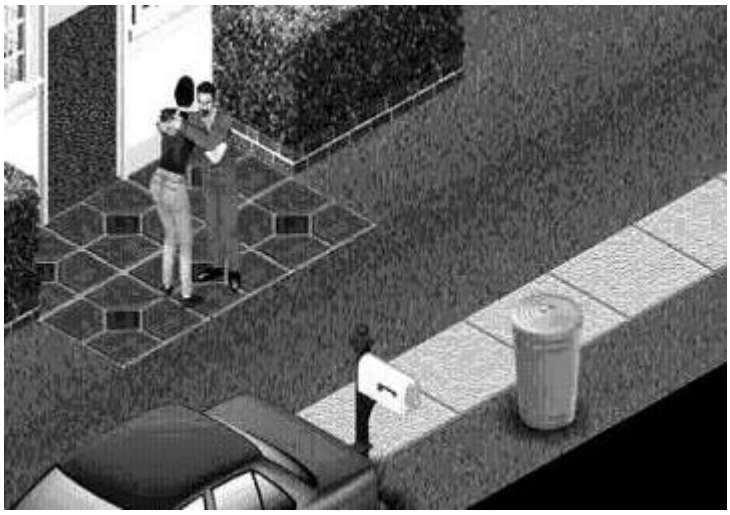

Figure 8.3 Relationships can be developed in many ways

The high level of interaction is not educational in itself; it needs an educational framework, which in this study is the last part of the session.

The interactions between the characters, and the interaction of the user with them, has the unusual feature of being open ended (See Fig. 8.3) "Free will" and wider possibilities of design of the environment and the characters, allow the game to be an artificial arena of the user's intentions, desires and values that are projected into the game through the commands. During gaming ethical dilemmas appear constantly, which requires decision-making by the user. Each time a person makes a decision concerning questions about values, his/her own fundamental assumptions, statements, belief about what is reality, emerged. The game comes to be a kind of synthetic arena or we can say a kind of changeable metaphor where the user through playing can build a narrative of his/her values, perspectives, and the meaning of reality. Quoting Barger [12]**,**

"*Thus, before one can make a judgment on whether a particular action is right or wrong, one must have adopted and understanding of what basic reality is about, and whether this particular action is in harmony with one's basic understanding of reality*" (p. 1)

4. *An educational activity* in the form of paper and pencil exercise. The first part is about writing down the experience, the second part consists of 14 questions intended to track analogies between the experience in both worlds.

8.5.3 Procedure

The experiment was divided into three parts. First, the students, in individual sessions, were asked to complete the Immersive Tendency Questionnaire.

After that, they were asked to use the VRE. First, they run the tutorial of the simulation in order to achieve the minimum expertise to move and interact within the environment.

After the tutorial, they played in between one and two hours with two different "environmental" conditions. The first condition required the user to design not only the characters but also select the objects, which the characters will interact with during the running of the simulation. The second was called a "chaotic" one. There were a couple of characters "living" in a nearly unfurnished environment with little money, no job, etc.

One hour of each gaming session was taped recorded. The taped material effectively covers the first part of the gaming session, that is to say the period after the participants finished the tutorial for the game. In order to systematise the huge amount of information that videos of these kinds have, a gathering grid was designed**.**

Items observed in the video data collected included:

- *expertise developed and transferred from one environmental condition to another* (spatial knowledge in the virtual environment, managing objects and managing characters);
- *emergence of dilemmatic conflicts* (a dilemmatic conflict here is a situation where a choice has to be made by the participant from a set of choices where the easy or more convenient way to solve the situation is not always available to the users or not desiderable for the whole situation; it is a choice between two courses of action;
- *concentration and disconnection from external distractions* (student's reaction as well as how these distractors were processed is the aim of this subscale).

In the third part, after they had explored and interacted with the environment, the student completed questionnaires and reports about the experience. They were encouraged to write down information such as what they did during the session with the VE. These written reports gave the chance to the students to write in their own words way what they had experienced. On the other hand, the questions were targeted to find evidence that learning took place. That means here, assessing whether the VE interactions generate discourse of educational value. It is supposed that if transfer is done, the participants should show what they had processed about the experience in the activity. Also the second part of this section has 14 questions that are intended to allow analogies to be found between the two worlds, this means transfer, not inside the knowledge process, but from the virtual environment experience to the physical world.

8.5.4 Results

The information received from the video data collected show important tendencies, that the transfer process is not strongly affected by immersive tendencies, but a low level of involvement could affect the development of spatial and interface knowledge and that could affect the instructional goal of ethical education. A low level of involvement and focus on the game, will adversely affect the transfer of knowledge. Motivation and interest in some way, to some extent, could be a matter of consciousness but this tendency appears to be beyond the control of the person, who can control concentration but not immersive tendencies.

Searching the data collected for the Educational activities, we found that, in different ways, the experience was effective for the production of knowledge. In other words, transfer was obtained as with many other educational tools.

One indication of transfer is found in the questionnaire. Participants were asked to answer the same situational question but first for the synthetic environment and second for the physical world, in the same manner as performed in the session. The aims of these questions were to search for analogies in behaviours, thought about similar things of physical life and of the VREs. We present this subsection just to mention some relevant examples from the answers of the educational activity. It is believed that in that way the exploratory nature of this research is better expressed.

In another section of the activity, participants were asked if they had discovered any dilemmas in the game. It is possible to infer that a minimum of knowledge was constructed either as a direct effect of gaming or as an indirect effect, like comparisons with the physical world.

When the participants were asked about how to win the game, the open-ended feature appears to many of them as analogical to real life.

8.6 Conclusions

According to our study, the use of VRE game simulation demonstrated potentialities as an educational tool. On the one hand the game appears to absorb the attention of the players, to incorporate in the simulation aspects of their personalities, like their own way of living; on the other hand, the ITQ results appear to have no gross effect on the knowledge-transfer proces. Obtained results indicate clearly that this simulation can be used with educational purposes, as transfer appears not to be affected by levels of immersiveness; further research should focus on other factors like involvement and focus, which in the instrument used here is ranked as a subscale.

The idea of using computer based learning tools like simulation is not new. Quoting Laurel [13], answering questions about agents and interfaces design:

"…I don't think we should fault computer-based characters or agents from being not human enough, when you compare them to Peter Pan or Coyote are not tremendously complicated characters, but they are grand for us to use in our imaginative construction of what it means to be human, and what the world is like, where the world came from, what is mean to be alive now" (p .2)

One feature that appears to make interesting the simulation setting is the flexibility that the user has in using the simulation. This relates to the user's flexibility because at the time he/she designs the interaction from a menu of options, he/she can observe the effects resulting from this decision as the command is launched in the computer software. That means the user can be a director, an observer, and can interact in doing so with different characters. The immediate feedback and the levels of freedom for the user, make the simulation a matter of concern in terms of its educational aims. Another feature that makes it interesting is that simulations open a new form of narrative, which will demand intensive research. This form of narrative is a multimedia form, written with a sequence of interfaces, a sequence of commands, a narrative that uses the mouse and the keyboard not to write sentences and paragraphs but for creating scenarios, situations, events. A narrative that is composed by objects, characters, commands, interactions. The topic described above does now open a new polemic debate in this area, since the question here is "Who is the author of these narratives? The designers or the users? ". Cameron [14] said in relation with this question:

"Although the author describes the characteristic of a model, he or she is not the author of the events that happen within the model once set in motion." (p. 6)

Users of simulation while playing write a story and in doing so experiential learning takes place. The question is whether this experiential learning refers only to one world or it can be transferred to one another. Is this experiential learning experimental as well?

Referring to the aims of this case study, the key question was if immersive tendencies defined here as a subjective quality affected in any way the transfer of knowledge. In that perspective no gross inferences can be done based on the results obtained from the research. Transfer is registered at the level of the educational activities, the navigational expertise and the recognition of dilemmas in participants with different levels of immersiveness. As well the participants who failed in understanding the game, in managing the interfaces, or detecting dilemmas have different ITQ scores. This is not enough to say that there is no relationship at all. Furthermore, a lack of involvement, a low level of focus or a continuous disconnection from the VREs have negative effects over the learning process. About this remark, it is important to say that immersive tendencies, even if they are high or low in any person, do not determine whether a person will be immersely involved in all the situations which require this minimum of disconnection from the physical environment. In other words immersed to, involvement with, or focus on some object, narrative, or events is not defined by the intensity that the immersive tendencies engender in each person; the objects of these qualities are variable. A general high level of immersion does not mean that a person will be effectively immersed in any situation but in one that is of interest to them. As Cronin [3] reminds us, the concept of "effective immersion" has to do with the ability of controlling attention and focusing over the VREs and at the same time of controlling interference from the outside. We can thus say that

immersion could be managed by the ability of concentration and focusing and disconnection from external distractors.

From other perspective, computer simulation can contribute to raise interest (and this feeling maybe leads to focus immersion) as simulations allow feeling of ownership and authorship like never before. One question that is tempting to research is how these immersive tendencies could be develop under training programs. In a sense, if we can make people direct their immersive tendencies, people with low levels of immersive tendency could increase this in order to improve their performances with VREs.

In the near future people will be living in more and more mixed environments, and this tendency will become a matter of consideration for designers and companies.

Overall, the simulation showed evidence of educational effectiveness, and this motivates further research lines. The incidence of immersive tendencies over the transfer of knowledge needs more research and maybe a diversion in the conceptualisation apply instead of "immersive tendencies" [5] to "effective immersion" [15]. In the same line it could be a matter of continuous study, to develop instrument like the one used here, in order to improve them in the search for more precise data. Also, studies about the development of the degree of involvement works could help to find new kinds of threshold or intensities scale.

As far as the specific simulation software used here is concerned, THE SIMS, it appears suitable to be used in different settings. The game is versatile and allows a number of different uses. Possible applications of special interest in educational contexts concern group activities in different forms. The first possibility is the traditional collaborative group where decisions about characters emerge from collective decision. The other way to work with this simulation could be even more stimulating and interesting, and consist in working with all members of the group having their own character, and playing together at a time. In this way, relational knowledge could be developed. Working in groups could also decrease the problem of isolation possibly generated by playing the game alone. Furthermore, playing the game in groups allows for more discussion at the time that any dilemma appears. Another feature of the game useful for educational purposes is the possibility to save the historical tracks of each session, thus allowing for evaluation of performances by external judges.

A final remark concerns the importance of a precise definition of the framework within which the VREs are to be used: the effectiveness of their use depends in fact not just on the specific features and the high level of interaction of the simulation-game in itself, but mostly on a suitable educational framework, in which the students can focus their reflections about the virtual experience.

8.7 References

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