

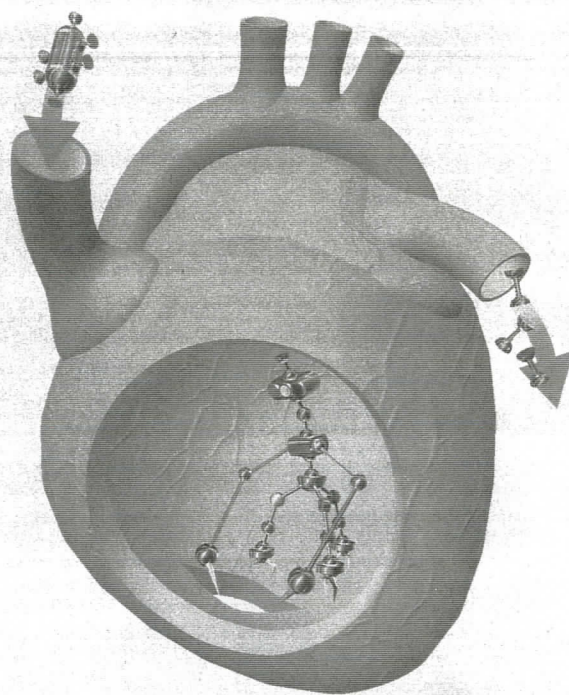


MHS2002

Proceedings of the 2002 International Symposium on Micromechatronics and Human Science

Nagoya Municipal Industrial Research Institute
October 20-23, 2002

- For the Technological Innovation
in the 21st Century -



Designed by Hitoshi Sakauchi

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Program at a Glance

October 20 (Sun.) International Micro Robot Maze Contest (Nagoya City Science Museum, Nagoya)

12:30	Opening Ceremony
12:50	Category 0 Teleoperated Micro Racer
13:40	Exhibition of Competiton
14:30	Category 1 Teleoperated Mountain Climbing Micro Robots
15:20	Category 2 Wireless Autonomous Mobile Robots
16:10	Exhibition
17:40	Award Ceremony & Closing

October 21 (Mon.) Technical Sessions and Invited Lecture

	Conference Room 1	Conference Room 2
9:30-11:30	Session MA-1 Microfabrication	Session MA-2 Microrobots
11:40-12:10	Explanation of Exhibition	
12:10-13:10	Lunch	
13:10-14:30	Session MP1-1 Microassembly and Microfactory	Session MP1-2 Human Machine Interface
14:30-14:50	Coffee Break	
14:50-16:10	Session MP2-1 Microfabrication and Micro Fluidic Systems	Session MP2-2 Microcomponents and Microdevices
16:10-16:20	Coffee Break	
16:20-17:10	Invited Lecture Integrated Micro Chemical Systems and Life Science <i>Takehiko Kitamori, The University of Tokyo, Japan</i>	
17:20-19:00	Reception Party	

October 22 (Tue.) Technical Sessions, Opening Remarks, Keynote and Plenary Lectures

	Conference Room 1	Conference Room 2
9:30-11:30	Session TA-1 New Materials and Measurement	Session TA-2 System and Control
11:50-13:00	Lunch	
13:00-13:20	Opening Remarks	
13:20-14:05	Keynote Lecture Preparation of Carbon Microcoils/nanocoils and Ceramic Microcoils, and their Properties <i>Seiji Motojima, Gifu University, Japan</i>	
14:05-14:50	Plenary Lectures Design and Fabrication of Silicon Micro Components <i>Stephanus Büettgenbach, Technical University of Braunschweig, Germany</i>	
14:50-15:35	New Food Culture with Digitized Taste <i>Kiyoshi Toko, Kyushu University, Japan</i>	
15:35-15:45	Coffee Break	
15:45-16:30	Plenary Lectures Future of Ceramics <i>Masanao Ôno, NGK INSULATORS, LTD., Japan</i>	
16:30-17:15	Vision-based Face Understanding Technologies and Applications <i>Masato Kawade, Omron Corporation, Japan</i>	
17:20-18:30	Beer Party	

October 23 (Wed.) Laboratory Tour

10:00-	Laboratory Tour Nagoya University
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Table of Contents

Welcome Remarks	i
Symposium Organization	iii
Program at a Glance	iv

Keynote and Plenary Lectures

Preparation of Carbon Microcoils/nanocoils and Ceramic Microcoils, and their Properties.....	1
<i>Prof. Seiji Motojima, Gifu University, Japan</i>	
Design and Fabrication of Silicon Micro Components	9
<i>Prof. Stephanus Büttgenbach, Technical University of Braunschweig, Germany</i>	
New Food Culture with Digitized Taste	17
<i>Prof. Kiyoshi Toko, Kyushu University, Japan</i>	
Future of Ceramics	25
<i>Mr. Masanao Ôno, NGK INSULATORS, LTD., Japan</i>	
Vision-based Face Understanding Technologies and Applications	27
<i>Mr. Masato Kawade, Omron Corporation, Japan</i>	

Invited Lecture

Integrated Micro Chemical Systems and Life Science.....	33
<i>Prof. Takehiko Kitamori, The University of Tokyo, Japan</i>	

Session MA-1: Microfabrication

Simulator for Observing the Si Anisotropic Chemical Etching Process in Atomic Scale	35
<i>T. Kakinaga, N. Baba, O. Tabata and Y. Isono, Ritsumeikan University, Japan, K. Ehrmann and J. G. Korvink</i>	
Rapid Production of an in Vitro Anatomical Model of Human Cerebral Arteries Based on CT Images	41
<i>F. Arai, T. Fukuda, and S. Ikeda, Nagoya University, Japan, M. Negoro and I. Takahashi</i>	
Techniques for Reduction in Surface Roughness and Aperture Size Effect for XeF ₂ Etching of Si.....	47
<i>K. Sugano and O. Tabata, Ritsumeikan University, Japan</i>	
Fabrication of TiNi Shape Memory Alloy Micro-structures and Ceramic Micro-mold by LIGA-MA-SPS Process	53
<i>N. Miyano, H. Iwasa, M. Matsumoto, F. Kato, K. Ameyama and S. Sugiyama, Ritsumeikan University, Japan</i>	
Die Making of Ultra-fine Piercing by Electric Discharge Machining	61
<i>T. Mori, K. Hirota, S. Kurimoto and Y. Nakano, Nagoya University, Japan</i>	
Micromachined Active Tactile Sensor for Detecting Contact Force and Hardness of an Object.....	67
<i>T. Shimizu, M. Shikida, K. Sato and T. Hasegawa, Nagoya University, Japan, K. Itoigawa</i>	

Session MA-2: Microrobots

The Prototype of a Piezoelectric Medical Microrobot.....	73
<i>G. Yan, Q. Lu, G. Ding and D. Yan, Shanghai Jiaotong University, China</i>	
A Novel Biomimetic Hexapod Micro-robot	79
<i>G. Yan and Y. Dai, Shanghai Jiaotong University, China</i>	
A Ciliary Motion Based 8-legged Walking Micro Robot Usig Cast IPMC Actuators	85
<i>J. Ryu, Y. Jeong, Y. Tak, B. Kim and B. Kim, Korea Institute of Science and Technology, Korea, J.-O. Park</i>	
A Fin Type of Microrobot in Pipe.....	93
<i>S. Guo and Y. Sasaki, Kagawa University, Japan, T. Fukuda</i>	
Positioning of a Miniature Robot Using Position Sensitive Detectors	99
<i>Y. Kawane, A. Torii, K. Doki and A. Ueda, Aichi Institute of Technology, Japan</i>	

Session MP1-1: Microassembly and Microfactory

Force Measurement with Pico-Newton Order Resolution Using a Carbon Nanotube Probe.....	105
<i>F. Arai, M. Nakajima, L. Dong and T. Fukuda, Nagoya University, Japan</i>	
Wire-in-hole Operation Using a Magnetic Suspension Parallel Motion Hand	111
<i>S. Ohno, Z. Liu and T. Nakamura, Tokyo Metropolitan University, Japan</i>	
Process Observation for the Assembly of Hybrid Micro Systems.....	117
<i>T. Pfeifer and G. Dussler, Aachen University of Technology, Germany</i>	
Development of Low-cost Microequipment.....	125
<i>E. Kussul, T. Baidyk, L. Ruiz, A. Caballero and G. Velasco, National Autonomous University of Mexico, Mexico</i>	

Session MP1-2: Human Machine Interface

Interactive Comedy: Laughter as the Next Intelligence System	135
<i>N. Tosa and R. Nakatsu Massachusetts Institute of Technology, USA</i>	
Toward Rich Facial Expression by Face Robot.....	139
<i>H. Kobayashi, Y. Ichikawa, M. Senda and T. Shiiba, Science University of Tokyo, Japan</i>	
Characteristics of an Active Type Surface Acoustic Wave Tactile Display.....	147
<i>M. Takasaki and T. Mizuno, Saitama University, Japan, T. Nara</i>	
Optimal Configuration of Micro Touch Sensor Array Structure.....	153
<i>L. Du, G. Kwon, F. Arai and T. Fukuda, Nagoya University, Japan, K. Itoigawa and Y. Tukahara</i>	

Session MP2-1: Microfabrication and Micro Fluidic Systems

Algorithm for Analyzing Optimal Mask Movement Pattern in Moving Mask Deep X-ray Lithography	159
<i>N. Matsuzuka and O. Tabata, Ritsumeikan University, Japan</i>	
Non-contact Acoustic Filtering of Particles by a Standing Wave Field	165
<i>T. Kozuka, National Institute of Advanced Industrial Science and Technology (AIST), Japan</i>	
Novel Interconnection for Micro Fluidic Devices	169
<i>T. Hasegawa and K. Ikuta, Nagoya University, Japan</i>	
Isolation and Extraction of Target Microbes for Bio-microlaboratory	175
<i>F. Arai, A. Ichikawa, T. Sakami, H. Maruyama and T. Fukuda, Nagoya University, Japan</i>	

Session MP2-2: Microcomponents and Microdevices

Integrated Sensors for PZT Actuators Based on Thick-film Resistors	181
<i>A. Bergander, T. Maeder, B. Valencia, J.-M. Breguet and P. Ryser, Swiss Federal Institute of Technology Lausanne(EPFL), Switzerland</i>	
A Multi-axis Force-moment Micro Sensor for Application in Fluid Mechanics	187
<i>D.V. Dao, A.T. Nguyen, C.V. Nguyen, J. C. Wells and S. Sugiyama, Ritsumeikan University, Japan, T. Toriyama</i>	
Development of Robust Variable Structure Controller Based on Sliding Mode for Large Scale Energy Systems	191
<i>M.S.A. Moteleb and M.A.A. Moursy, Electronics Research Institute, Egypt</i>	
Large Displacement Control System beyond Pull-in Limitation in Electro-static Micro Cantilever	197
<i>Y. Tanaka, Y. Hirai, N. Kimura, T. Jin, and M. Kabuto, Osaka Prefecture University, Japan</i>	

Session TA-1: New Materials and Measurement

Design and Synthesis of New-type Ultra-fine Magnetic Fluid and its Evaluation of Material Property	203
<i>K. Yagi, Tokyo Metropolitan University of Health Sciences, Japan, S. Yoshida and M. Tokuda</i>	
Super-lubricity of C ₆₀ Monolayer Films	207
<i>S. Okita, and A. Matsumuro, Nagoya University, Japan, K. Miura</i>	
A Testing Mechanism and Testing Procedure for Materials in Inertial Drives	213
<i>A. Bergander and J.-M. Breguet, Swiss Federal Institute of Technology Lausanne(EPFL), Switzerland</i>	
A New Micro Jerk Sensor with Viscous Coupling	219
<i>M. Fujiyoshi and Y. Nonomura, Toyota Central R&D Labs., Inc., Japan, F. Arai and T. Fukuda</i>	

100nm Square Single Crystal Silicon Shear Strain Gauge	223
<i>T. Toriyama, New Energy and Industrial Technology Development Organization, Japan, S. Sugiyama</i>	

Session TA-2: System and Control

Computational Intelligence in Autonomous Mobile Robotics - A Review	227
<i>L. Wang, National University of Singapore, Singapore</i>	
A New Approach to Exploiting Parallelism in Ant Colony Optimization	237
<i>D. A. L. Piriakumar and P. Levi, University of Stuttgart, Germany</i>	
Walking Gait Stability in Young and Elderly People and Improvement of Walking Stability Using Optimal Cadence.....	245
<i>M. Arif, Y. Ohtaki, T. Ishihara and H. Inooka, Tohoku University, Japan</i>	
Analysis of the Effect of Fatigue on the Walking Gait Stability	253
<i>M. Arif, Y. Ohtaki, R. Nagatomi, T. Ishihara and H. Inooka, Tohoku University, Japan</i>	
Perception Driven Robotic Assembly Based on Ecological Approach.....	259
<i>K. Tagawa, K. Konishi, D. Ito, and H. Haneda, Kobe University, Japan</i>	
A Novel Electro-thermally Driven Bi-directional Microactuator	267
<i>K.-M. Liao, C.-C. Chueh and R. Chen, National Tsing Hua University, Taiwan</i>	

International Micro Robot Maze Contest

Authors Index

Interactive Comedy: Laughter as the Next Intelligence System

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Abstract

Generally, technology looks at the external value of an object. At a very deep level, however, laughter comes from the touch of living decidedly an internal value. It is very difficult to fully comprehend this deep relationship. Our personal feeling is the key to grasping the phenomenon of laughter, which is not an issue of analysis or understanding but one of the mind's spontaneity, such as the emergence of an idea or a burst of imagination. Laughter is an intelligence that emerges through sympathetic communications and, therefore, has great power.

Recently, artificial intelligence research has focused too much on analysis and knowledge and, consequently, risks being capable of achieving only boring results. Genuine intelligence is not boring, so the intelligence we develop should not be boring. To meet this challenge, I have developed a comedy system that enables humans and computers to interact and create laughter.

Key Words:

Emotional Intelligence, Computing for information of Culture database, creative Intelligence Communication system

1. Introduction

Laughter is an essential element of verbal conversation, and we transmit information by verbal conversation. At the same time, verbal conversation transmits our emotions and basic desires [1]. Therefore, verbal conversation is the basis for maintaining human relations and a social life. In this type of conversation, such factors as voice tone, timing, and speed play very important roles [2]. By controlling them, we enjoy our conversations, sustain human relations, and energize our social life [3].

2. Laughter as Emotional Intelligence

Laughter has a great power and an important impact on our body. Laughter constantly moves back and forth, up and down, inside and outside of our world. It can elevate our minds and banish deceptive gloss.

Laughter that comes from the deepest crevice of our mind can break the wall of our anxiety and loneliness. Its effect can match that of tears. Our laughter can also make a strong impact on the minds of those around us.

3. Comedy as good communication

Communications has the power to entertain, and this power of communications has a strong appeal to us. Therefore, an artfully conducted conversation entertains us. In the entertainment discipline of comical dialogues, conversation has been refined to a level of sophisticated entertainment. In Japan, we have our own form of comical dialogue called Manzai. We enjoy Manzai by listening to the dialogue of two Manzai comedians. The two comedians play the role of Boke and Tsukkomi. Boke plays the role of an ordinary person who expresses his/her everyday opinions. Sometimes these opinions are superficial and boring, far from nuanced reality. Tsukkomi plays the role of a sensitive person who is keen to detect these opinions and becomes offensive to Boke. Boke usually shrinks from the opinions of Tsukkomi but sometimes awakens to reality. For the conversation between Boke and Tsukkomi, such factors as voice tone, timing, and speech are as critical as the conversation's content. When these factors are skillfully controlled, the audience is fascinated and becomes involved in the conversation. They want to become Manzai comedians themselves.



Figure 1. Japanese Comedy: Manzai

4. An Interactive Comedy System

An interactive comedy system is designed to realize the passive audience member's dream of becoming a Manzai artist. You play the role of defence and the computer plays the role of offence. When you speak, the computer analyses the content, emotion, speed and timing of your utterance and utters back an appropriate offensive phrase. Then you speak back. By interacting with this system, you feel the joy of conversation itself. At the same time, you subconsciously learn how to effectively control timing, utterance speed, and emotional expression.

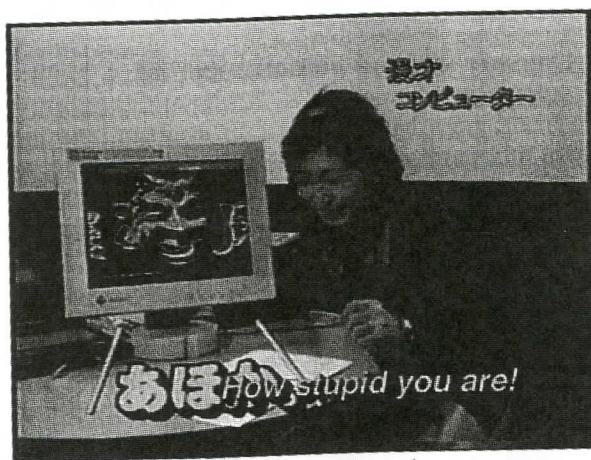


Figure 2. Interactive Comedy system

5. Emotion model of Computer Comedian

The Computer Comedian can recognize eight emotions from the intonation in the voice and respond to these emotions. For example, unless someone speaks, the Computer Comedian sleeps; when someone speaks, the Computer Comedian responds with 'What's shakin?' when in a good mood or 'Oh, I'm sorry, were you talking to me?' when in a bad mood. When made fun of in a low voice or when teased, the Computer Comedian becomes angry. When someone whistles, it becomes excited and jumps, and when a person makes an unflattering face and coughs, it becomes sad, covers its face with its hands, and looks backward. Occasionally, it complains to a person that shows disgust. The emotions model of Computer Comedian is shown in the 2D coordinates in Fig. 3. The X axis represents goodness/badness and the Y axis represents the strength of the emotion.

The eight concrete emotions and the characteristics (denoted by *) of the input speech corresponding to them are as follows.

- (1) Joy (happiness, satisfaction, easy comfort, smile)
*High and strong voice, whistling, etc.
- (2) Anger (anger, bad mood)
*Scolding in a low and strong voice.
- (3) Surprise (wonderment, shock, surprise)
*Scolding in a sudden and loud voice.
- (4) Sadness (pity, tears, loneliness)

*Low and weak voice, coughs, etc.

(5) Disgust --- * Tired voice with disgust.

(6) Teasing --- * Teasing in a high and light voice.

(7) Fear --- * Fearful voice with a flat and low voice.

(8) Neutral --- * Natural voice.

An example from the Database for Interactive Comedy is shown below.

People = (P) Computer = (C)

(P) Well, the nice weather is finally here.

(C) It's about time.

(P) I can't wait to get to the beach.

(C) Are you crazy, the water here is freezing.

(P) It's pretty amazing speaking with a Manzai Computer.

(C) Stop sucking up!

(P) If that's the way you're going to be, then maybe I should leave.

(C) Chill out.

(P) I'm glad you found time to join us today despite your busy schedule.

(C) You make me feel so good.

(P) Maybe you are not that busy, seeing as you made it here today.

(C) What is that suppose to mean?

(P) Can you guess how many years we have been carrying out this research? 300 years!

(C) You lie like a dog.

Emotion recognition is carried out using human voice intonation information and an artificial neural network [4].

An example of emotional dialogue is shown below.

<Excited>

Awesome!

Ooh, you're giving me goose bumps!

<Neutral>

Oh, I'm sorry, were you talking to me?

Tell me more.

<Anger>

Keep your pants on.

Bite me.

<Disgust>

Take it easy there, cowboy.

I know your lips are moving, but all I hear is blah blah, blah.

<Teasing>

Talk to the hand.

Are you trying to seduce me?

<Sadness>

Don't make me cry.

Maybe you're right. Maybe I should just go.

<Surprise>

I think you're lying to me

<Greeting>

What's shakin'?

<Fear>

You're scarin' me now

Don't go psycho on me.

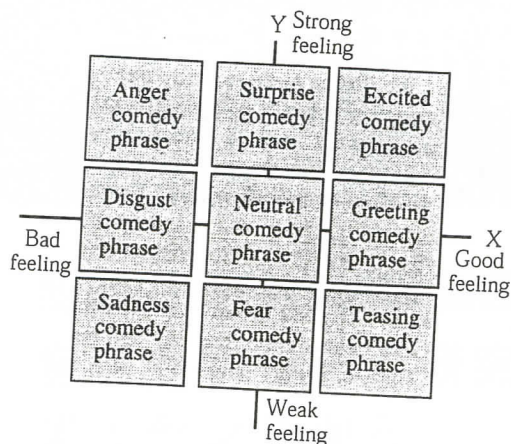


Figure 3. Comedy emotion model

6. How does it work?

6.1 Components of the system's architecture

The system consists of three parts. In the content analysis part, the meaning of the input speech is recognized using speech recognition technology. In the emotion analysis part, the tone of the input speech is analyzed.[5] The speed and the timing of the input speech are also analyzed. By combining these two results, the level of user involvement, in other words how deeply a user is involved in the conversation, is decided. In the character synthesis part, using the content analysis and the involvement analysis results, the speech output and the facial animation of the comedy character is generated. Accordingly, the user enjoys a laugh-filled conversation with the system

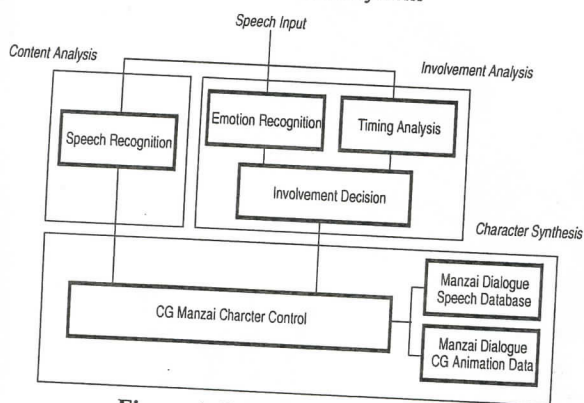


Figure 4. System Configuration

6.2 Processing

Emotion Recognition[4]

- 1) User voice input is first made by microphone. Then speech processing is used to achieve spectrum, pitch and tone.
- 2) Emotion recognition result is generated from the learned neural network by a human emotional voice. Emotion recognition result output is transformed to a two-dimension coordinate and then sent to the script manager. Next, the system carries out adaptation to the voice of a new user by shifting the point in the 2D emotion plane

corresponding to the recognition of the neutral voice to (0, 0).

Voice recognition

The user's voice is detected from microphone analysis by the voice recognition system. If the system recognizes a comedy-registered dictionary designed for the voice recognition system, it sends a relevant comical reply to the script manager.

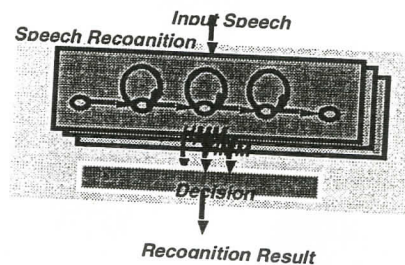


Figure 5. Speech analysis diagram

Script Manager

The script manager selects a facial expression from the computer graphics data and outputs voice data from the result of emotion recognition and voice recognition. The system carries out emotion recognition and speech recognition simultaneously. If the speech recognition result is rejected because it does not have a high enough recognition score, the system uses the emotion recognition result.

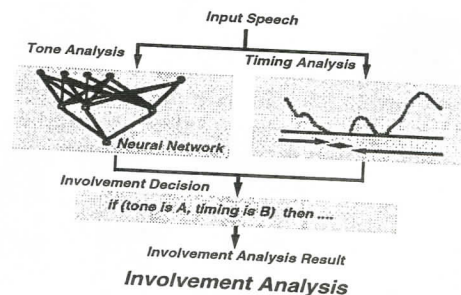


Figure 6. Involvement analysis diagram

Real-time Computer Graphics generation [6]

The Computer Graphics Character displays facial animation from the data sent from the script manager. At the same time, the system makes the output sound of narration.

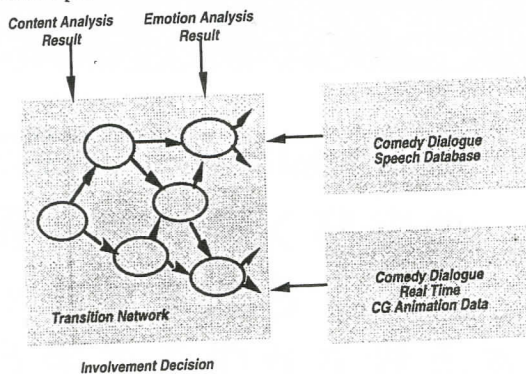
The system making the emotional expression depends on several types of emotion data represented by facial expressions and comical emotions.

Output comedian phrase

The script manager finally decides whether the speech recognition result or the emotion recognition result should be used by the system.

- 1) If the result of speech recognition is adopted, the corresponding output phrase is selected from the database and sent to the user both as a response voice and as a character sequence on the display.

2) If the emotion recognition result is adopted by the system, wave file data stored according to each point of the 2D emotional plane are selected and sent to the user. Multiple wave file data can be stored on the same emotion plane.



Character Synthesis

Figure 7. Real-time based Computer Graphics Character Synthesis

7. Conclusions

This system was demonstrated and broadcast on Most Interesting News Digest of 2001, the special New Year's Eve program of Asahi TV. We received the Grand Prize in the Future Robot category. This system is simple, but the technology introduced here to make people laugh has a strong emotional resonance that can spread worldwide. Laughter opens the mind and stimulates real communication among us. Computers can actually make us laugh, and this is very intelligent interaction. However, when people are too self-conscious in trying to have fun, communications do not go smoothly and become difficult. This means that laughter is related to the nonverbal and subconscious aspect of our intelligence. If this type of technology were introduced into a computer system or robot in the future, the tendencies toward hospitality and caring for others would become more important in our society. Also, a comedy script is a very important tool to make us laugh. Furthermore, laughter is strongly dependent on local culture, and in each country the meaning of laughter is very different. For the Japanese version of Interactive Manzai, the script was developed by the Yoshimoto Entertainment Company in Japan. Then when I showed Interactive Comedy in Boston, Improv Asylum, which is one of the best comedy groups in the city, translated the dialogs into an American style. This spring, we performed the English version of Interactive Comedy System at the Japan Pop Culture Festival, one of the events of the Haru Fest in Boston, at the MIT Media Labs Bartos Theater. This performance was organized by the Consulate General of Japan in Boston.

In evaluating the system's effect, we must bear in mind that comedy is very different depending on the area and culture. A comedy system also has to contend with the

same features of user reaction as does a conventional comedian. In the Osaka area, where people use daily conversation for comedy, there was great excitement about our interactive comedy system. On the other hand, Tokyo people reacted with a sneer when viewing interactive comedy. However, when people start the interaction, good communication starts flowing because people are laughing. In Boston, I first showed the system by directly translating from Japanese to English and, not surprisingly, the Americans did not laugh. When the Boston comedy group translated the material into a more American style of comedy and performed it at the MIT Theatre, people laughed at each interaction of the Interactive Comedy System. Consequently, we also performed cultural computing.

8. Acknowledgements

The authors express their thanks to the contributions of the legendary Japanese entertainment company Yoshimoto Kogyo Co., Ltd and Boston's comedy group Improv Asylum, for creating the comedy script for us. We also thank the Consulate General of Japan in Boston for their arranging the exhibition of this system.

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