A Study on a Cyber World for Language Acquisition and Sensory Information Transfer Control

Yuya KATAYAMA　　Minoru OKADA
Graduate School of Information, Production and Systems, Waseda University
7 Hibikino-2, Wakamatsu-ku, Kitakyushu 808-0135 Japan
u8ktym@suou.waseda.jp　　mokada@waseda.jp

ABSTRACT

In this paper sensory information transfer methods for sight, sound, and text chat are proposed. The authors have studied a foreign language acquisition system *Orbis* utilizing cyber worlds. For such a system, realistic communication, and the server CPU load and the network traffic become important issues. A concept of *communication space* to control sensory information in a cyber world is introduced and discussed.

Keywords
The Internet, Multi-user, VRML, Virtual Environment, Avatar, Cyber World

1 INTRODUCTION

The authors proposed a foreign language acquisition system *Orbis*[CBoudreau98]. It is intended to provide places and chances to communicate with native speakers in a shared cyber world on the web. Then it becomes important to construct the place in which users can experience realistic communication and unnecessary sensory information is eliminated. In this paper we propose a concept of *communication space* which controls sensory information in a virtual environment.

2 ORBIS ARCHITECTURES

In the Orbis, a client-server model synchronization of avatar information enables users to share a virtual environment. Autonomous characters, behaving as an avatar without the actual user, is recognized as a client at the Orbis server; implemented with the same protocol as an ordinary client. Prototype of autonomous characters only do autonomous walk and tiny conversation. The text chat function is implemented with a Java frame component (Figure 1), and synchronizes the chat messages with a client-server model.

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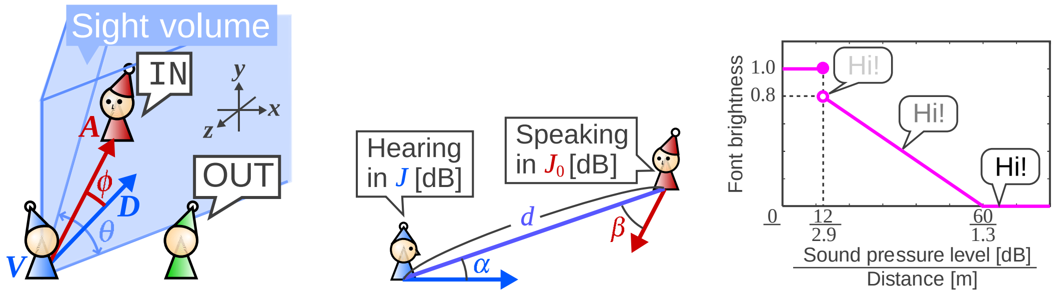
Figure 1: Main and chat frames

3 COMMUNICATION SPACE

3.1 Sight Communication Space

For the system many people logged in, the server CPU load dominated with the amount of dispatch processes becomes problematic. As a solution, there is a method that the server sends a scene by each divided region instead of avatar information[DMinoura98], however; the rendering reality decrease. Therefore, we propose a concept of a sight communication space which restricts the dispatching to the avatars in his sight. *E.g.* the case of Figure 2 (a), the client of the green avatar is not required to receive the blue avatar's information. We performed experiments to evaluate the availability of the sight communication space by measuring the dispatch ability of the Orbis server using autonomous characters keep updating themselves. In the experiments, the total client's update counts α_C and the server's dispatch counts α_S were measured. In Figure 3, $(n-1)\alpha_C$ and α_S are plotted with lines marked ■ and ●, respectively. The horizontal solid line indicates the bandwidth limit caused by the network. The measurement value missed from around $n = 10$, and saturated around 45,000 [times/sec]. So this means



(a) Sight (b) Sound (c) Text chat

Figure 2: Three types of communication spaces

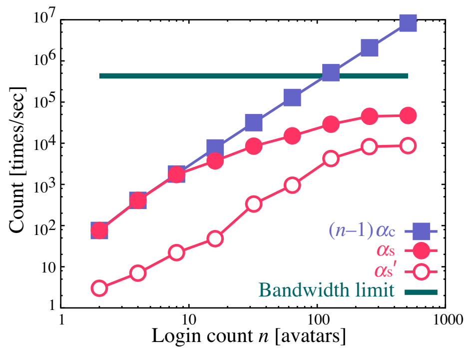


Figure 3: Dispatch ability of the server

the limit of CPU processing at the server. As the result with the sight communication space, the dispatch count α'_S, plotted with lines marked ◯ in Figure 3, was reduced to approximately 1/4 at least, and the CPU load was reduced to approximately 1/4, similarly.

3.2 Sound Communication Space

In a virtual environment, controlling the loudness of voice according to the distance d between a speaker and a listener can improve the immersion[HNakanishi99]. Referring the speaker's sound pressure level J_0[dB], the angles α, β and the distance d[m] are prepared as illustrated in Figure 2 (b). The sound communication space defines the sound pressure level J[dB] at the listener by the following function.

$$J = \frac{J_0 f(\alpha) g(\beta)}{d^2} \quad (1)$$

Where the functions of angles, $f(\alpha)$ and $g(\beta)$, are in a range $[0, 1]$, and cosine is actually used for them.

3.3 Text Chat Communication Space

Chatting with texts in a large virtual space, messages from avatars stay so far might be excess information; the text chat commutation space is used to eliminate the message from a position which cannot be seen by the sight communication space. Furthermore the font brightness of the message displayed at the chat window is changed by the same function described in 3.2. According to eq. (1), where J_0 is 100[dB], the font brightness B is determined by a function as shown in Figure 2 (c). If B becomes 1 the message is not displayed at the chat frame, because when $B > 0.8$, the font is almost invisible. In the case that a user wants to call to avatars at the place the message is not sent, the Loud function makes the message be dispatched to the all avatars in less than 10[m] distance without above conditions.

There are found some problems such as, (1) closeness of conversation range, (2) difficulty to know where avatars chatting up, and (3) difficulty to know whether sent message was reached. For (1), the transfer functions of sound and text chat communication are problematic. In eq. (1), cosine functions for $f(\alpha), g(\beta)$ and the denominator d^2 are needed to improve. For (2), a simple overhead view map can be helpful to communicate easily. Then for (3), an implementation of a new function to announce users whether an input message was sent might be required.

4 CONCLUSION

This paper has described a concept of communication space to improve the cyber world environment. The three-types communication space, sight, sound and text chat, corresponding to main sensory information of the Orbis, are introduced. One of the future works is to set and to improve the transfer function of sensory information for each communication space.

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