ZENeticComputer

Seigo Matsuoka, Naoko Tosa

Music by

Toshinori Kondo

MIT Museum Main Gallery "Thinkapalooza"

Oct. 24 - Nov. 13, 2003

Opening : Oct. 24 6pm- 8pm

N52-200, 265 Massachusetts Avenue

Cambridge, MA 02139

Open Tues.-Fri. 10 - 5pm

Sat. & Sun. 12 - 5pm

Closed Mondays and holidays

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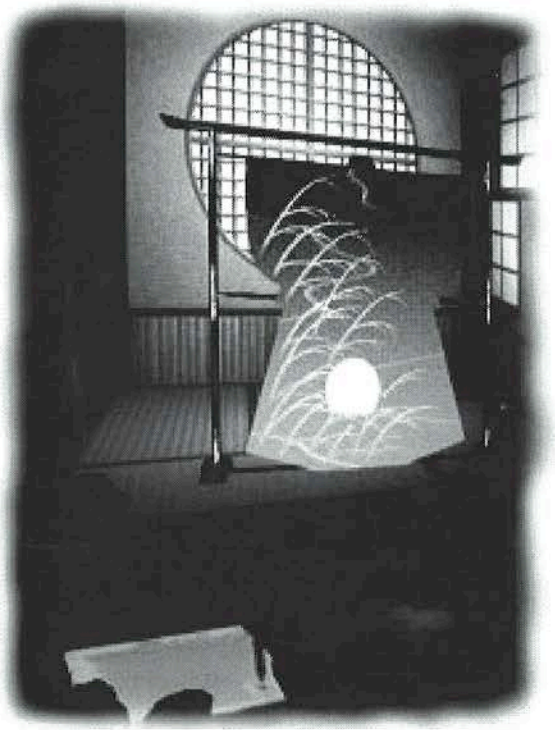
Greeting

Last year, Naoko Tosa approached me about the possibility of our installing her work in the MIT Museum's Compton Gallery. After seeing her work, all of which demonstrates human/computer interaction and sociability, I felt that it would make more sense to highlight her work in one of the Museum's main gallery spaces. In this location, there was a logical connection to the work presented in our "Beyond Robots: Artificial Intelligence @ MIT" gallery. It seemed to fit in naturally with the spirit of Kismet, the first sociable robot, and James McLurkin's ants.

Naoko's work is yet another example of the art/technology connection so prevalent at MIT. In particular, much of this work has occurred in MIT's Center for Advanced Visual Studies, where Naoko is a research fellow. In ZENetic Computer, visitors manipulate traditional images through a computer interface. Throughout the program, the voice of a Zen master interacts with the visitor, raising questions, probing for answers, pushing for introspection.

I hope you will enjoy the ZENetic Computer experience.

Beryl Rosenthal
MIT Museum Director, Exhibitions Public Programs



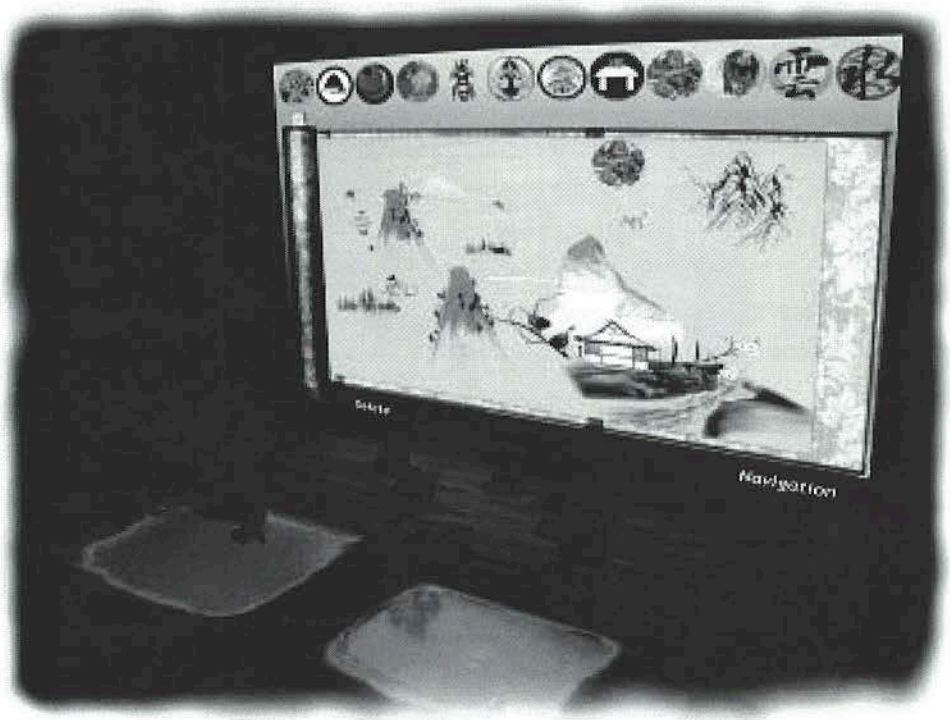
What is ZENetic Computer?

ZENetic Computer is an interactive experience that evokes "self-awakening," a particular cognitive response to processing reality via subliminal consciousness.

It uses stories portrayed in sumi-e (ink painting), haiku and kimono which display features of Eastern philosophy, and Zen in particular. Museum visitors create their own sumi-e and stories on a large rice paper screen, while learning about Zen, Japanese art, and themselves.

The artist guides visitors toward an altered mindstate. It is the collaborative work of Prof. Seigo Matsuoka, director of Editorial Engineering Labs in Tokyo, and Naoko Tosa, research fellow at the Center for Advanced Visual Studies at MIT. The music is by Toshinori Kondo, an improvisational Jazz trumpeter.

ZENetic Computer will travel to Kyoto Culture Museum (JAPAN) Nov. 11 - 30, 2003, and KODAIJI - ZEN Temple (Kyoto, Japan) May. 6 - 31, 2004 and around the world.



I Wanted to Have a Computer do *Zazen*:
Training a machine in the way of Zen

There is no "hesitation" in a computer. The scheduled communications proceed as if the machine knows exactly what it is doing. However, human consciousness, language and judgment are qualities that always hesitate. They are constantly wavering.

Buddhism and Daoism hover at the base of Eastern philosophy and Japanese culture, where the rhythm of a haiku and the design of a kimono flutter freely. Within that setting, ideas indeterminate or ambiguous are not destroyed, but preserved – they bide their time on the bench until a more resonant feeling emerges. When this resolution is finally reached, they rise from the bench and rush to the playing field.

With the ZENetic Computer, I focused on the "hesitation" lurking within human consciousness and unconsciousness, as the Zen ascetic explores the Zen Dialogues led by a Zen master. We projected this Eastern, Japanese sensibility onto a computer screen and built an interface so that the users could enter the world of a Japanese *Sansui* ink painting.

Regarding the development of this project, I provided scenographic images of Eastern philosophy, and Dr. Naoko Tosa, having an exceptional artistic sense, transformed these images into interactive technology. We then reviewed the results together many times. We strived especially for the outflow of "subtractive" aesthetic sense and the formulation of a margin of judgment that skirts the threshold of consciousness. Also, in order to make this variable process more dynamic, we included in our system the successes of Dr. Peter Davis' chaos engine research.

Clouds of consciousness and rivers of a narrative never before experienced are flowing through the ZENetic Computer. This is an endeavor wherein we have tried to train a machine in the way of Zen. Please abandon all former ways of thinking and enjoy playing with this experiment.

Prof. Seigo Matsuoka
Director, Editorial Engineering Laboratory
Professor, Tezukayama University

The Secret of ZENetics: An Interactive Scenographic Cinema

My major motivation to produce this work was the exhibition of Sesshu's work held in Kyoto in 2001. Although I had never been affected by Japanese paintings before, I was moved deeply then as if something flashed in my heart. I was very surprised. I found myself traveling through this Sansui world that Sesshu painted, and I had a hard time returning to reality.

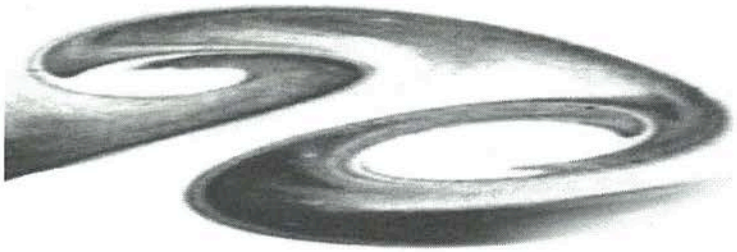
When I spoke of this to the great philosopher of information culture, Prof. Seigo Matsuoka, with whom I had promised to do a collaborative research project, he said that he was actually writing a book entitled *Sansui Thought*. Thinking that this might be a "Zen occasion," we decided to work together on this project. We thought for the user to travel from a *Sansui* painting into the world of Zen, find their personal kimono, and then experience the Ten Bulls Story for the finale. At first, we had a series of difficult problems with the implementation of the system, but my mood alone was flying high, motivated yet by something invisible. My collaborator Prof. Matsuoka seemed to see this "invisible something" as well, as he gave me earnest encouragement and suggestions in spite of my showing a string of failures - he is truly a wise and broad-thinking man. As long as I can remember, both Art and Technology, like Jekyll and Hyde, have coexisted within me. It is my job to control these aspects like the bulls in the Ten Bulls Story, leading them through conflict and inspiration until they become one. In order to complete the system, we used technology methods for the interaction analysis and recognition, and artistic methods for the integration. As a new experiment this time, we built the interaction model by incorporating Buddhist thought such as *Goun* (the five personalities) and *Godai* (the five elements) into the recognition methods, as per Prof. Matsuoka's suggestion.

Now, we have reached the final stages, and another significant "occasion" has appeared. I have gotten to know the jazz improvisation trumpeter Toshinori Kondo, of whom I have been a fan since my college years, and it has worked out for him to produce the music for the project. He is an incredibly cool guy, having once brought the Dalai Lama to Japan for a concert. More recently, he has produced a mix of Japanese *Kouta* traditional song and techno-jazz in an album entitled "Yoshiwara," which also is used in the ZENetic Computer. With the singing of his sublime trumpet, he has turned ZENetics cinema into an ever cooler and truly unique work. I would like to thank him from the bottom of my heart.

Interaction is not just between people and machines. I always try thinking about it as human communication. In that case, there always emerge communications that cannot be explained by logic alone. The Zen Dialogues fall into this category. I have an interest in what kind of hints people use so that illogical communication holds firm. For instance, a wise person may fail in love for lacking common knowledge, or people from different countries may communicate emotionally in spite of a language barrier. If you model these phenomena and replace the human-human communication with human-computer communication, I find it interesting how the way in which people try to communicate may be mirrored in the computer.

For this project, we used the Zen Dialogues, Haiku and Waka and researched the original narrative techniques of movie directors and novelists to figure out how a computer could read a person's feelings and respond expressively. In the future, I hope to modularize this system into an input device, context generator, and output device with the goal of realizing an authoring system for narratives generated from unconscious data.

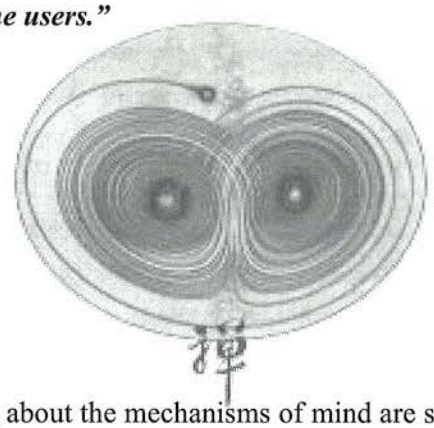
Naoko Tosa, Ph.D. Research Fellow
Center for Advanced Viual Studies
Massachusetts Institute of Technology



Chaos and Consciousness :

Notes on the Design of the Chaos Engine for the ZENetic computer

"Science says that human consciousness may have a chaotic nature. By incorporating chaotic mechanisms, we aim to create an interaction which is not only rich and dynamic, but also reflects key processes in the consciousness of the users."



Our scientific understanding about the mechanisms of mind are still very limited. We do not know how to describe a "thought" or a "feeling" or a "concept". However, we do know that when the laws of modern physics are applied to the activity of neural cells, they predict that our brains can have chaotic dynamics. That means that the activity of a brain has aspects in common with more familiar and tangible forms of physical chaos, including the eternal whirl of planets, the turbulent dances of wind and water, and the explosive growth of organic systems.

We go further and express a view that chaotic mechanisms are indeed essential mechanisms supporting all the significant spontaneous behaviors of our bodies and minds. According to this view, each thought process is the manifestation of a complex cascade of micro dynamics, involving a multitude of dynamical components of thought and feeling, pushing and pulling, in a self-reflecting interface between our physical bodies and the external world.

Our chaos engine is designed to capture key aspects of this view. The chaos engine consists of multiple dynamical components, mimicking the multiple components of our selves. There are two naturally opposing tendencies for these selves, to merge together and be one, or to diverge and act differently. We can describe these merging and diverging processes in terms of resonances or "chaotic synchronization" - resonances similar to the musical resonances between pure harmonic tones, but much more rich and subtle. Sometimes the multiple components are tame slaves to the push and pull of our external world. Other times they lock to each other in a united but fiercely independent motion. Yet other times, they all do their own wild spontaneous dance, bursting and syncing in wild creative transients, each action feeding back on itself in an endless mirror world where no one is master for more than a moment.

When it is in its most tame state, our chaos engine can act just as a conventional control interface. However, its capacity for other types of behavior provide a mechanism for more exciting, provocative and creative interactions. Is it "imagination," "free-will," "frustrated," "confused" - or just "out-of-control?" Please try it and see.

Peter Davis, Ph. D.
Senior researcher
ATR Adaptive Communication Research Laboratories

Can You Really Play With Him?

A Zen master is often teasing and sarcastic. Just as a Judo master can easily twist his student's arms, a Zen master looks most jubilant when he playfully guides his disciple to a maze of unconventional thinking in which all the logic and assumptions are of no use.

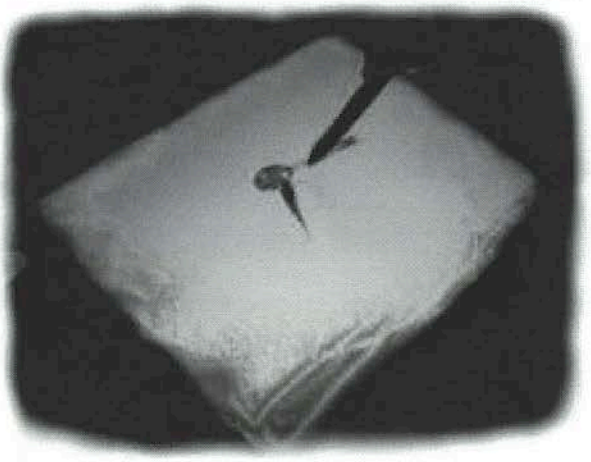
A Judo master keeps throwing his student on the *tatami* mat, until the student can stand firmly with his own feet. A Zen master never stops teasing, until his disciple finally learns to think with his own mind and body.

Zenetic Computer knows all the tactics that a Zen master uses for his disciple. It reads the user's mind and lets him think hard - not in a regular manner, but more intuitively and creatively.

Yes, Zenetic Computer is a big catfish, which you have to grab with your own hands. He is funny and spontaneous. When you think you poked him, you have been poked. When you think you hit him, you have been hit.

Unless you are equipped with a good sense of both humor and esthetics, you can never play with this slippery catfish. Jump into the river and grab it. Are you ready for catfish *sashimi*?

Soho Machida, Ph.D.
Buddhist Priest
Professor, Tokyo University of Foreign Studies



Eastern Culture meets Western Technology

ZENetic Computer is an ambitious project that crosses boundaries and complicates simple binary divisions such as those between "East" and "West"or modern and pre-modern, as well as between science and religion or science and art. The designers have mobilized cutting edge computer technology to offer participants a chance to engage and understand—through experience-- Buddhist principles of "re-creation" of the self. This is not just a matter of delivering content consisting of an "Eastern" essence or ancient culture by means of "Western" or modern technology. The content itself, which includes elements such as jazz improvisation performed by a New York-based, Japanese musician, is a modern hybrid. This project is an intriguing advance in creating interactive computer systems dealing with complex matters of human consciousness.

Andrew Gordon, Ph.D.
Director, Edwin O. Reischauer Institute of Japanese Studies
Lee and Juliet Folger Fund Professor of History, Harvard University

拈華微笑

Philosophy of ZENetic Computer

The user creates a virtual world by manipulating 3D images of Asian *sansui* ink painting on a computer display with an intuitive and enjoyable interface tool. These images, which typically symbolize nature and philosophical precepts, provide a dramatic departure from our view of daily experience. This awakens us from our daily consciousness and gives free reign to subconscious imagination[2]. Based on the user's *sansui* design, the system infers his or her internal consciousness and generates a story that the user can 'enter' via the computer display. This story further shakes the user's consciousness. This is not a complete story, such as those in the movies or novels, but fragments of short stories. Experiencing these episodic stories makes users feel uneasy and arouses their subconscious desire to construct a whole story by linking the fragments. In each of these inchoate stories, the system stimulates interaction through Zen dialogue or haiku as a form of allegorical communication. The user is asked questions that do not have "correct" answers. He or she is forced to deal with these ambiguous provocations while subconsciously struggling to answer the questions.

This subconscious effort inspires the user to find ways of linking the stories into an original whole. The user responds to objects presented by the interactive system, whether a graphic image or a provocative statement, by manipulating input media, such as a virtual calligraphy brush or rake of a Zen rock garden, on-screen images, or simply clapping hands. Coupled with the subconscious effort exerted to link the fragmentary stories, these user interactions decrease the gap between daily self and hidden self. This process of bringing our selves to gether is called MA-Interaction; *ma* is a Japanese concept tha stresses the ephemeral quality of experience. In the final phase the user has a dialogue with a "bull," which is used as a meta phor of our hidden self in Zen Buddhism. Through this dia logue, users experience a virtual unification of their daily sel and their unconscious self into a recreated conscious self.

Technical Realization

Key technologies used to realize the system include a digital 3D *sansui* ink-painting engine which allows the users themselves to compose an ink painting to enter, a neural network engine which classifies the user's "hidden personality" revealed in the ink painting into Buddhist *Goun* categories, and a dynamical chaos engine which is injected with signals from *Goun* categories and other user actions to generate high dimensional data for the context and evolution of the storytelling. The following are the main components of the system structure.

Fig.1 User makes Sansui ink painting with ZENetic Computer

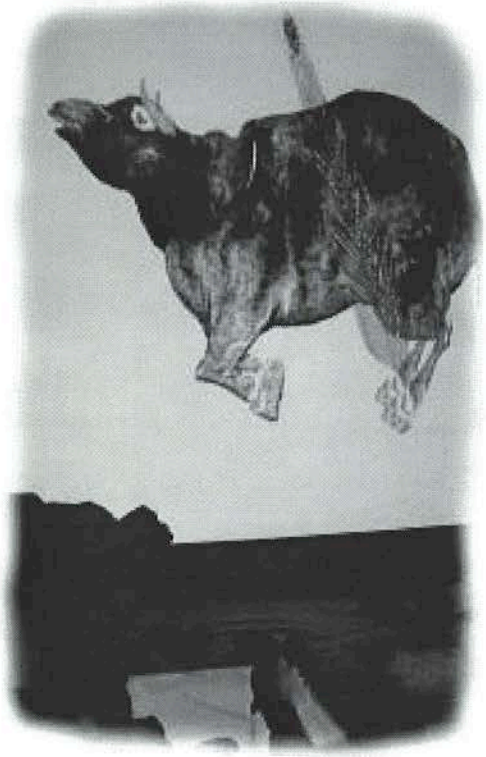
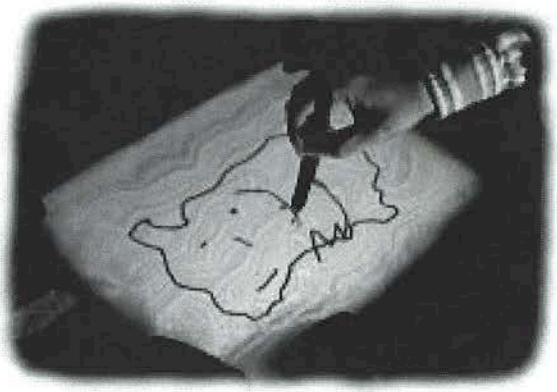


Fig.2 The Ten Bulls Story Interaction in ZENetic Computer

Software Integration

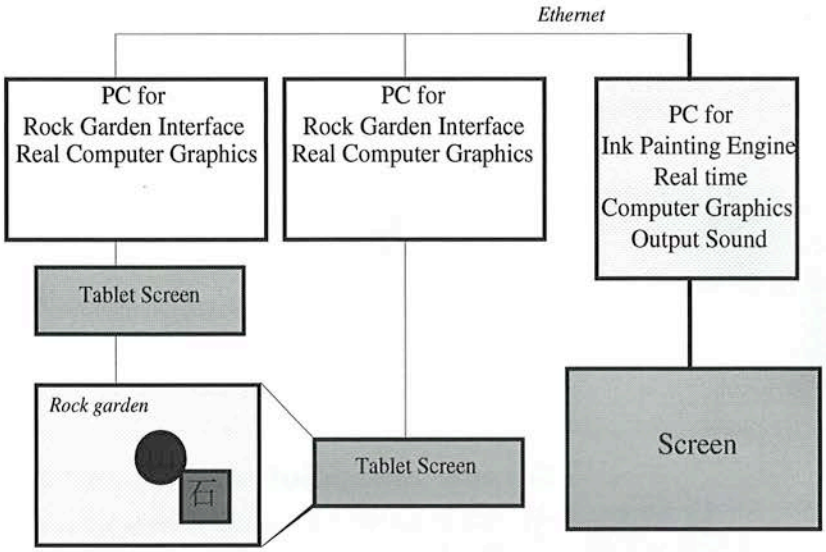
The flow of the system is as follows:

1) User makes a 3D *Sansui* ink-painting picture by manipulating symbolic icons
2) User's hidden self is classified into *Goun* categories.
3) User enters the *Sansui* picture and a journey begins. *Haiku* is used to generate story fragments that are presented in *Sansui*.
4) User experiences various stages of MA-Interaction (User may experience Steps 3 and 4 several times).
5) Finally, the Ten Bulls Story Interaction takes place.



Hardware Structure

Fig. 2 shows the overall hardware structure of the Zenetic Computer System



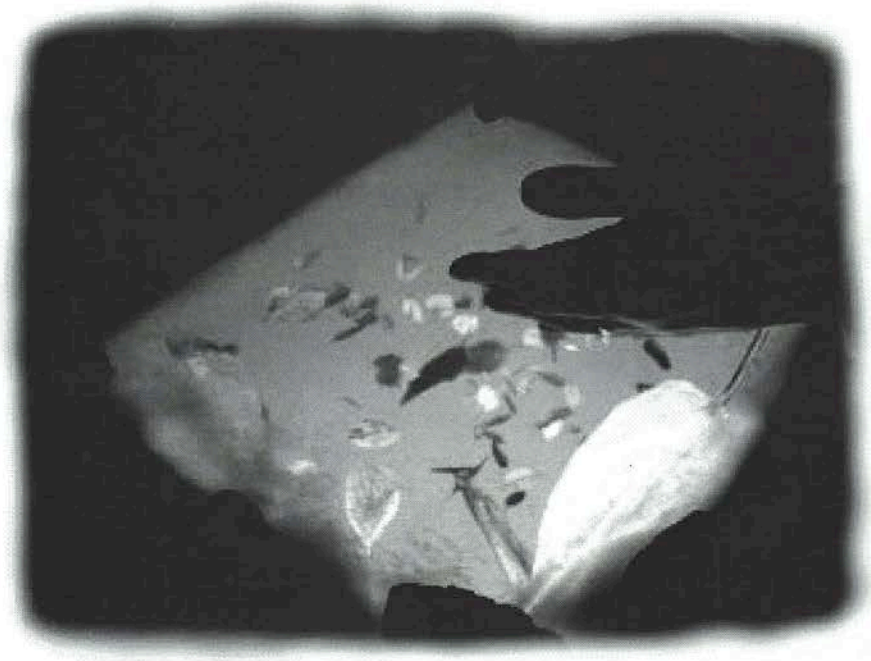


Fig. 3 ZEN dialogue: "One Hand Clapping" Interaction

3D Sansui Ink-painting engine

A key part of the system is the user interaction with a digital 3D ink-painting engine. Depending on how users compose their initial ink-painting, the system classifies their intrinsic personality using a neural network. The personality corresponds to a point in a *Goun* space. *Goun* is a categorization from Buddhism based on the view that five basic spirits and materials make up the world. The five categories of personality based on *goun* can be summarized as follows.

色 *Shiki* is how nature and materials actually exist.
受 *Jyu* is the intuitive impression.
想 *So* is the perceived image.
行 *Gyo* is the process of mind that activates your behavior.
識 *Shiki* is the deep mental process that lies behind all of the above processes

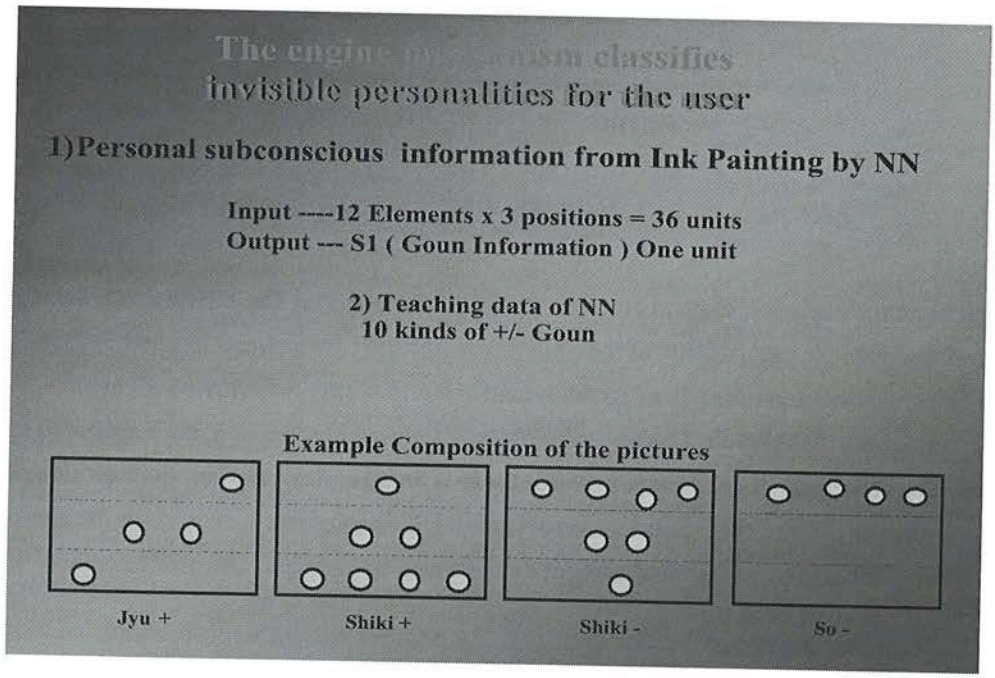


Fig. 4. Examples of neural-net classification of the composition of pictures created by a user into Buddhist *Goun* categories corresponding to "hidden self"

User data is also obtained at later times from various interactions between the user and the system, and used to determine a pseudo Goun personality. Depending on how the user is affected by the evolving story, the pseudo Goun personality may differ from the intrinsic (=hidden) personality. Conversely, the difference between the pseudo personality and the intrinsic personality will affect the evolving story via an engine, called a chaos engine.

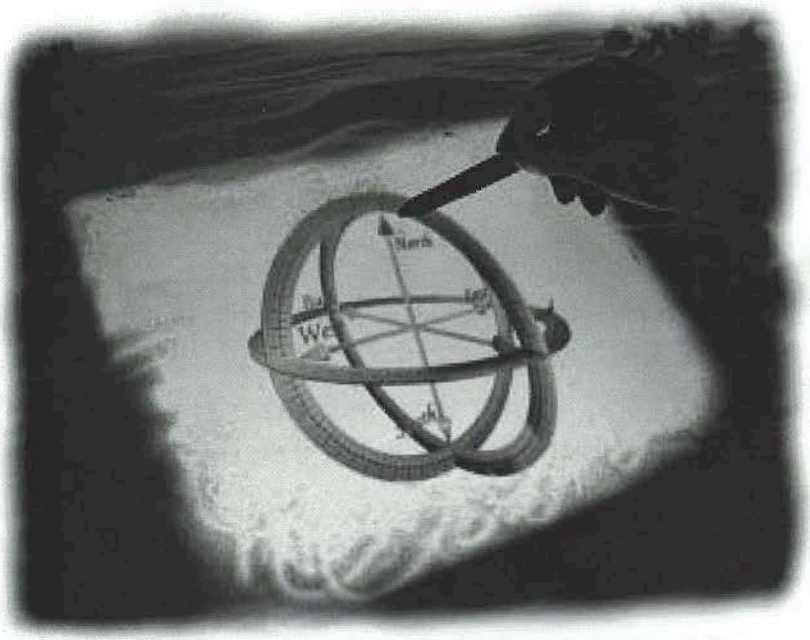


Fig.5. Compass for navigation in your ink painting world

Storytelling generated by chaos engine

A dynamical chaos engine is used to couple activity of the user, via the difference between the pseudo personality and the intrinsic personality, to the generation of high dimensional context and evolution of the storytelling. The chaos engine consists of three dynamic components, which we call agents. We name the three agents User, Target and Master. The agents each have internal chaotic dynamics, and also move around in *Goun* space. The three agents are coupled so that there is an interplay between their motions in the *Goun* space and the synchronization [4] of their internal dynamics. The transient dynamics of the chaos engine are sampled and used to create the sounds and images experienced by the user, and also to control the evolution of the story.

In the current implementation of the chaos engine for the ZENetic computer, the position of the User agent corresponds to the user's pseudo personality, and the position of the Target agent corresponds to the momentary view of the user's pseudo personality obtained from the latest user interaction. The User agent starts at the position of the intrinsic personality and tends to move toward the position of the Target agent. The User agent is coupled to the Target via the Master in such away that if there is no interference from the Master, the User tends to synchronize to the Target and move toward the Target position, so that the User and Target become identical. On the other hand, if there is interference from the Master, it is more difficult for the User to synchronize with the Target, and so less likely that the User will reach the Target.

The strength of the Master's interference depends inversely on the distance between the pseudo personality and the hidden personality - the smaller the distance, the stronger the influence of the Master, and hence the more difficult it is for the User to synchronize and merge with the Target.

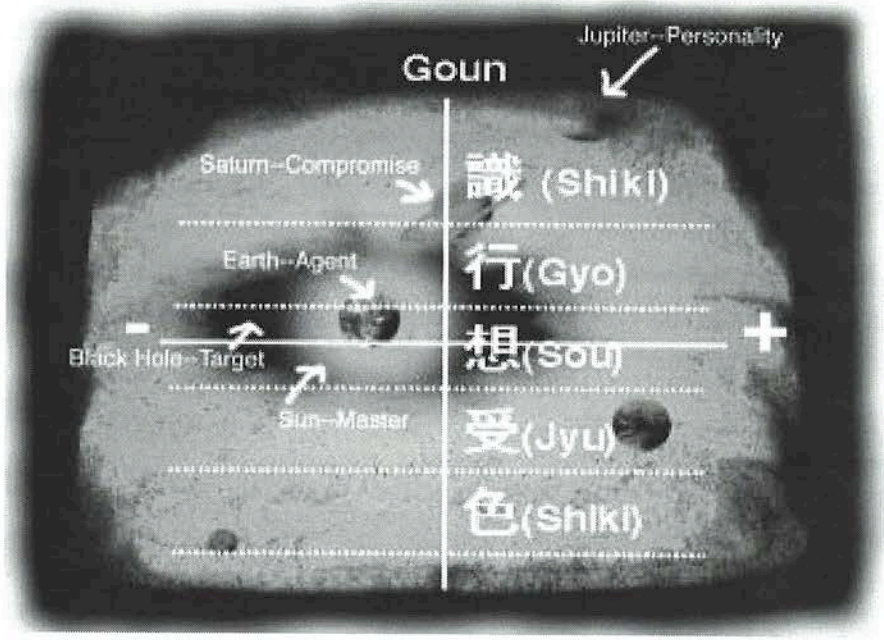


Fig.6. Visualization of your own Chaos engine in ZENetic Computer

Conclusions

Real-time interaction with individual consciousness and subconscious is a long-term challenge for computer systems. Interactive storytelling is a frontier which allows us to explore this challenge. Science says that human consciousness may have a chaotic nature. By incorporating chaotic mechanisms, our system aims to provide a rich and dynamic interaction which entangles the conscious and subconscious. Responses to questionnaires from users who have experienced the ZENetic Computer show that they tend to feel relaxed and stimulated in a way that they had never felt before.

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ARTIST'S BIOGRAPHY

SEIGO MATSUOKA

Director, Editorial Engineering Laboratory
Professor, Tezukayama University

Seigo Matsuoka was an editor-in-chief of an avant-garde magazine entitled "YU" from 1971 to 1982 which created the significant phenomenon among creative people for its cross-disciplinary contents and innovative approach in editing and graphics.

He founded Matsuoka and Associates in 1982. Matsuoka developed a system he refers to as "editorial engineering." In searching and analyzing editing systems in history, science and art, Matsuoka established the intelligent system that is a remarkable clue for discovering an unexpected perspective or an unconventional value system.

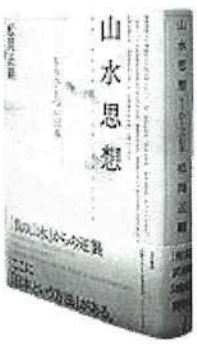
Matsuoka has published a number of books in various fields such as history, Japanese culture, art, design, philosophy, natural science, computer technology, and artificial intelligence. Matsuoka's activities are diverse, including directing and producing many projects, corporate consulting, conceptualizing and organizing art exhibitions, and directing programs.

In 1987, Matsuoka launched Editorial Engineering Laboratory with the aim of using his editing method on extensive fields such as multimedia and computer networking systems. One of Matsuoka's recent projects is "Meme Country," the virtual world containing Matsuoka's editing method used in exchanging or linking "meme" in different levels of strata on the web. With the spread of excessive information by today's computer systems, Editorial Engineering has emerged as a useful tool to link information technology and cultural history.

PUBLICATIONS

[New Books] **"Sansui shiso" (Sansui Thought)Åh -Another Japan-, Gogatsu shobo, 2003**

Tracing the history of suiboku sansui painting back to China, from Sesshu to Hasegawa Tohaku, and further to Yokoyama Misao, this great work brings to light what sansui meant to the Japanesepeople and what kind of Japan lay therein



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School of Informational Culture, NTT Publication, 1998

ARTIST'S BIOGRAPHY

NAOKO TOSA

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naoko@mit.edu

Naoko Tosa is a Media Artist & Researcher. She is also a guest professor in the Kyushu University Department of Art & Technology. She received a Ph.D. in engineering for Art and Technology research from the University of Tokyo. She was a researcher at the ATR (Advanced Technology Research Labs) Media Integration & Communication Labs. Also, she was a guest professor at the graduate school of Science and Technology at Kobe University and a lecturer at Musashino Art University's Department of Media Art & Science.

In particular, she focused on the topic of communication and used computers, video and electronics to design art work that relates to the intelligence of emotions, consciousness and unconsciousness. She specializes in the creation of experimental film, video art, computer graphics animation, and interactive arts. She has been carrying out technological research that explores human emotions and the expansion of human sensibilities and consciousness by making innovative use of artistic creativity. The *Neuro-Baby* project is one example of this research. *Neuro-Baby* is an autonomous computer agent that can communicate with people in conversation or e-mail by recognizing emotions. Some of her other projects include a computer poet that can recite interactive poetry by reading people's emotions, *Interactive Theater*, which builds a narrative based on users' emotions, and *Unconscious Flow*, which can express the emotion hidden within human communication. She has also produced an *Interactive Comedy* system that can communicate with people via laughter using storytelling from subconscious information.

Her work has been exhibited at the Museum of Modern Art New York, the New York Metropolitan Art Museum, SIGGRAPH, ARS ELECTRONICA, the Long Beach Museum, and other locations worldwide. Her works are also part of the collections at the Japan Foundation, the American Film Association, the Japan Film Culture Center, the Nagoya Prefecture Modern Art Museum, The National Museum of Art, Osaka, the O Art Museum, the Toyama Prefecture Museum of Modern Art, and the Takamatsu City Art Museum. In 1996, she received the best paper award from the IEEE International Conference on Multimedia. In 1997, the L'Oreal Grand Prix for research combining art and science awarded her first prize. In 2000, she received prizes from the Interactive Art section in ARS Electronica, as well as a special grant from the agency for cultural affairs in Japan. In 2001, she received a research grant from the Japan Science & Technology Corpration. She was invited to the MIT Center for Advanced Visual Studies as an Artist Fellow. In 2003, she received a research contract from France Telecom R & D. If you are interested in learning more about her work, please visit http://web.mit.edu/cavs/people.html

[Interactive Art Installations]

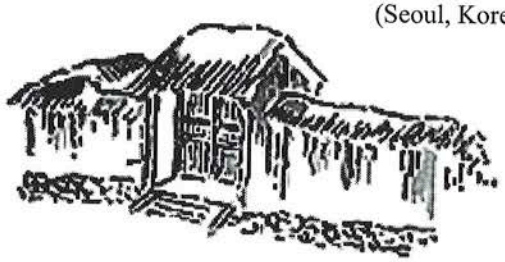
Talking to NEURO BABY	1993-2000
"Network Neuro-Baby"	1994-1995
"Interactive Poem"	1996-1998
Interactive Theater "Romeo & Juliet in Hades"	1998-1999
Unconscious Flow	1999-2000
Interactive Sand Display	2000-2001
Emotional translation Mail	2000-2001
Interactive Comedy	2001-2002

[Computer Graphics & Videography]

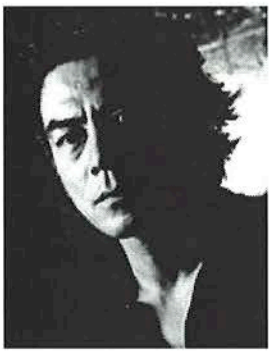
An Expression	1985	9min	Stereo	Color
TRIP	1985	8min	Stereo	Color
ECSTASY	1986	6min	Stereo	Color
ISLAND	1986	7min	Stereo	Color
Pleasure	1986	3min	Stereo	Color
GUSH!	1989	7min	Stereo	Color

[Selected Awards and Exhibitions]

1985 Accepted for 2nd International Biennial Video CD '85 (Ljubjana, Yugoslavia)
1986 Invited Exhibition: New Video Japan (the Museum of Modern Art New York, U.S.A)
1986 Received Prize for Independent Art: NCGA '86 (Anaheim California U.S.A.)
1986 Accepted for SIGGRAPH '86: Art Show (Dallas Texas U.S.A.)
1986 Invited Exhibiion "NEW VIDEO JAPAN" (Long Beach Museum of Art. U.S.A)
1987 Second prize at the American Film & Video Festival (New York U.S.A.)
1987 Accepted for The 21st Annual New York Film-Video Exposition (Metropolitan Art Museum U.S.A.)
1987 Received Prize for the San Francisco International Film Festival; Golden Gate Awards (San Francisco U.S.A.)
1987 Accepted for SIGGRAPH '87: Art Show (Anaheim California U.S.A.)
1993 Accepted for SIGGRAPH '93: Machine Culture section (Anaheim California U.S.A.)
1993 Invited for Ars Electronica '93: Artificial Life (Linz, Austria)
1995 Invited for SIGGRAPH Art Show: Networked Neuro-Baby (Los Angeles, U.S.A.)
1996 Best paper Award Prize for IEEE International Conference on Multimedia (Hiroshima, Japan)
1997 Received First Prize the L'Oreal Grand Prix for research combining art and science (Japan)
1999 Invited for International Berlin Film Festival: New media division (Berlin, Germany)
1999 Accepted for SIGGRAPH Art Show (Los Angeles, U.S.A.)
2000 Invited Exhibition for Imagina 2000: Emerging Technology (Monaco)
2000 Received Interactive Art Prize from Ars Electronica (Linz, Austria)
2001 Invited for Solo Exhibition at Art Center Nabi (Seoul, Korea)



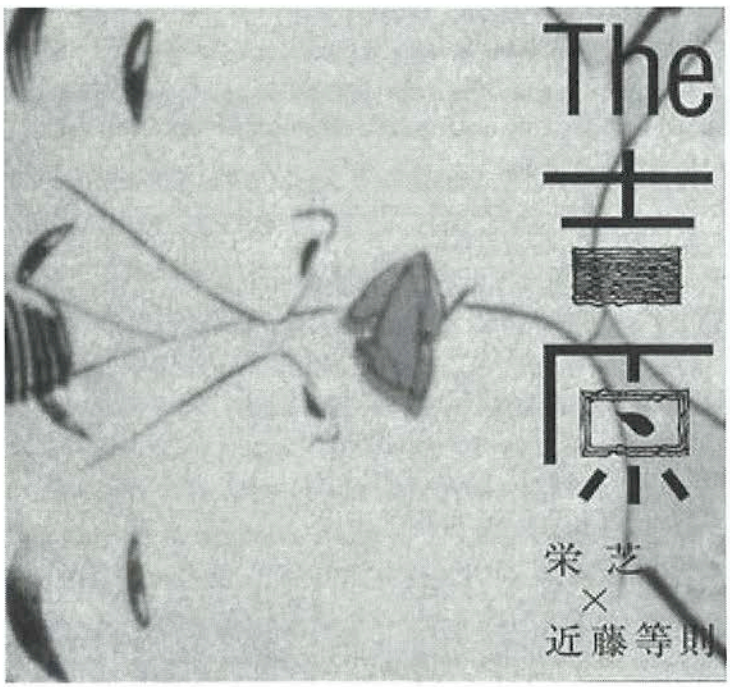
ARTIST'S BIOGRAPHY



Toshinori Kondo

Trumpeter, Producer

Kondo is an outstanding trumpeter who has received top recognition among both European and American jazz scenes. In Japan as well he has produced and performed music for various motion pictures and commercials. As the "Kondo Toshinori IMA Band," he has been active since 1984 in many projects such as a live concert in protest of the Tiananme Square Massacre and producing the theme music for the movie "Tenamonya Connection," until in 1993 he moved his activities to Amsterdam, Holland. In the year 2000 he produced "Mt. Fuji Aid 2000," and "The World Festival of Sacred Music - Hiroshima 2001" with the Dalai Lama in 2001. For his life work, the NHK series "Blow the Earth," he has continued creating soulful music, coming face-to-face with the natural world in places like the Negev Desert in Israel and the Andes Mountains. He is now working on projects such as "FREE ELECTRO" and "CHARGED (w/ Bill Laswell)."



His new CD: The YOSHIWARA
by Victor Entertainment
www.jvcmusic.co.jp/yoshiwara/

CONTRIBUTORS

Soho Machida, Ph.D.

Born 1950 in Kyoto, Dr. Machida entered the buddhist priesthood at age 14. He came to the United States of America in 1984, where he received a master's degree from Harvard Divinity School and a Ph.D. from the University of Pennsylvania Department of Asian and Middle Eastern Studies. After several years as Assistant Professor at Princeton University, and then Associate Professor at the National University of Singapore Department of Japanese Studies, Dr. Machida is now Professor in the Department of Comparative Religion at Tokyo University of Foreign Studies. In addition to several Japanese language works, his English language books include *Renegade Monk: Honen and Japanese Pure Land Buddhism*.

Andrew D. Gordon, Ph.D.

Andrew D. Gordon is Lee and Juliet Folger Fund Professor of History at Harvard University, where he is also director of the Reischauer Institute for Japanese Studies and member of the executive committee of the Asia Center. Professor Gordon received his Ph.d from Harvard University in 1981 in History and East Asian Languages, and was a faculty member at Duke University from 1984-1995. He has served on the Northeast Asia Council of the Association for Asian Studies and the Joint Committee on Japanese Studies of the Social Science Reseach Council and the American Council of Learned Societies. Professor Gordon has written, edited, or translated 8 books, and he has published articles in journals in the United States, Japan, Great Britain, France, and Germany. His most recent books include *Labor and Imperial Democracy in Prewar Japan*, *The Wages of Affluence: Labor and Management in Postwar Japan*, and *A Modern History of Japan*.

Peter Davis, Ph.D.

Peter Davis is leader of the Device and Network Dynamics Group at ATR Adaptive Communications Research Laboratories, based in the Keihanna Science City in Kyoto, Japan. His main research activites concern nonlinear physics, dynamical devices and communication systems. He hasnumerous publications in journals of Physics, Applied Physics, Quantum Electronics, Optics, and Neural Networks. He has also published a number of review articles and book chapters in English and Japanese related to chaotic phenomena and its applications, including "Functional Optical Chaos", in the 1994 Elsevier publication "Towards the Harnessing of Chaos".