The Sensory Model of Virtual Person

邱美珍　鄭淪維 張明治 賀嘉生
May-Jane Chu, Yu-Wei Jeng, Maiga Chang, Jia-Sheng Heh

Department of Information and Computer Engineering

Chung Yuan Christian University, Chung Li, Taiwan 32023, R.O.C.

keywords: VP(virtual person), sense, virtual environment, virtual reality, learning

Abstract

Virtual environment is an interactive environment that gives users the illusion of displacement to another location. In this paper we design a kind of virtual creature, called Virtual Person (VP), whose role in virtual environment is similar to the human being in real world. We analyze the fundamental requirements of VPs and propose an integrated design of VP, including audio-visual senses, multiple role scripts, learning ability and communication behavior.

Two VPs (a virtual teacher and a virtual student) are designed in a simulated system. Therefore, four modes are allowed in the implementation: real teacher - real student, real teacher - virtual student, virtual teacher - real student, virtual teacher - virtual student. The virtual teacher instructs the virtual student by some teaching strategies. The student receives training samples from the teacher, and memorizes them in knowledge unit.

1. Introduction

Virtual environment displays provide a new communication medium for human-machine interaction and advanced interfaces, [Lat94] [Ell94] which have been used widely to simulate many practical conditions, such as flight simulator. [Ell94] After network functions have been added, networking functions, a virtual environment can provide versatile interactions among multi-user interfaces. Furthermore, many researches discuss different virtual creatures in computers, for examples, virtual student in LCS (Learning Companion System) [Cha88] and virtual ant in DAI (Distributed Artificial Intelligence). [DrF92] As these creatures join the virtual environment, the interactions exist not only among real users, but among real users and the virtual creatures. This paper proposes a general structure of one kind of virtual creatures in virtual environment, called Virtual Person (VP).

A Virtual Person lives in virtual environment and behaves as a real person. He has emotion, personality, basic skills and he can think, learn or take over somebody's work. Moreover, he can communicate with real or virtual person via his sensing system. A VP can be a teacher , a student, a doctor, a mother , a baby, or anyone which only depends on the designated role script. Beside the role script, knowledge unit and learning unit are also important elements.

The following sections discuss the design principles of VP. In Section 2, the sense model of the human and fundamental requirements of VP are analyzed. The integration of VP's senses and the interaction among VPs and environment are discussed in Section 3. Section 4 gives a VP model and explains its goal, its functionality, and how it works. In Section 5, there is a computer simulation result for distance learning, which can play the role of virtual teacher or virtual student in distance learning. Section 6 is a conclusion.

2. The needs of Virtual Person

A person has several senses, with which these sense he can see, hear , smell , taste , touch and feel the multifarious phenomena of the world. Within these senses, the basic requirements for a VP is hearing and seeing, both of which are necessary for interaction with other persons and environment. Of course, it is important for a general VP to possess other senses, such as smell, touch and taste, which are still research topics of virtual reality and will be included in the future. Moreover, for its communication abilities, we add simple speech and image to represent the mouth and display actions of this VP.

If a VP just get the signal from the sensory systems, its usage will be limited. They must be clever enough to learn something new and have the ability to tell the differences about what they learn. A VP must collect data from different information sources (such as text, image, audio and other media), process these data to get the idea of what the information source means, and finally store the information or concept in some storage units. Through this way, the VP can deal with the things that he/she has never done before. That is why we need a brain and memory.

Everybody has some roles in real environment; for instance, he/she may play a teacher in one school and play a student in another one. These roles depend on several external conditions, such as environment, time or the person with whom he talks. Similar to real person, a VP should also play suitable roles for various statues, and these roles have to be designated by some scripts. Hence, a VP must hold multiple role scripts, which can be changed dynamically when the VP facing different conditions.

To sum up, a VP needs the senses to feel the multifarious phenomena of virtual environment, the brain to think and to store knowledge and the role scripts to define his roles. In the next section, the VPs' communication through the senses will be deeply discussed.

3. The interaction and integration of VP senses

This section emphasizes the interactions among VP, user and virtual environment. Their relations are shown in Figure 1. The virtual environment of an organization is generally treated as the external or equipment of this organization. [Rob86] The presentation interface includes tools (with media storage) and some VPs. Media storage contains all media which can be accessed directly by VPs, but perceived through some additive physical devices by real persons. VPs can cooperate, compete, and moreover, command other VPs to do something. There are two communication methods among VPs: the inter-process communication through common media storage, and the network communication through the virtual environment and multiple presentation interfaces. Besides, the communication of two real persons is similar to that of two VPs, except that the media must be played in real world. Therefore, the device and its driver have to be designated.

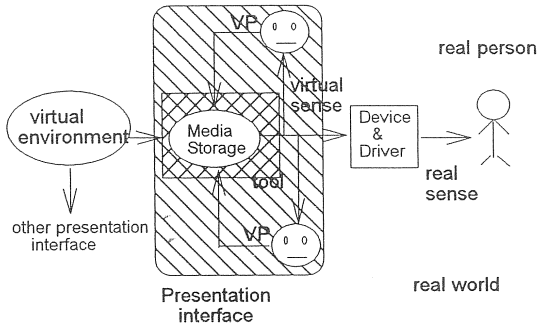


Fig.1. The relation between VP, user, and environment

Virtual environment is an interactive, enhanced virtual displays to convince users that they are immersed in a synthetic space. [Ell94] There are several virtual environments [Urz92][DrF92] in which some agents may act according to the contracts that they accept or the stimulation they receive. Therefore, although a VP is similar to the agent in artificial intelligence, it has to possesses multiple role scripts, general and adaptive sensing structure, as described in the following.

Virtual Person interacts with people in natural ways, such as image, audio, animated graphics, or even natural language. Two major themes are concerned. One theme deals with the way people sense VPs, and the other deals with the comfort and acceptance of VPs' automatic, autonomous actions. [Nor94] The former asks VPs to own human-like sensing interfaces through which human-VP interactions are natural and simple. For the latter, VPs must have fluent, trustable behaviors and changeable roles, then multiple role scripts with assigned power and priorities have to be designated for VPs.

A single medium may not make VPs be comprehended enough. For example, students taught by face-to-face teachers usually learn better than those who can not hear/see teachers. Gunawardena [Gun95] finds that in computer mediated-communication, different media can express different social presence with different cues. Multi-mode media may present higher social presence. [CHA95] Hence, sense integration is helpful to make VPs more perceptive to interaction with environment.

4. The design model

With the previous analyses, the basic VP functions that match VPs' needs can be obtained:

1. A VP can communicate with real person and other VPs in human-like ways.
2. A VP can think, learn, and memorize things which have been done before.
3. The roles of VPs can be assigned in some role scripts.
4. There are integrated senses.
5. The design should be practical, i.e. VPs can help real persons to do something.

Thus, a simple and general model of VPs is designed to fit VPs' functions, as Figure 2 shown.

In this model, the input and output sensory storage are responsible for the access of senses. The knowledge unit records the concept that the VP learned. Some learning method embedded in the learning unit can be used to adjust the knowledge. And all the emotions [BLR92], action rules and mental states [Sho92] of the VP are defined in the designated role scripts, which can be changed as the environment changes.

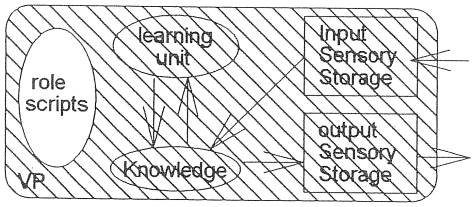


Figure 2. Virtual Person model

5. The example

An example is implemented in IBM compatible PC 486 and Microsoft Windows NT operating system, and the chosen language is Borland Delphi, for it is an visualized environment and is easy to generate graphical user interface.

The implementation includes three independent executable modules: Teaching Panel, Learning Panel, and the Virtual Person with two role scripts (Virtual Teacher and Virtual Student). Figure 3 shows the appearances of Virtual Student and Learning Panel. Let the user play a Real Teacher or a Real Student, then we can have four operating modes:

- **Real Teacher teaches Real Student**: uses only two Panels, connected with networking.
- **Virtual Teacher teaches Real Student**: real Teacher is absent and VP acts Virtual Teacher, as shown in Figure 4.
- **Real Teacher teaches Virtual Student**: only Virtual Student joins.
- **Virtual Teacher teaches Virtual Student**: they can teach and learn autonomously.

Between a VP and a Panel, several media, such as audio, text, and image can be exchanged by inter-process communication. Therefore, these VPs possess eyes, ears, and mouth to "see", "hear" and "talk".

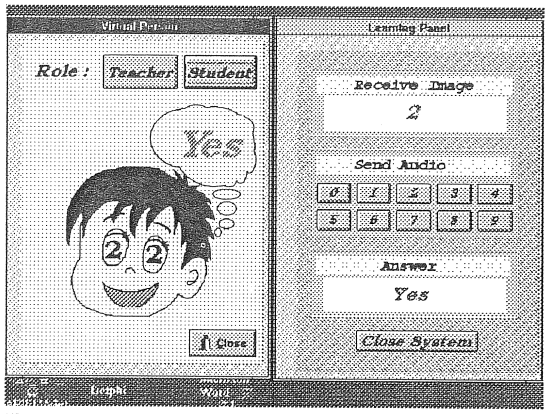


Fig.3. Virtual student and learning panel

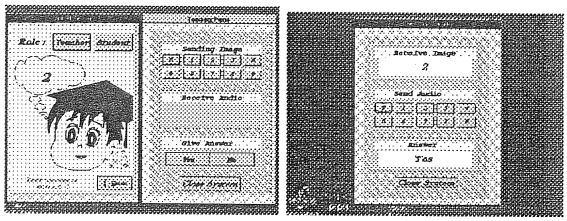


Fig 4.Virtual Teacher teaches Real Student

For each operating mode, there are two stages: training phase and testing phase. During training phase, the teacher trains student by delivering texts, images and audio to the student, and the student learns by using these media. The teacher can have some teaching rules, and adjusts his teaching strategies dynamically. During testing phase, the teacher sends an image (the question) to the student, and the student chooses an appropriate answer from his knowledge unit to answer (via audio) the teacher, then the teacher will judge the answer's correctness (in text form).

6. Conclusion

In this paper, the senses, the role-script and the learning function of VPs are particularly investigated. The proposed VP model is general enough to be applicable to almost all kind of virtual

environment, since the role script of VP and the panel can be changed accordingly. An example is implemented to prove this idea.

References

[LaO94] J.N.Latta," Conceptual Virtual Reality Model" , *IEEE CG&A*, Jan. 1994, pp.23-29

[Ell94] S.R.Ellis, "What Are Virtual Environments?", *IEEE CG&A*, Jan. 1994, pp.17-22

[Cha88] T-W.Chan, "Studying with the prince, The computer as a learning companion", ITS-88, Montreal, Jan. 1988, pp. 194-200

[DrF92] A.Drogoul, J.Ferber, "Multi-Agent Simulation as a Tool for Modeling Societies: Application to Social Differentiation in Ant Colonies", *Artificial Social Systems*, 1992, pp.3-23

[Rob86] S.P.Robbins,"Organization Behavior : Concepts, Controversies and Applications", 2ed, 1986

[Nor94] D.A.Norman , "How Might People interact with Agents" *CACM* , Vol.37, No.7 , July 1994, pp.68-71

[Gun95] C.N.Gunawardena, "Social Presence Theory and Implications for Interaction and Collaborative Learning in computer conferences" *The Fourth Intern.Conf. CAI,* March 1995, pp.S1.11--S1.21

[CHA95] C.Cole, L.Hirschmanb, L.Atlas, " The challenge of Spoken Language Systems : Research Directions for Nineties", *IEEE Trans. Speech and Audio Processing,* Vol.3, Jan. 1995. pp.1-20.

[Urz92] K.Urzelai, "MAKILA : A tool for the Development of cooperative societies", *Artificial Social Systems*, 1992, pp.311-323

[BLR92] J.Bate, A.B.Loyall & W.S.Reilly, "An Architecture for Action, Emotion, and Social Behavior", *Artificial Social Systems,* 1992, pp.55-68

[Sho92]Y.Shoham, "Multi-Agent research in the Knobotics Group", *Artificial Social Systems,* July 1992, pp. 271-278