KEER2010, PARIS | MARCH 2-4 2010
INTERNATIONAL CONFERENCE ON KANSEI ENGINEERING AND EMOTION RESEARCH 2010

A METHOD OF TRANSFORMING IMPLICIT KNOWLEDGE INTO EXPLICIT KNOWLEDGE TO ACTUALIZE SELF-PRACTICE OF *KYOGEN* MOVEMENT BY UTILIZING IT

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ABSTRACT

This paper will report on the formalization of implicit knowledge in order to aid the self-practice of *Kyogen* movements by utilizing IT. The formalization of implicit knowledge was done by introducing the *Furicho* system which was already being used in Japanese dance, *Buyo*. By implicit knowledge we mean that knowledge which cannot be taught using textbooks. It is taught to students (disciples) by Masters through using words and movements. Sensory teaching can also be seen. *Kyogen* traditionally uses this teaching style. On the other hand, explicit knowledge is knowledge taught by using various forms of media (e.g. video and print). The *Furicho* method is a good example of this. Information on the different parts of the body was collected as digital data by recording *Kyogen* movements and techniques using motion capture software. Using the data, a *Kyogen Furicho* was created by using the templates that were forms of *Kyogen* Komai (*Kyogen* dance). This *Kyogen Furicho* was adapted for use in software.

Keywords: *Motion Capture, Kyogen, Implicit Knowledge, Furicho*

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1. INTRODUCTION

Practice of *Kyogen* and other traditional performing arts has always been done through face-to-face teaching in using traditional oral teaching techniques. This is the lesson method for those who want to be professionals. But, fewer people practicing traditional performing arts these days have the chance to learn in face-to-face practice with a master. It will be difficult for *Kyogen* practice to continue using only face-to-face situations.

The authors are researching "Self-Practice Aid for *Kyogen* lessons using IT" for those who want to practice traditional performing arts [1]. A lesson is usually made up of movements and *Utai* (*Kyogen* singing). The movement part of it is the subject of this research. The Japanese dance *Buyo* has *Furicho* which is a series of notes traditionally used to memorize *Buyo* action for use in self-practice, not through a face-to-face. It takes time to make *Furicho* readable. In order to make *Furicho* easily and quickly, software to digitize *Furicho* was developed and presented [1]. We proposed a method for converting Movement (implicit knowledge) by combination of IT *Furicho* and Motion Capture into a *Furicho* (explicit knowledge) semi-automatically [2].

This paper reports on the software and the implementation of the system. In addition, this study will deal with the Okura School *Kyogen* that one of our collaborators, Nobuhito Nojima belongs to.

2. APPLYING IT *FURICHO* TO *KYOGEN*

Furicho is a set of notes describing in detail dance (steps and movement) and *Utai* of the Japanese dance, *Buyo*. Figure 1 shows the *Furicho* of the program called "*Renjishi*" for the Kano style of Japanese dance. This *Furicho* shows movements of "*Renjishi*" *Utai* in diagrams and sketches with the words and lines written to the right side of each movement. Figure 2 shows a unit of *Furicho* which usually divides the body into three parts, the head, the arms and legs and feet. Small tools such as a fan, a string, etc… are added to *Furicho* if necessary. Even well trained performers find that they have to spend a lot of time and effort in making *Furicho*. Software was developed to digitize *Furicho*. This software was found to be very useful for describing *Furicho* when evaluated by an actor from the Kano style of Japanese *Buyo*.

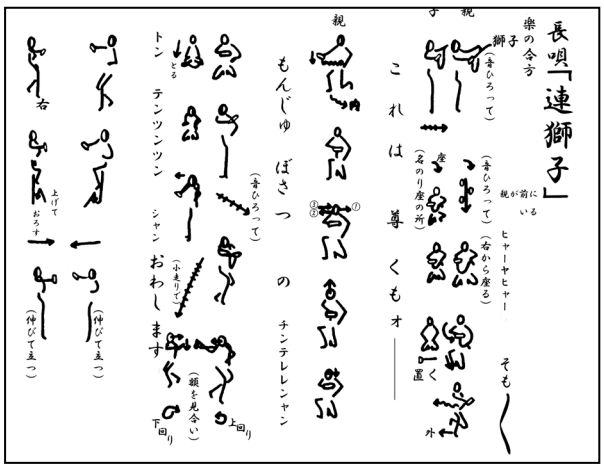


Figure 1: The *Furicho* of the "*Renjishi*" Kano style for Japanese Dance.

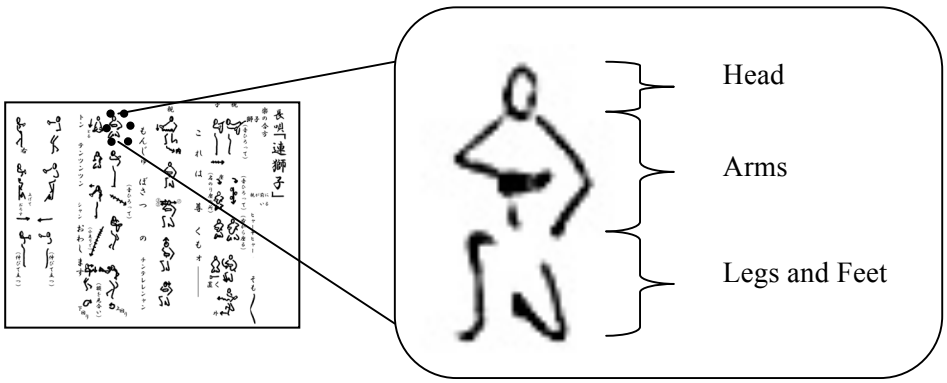


Figure 2: A unit of *Furicho*

To confirm the validity of the study, the authors asked performing arts students who are majoring in *Kyogen* to complete a questionnaire. One question asked was "How can the practice of *Kyogen* be made more interesting".

Table 1 shows the subject specifications of the questionnaire. This questionnaire contained multiple choice questions. The students were allowed to choose more than one answer. Figure 3 shows the results of the questionnaire. It shows that "Establishment of the movement text" was the most popular answer.

According to the questionnaire results, to make it easier for students who are beginners to take lessons in *Kyogen*, it is clearly preferable to have clear lesson materials available. The possibility of applying IT *Furicho* for *Buyo* to the *Kyogen* movements came up. So IT *Furicho* was adapted for this purpose and was used to successfully analyze the movements of *Kyogen* from the *Kyogen* short dance, Komai "*Sakazuki*".

Table 1: The subject specifications of the questionnaire

Item	Content
Number of students	32 people of the drama specialty (men:4，women:28)
The years of experience before the study	None，This class only
Age (Students)	19～20 year old

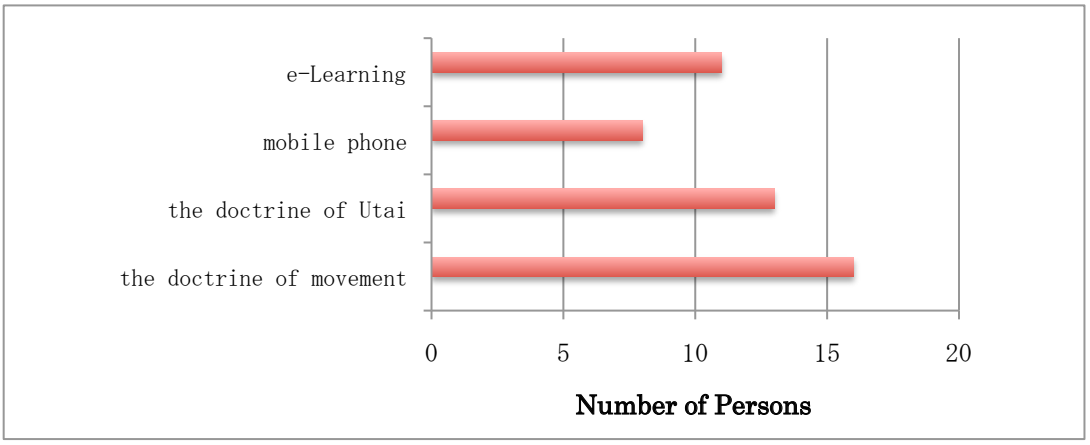
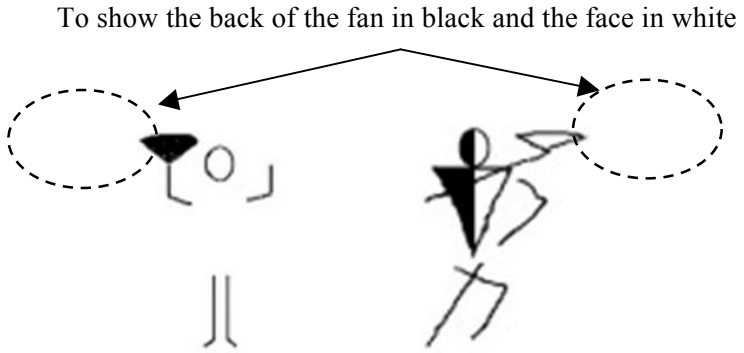


Figure 3: Parts of the results from the questionnaire give to the drama specialty students.

The differences between *Buyo* and *Kyogen* movements were analyzed first. After considering the differences of description of movements, the revisions concerning fan handling and the body were made on the advice of a *Kyogen* actor. Figure 4 shows the revision points. Figure4 (a) shows the revision point added to the fan, which is the back of the fan; (b) shows the face of the fan. Fans are essential in *Kyogen* and used in many ways. Therefore it is important to show both sides of the fan.

Figure4 shows the direction of the hand and the body. In Japanese dance, the head and the body sometimes turn in different directions. But, in *Kyogen*, the head and the body more often than not turn in the same direction. Therefore, for the sake of users, the direction of the body movement is described carefully and clearly. In the same way as the Japanese dance *Furicho*, except in the case of the revision points, *Utai* and lines are written at the right side of the description of the movements.

Figure5 shows a *Kyogen* dance, Komai "*Sakazuki*" with revision points.



(a)Addition of fan (b)Direction of the head and the body

Figure 4: Revision points of the *Kyogen Furicho*

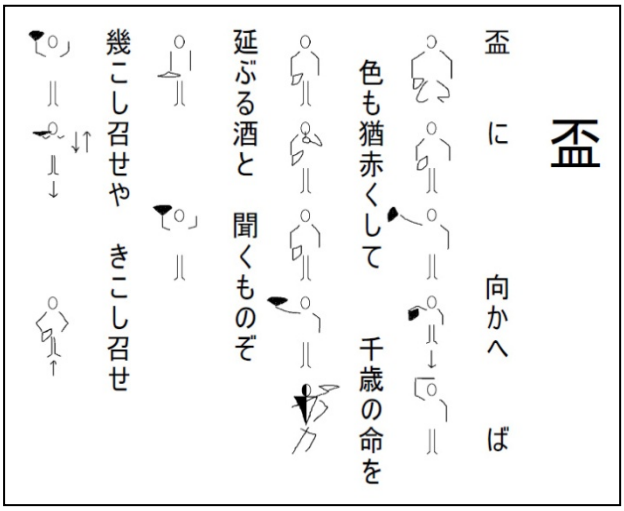


Figure 5: Kyogen Furicho"Sakazuki"

3. AUTOMATIC *FURICHO* SYSTEM

Kyogen is one of the oldest Japanese traditional arts. In *Kyogen* the only way used to teach the art has always been a "Face–to –Face" method where the "Master" teaches the students directly and shows them how to perform using physical demonstrations and verbal explanations. At a later date, Japanese Dance "*Buyo*" was born and with it "*Furicho*"was developed. The object of this study is to take *Furicho* and use it to help in the teaching and practice of *Kyogen*. Applying *Furicho* to *Kyogen* takes a lot of time and effort for both a Master and pupil(s).

Therefore we analyzed the form of *Kyogen Komai "Sakazuki"* and developed a system, based on this analysis, using Motion Capture [3][4][5][6], which can convert implicit knowledge of the master's movement into explicit knowledge of *Furicho*.

Using the system, the Master has only to point at a particular movement (on the screen), which he thinks is important, (tactic knowledge) that has been photographed using Motion Capture. The system can then formalize (Form Intellect) the shown picture by performing Rough Matching with a model (Form) that has been registered .

Figure 6 shows the master's side of the developed system. Figure 7 shows the user's side of the developed system. This system is made up of five parts, procedures from 1 to 5, and performed procedures 3 to 5 repeatedly make *Furicho*. Plan 1 and 2 is the master's side. Plan 3 to 5 is the user's side processes.

1. Recording of movement

2. The extraction of coordinate data, XML formalization

3. *Furicho* point decision

4. Rough matching to pattern data

5. Making a unit of the *Furicho*

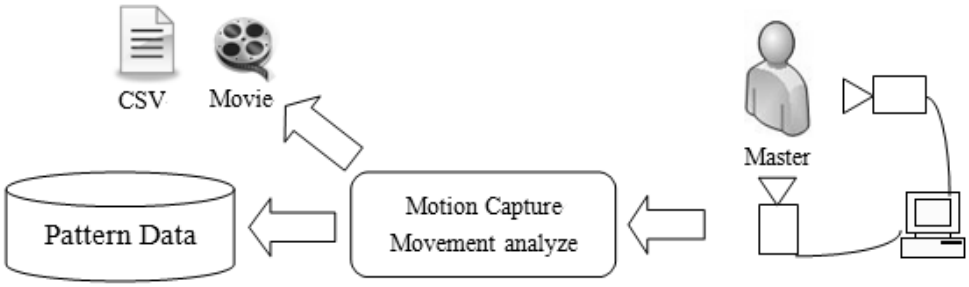


Figure 6: Automatic *Furicho* system master's side

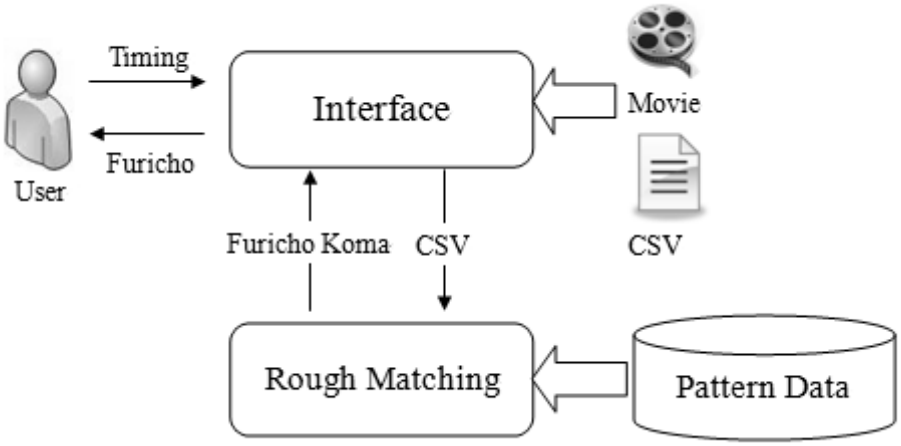


Figure 7: Automatic *Furicho* system user's side

1. Recording of movement

Recording of the master's movement.

2. The extraction of coordinate data, XML formalization

The video extracts coordinate data with Motion Capture. The data was converted into an XML form and accumulated as pattern data to perform rough matching.

Figure 8 shows the setting position of the software maker whose software was used on the video. The markers were placed at between three and fifteen locations (from the fan to the joints of the body). Fifteen markers were set up and attached to a body as data for rough matching. Head parts have markers as do the head, neck and both shoulders. Arm parts have markers on both shoulders, both elbows and both hands. Leg parts have markers on both hips, both knees and both legs.

Figure 9 shows XML format of the extracted location data. This pattern data file is divided into sections, namely the head, the arms, and legs and feet. The contents of the XML format are shown using a route tag for the relevant parts group. Coordinate data and real part data

in drawing a unit are stored respectively in the child tag. Four kinds of coordinated data are stored under different headings such as "parts data", "parts name", "image file name", "favorite parts" and "coordinated data".

3. *Furicho* point decision

To convert it into *Furicho*, the user can click on a point or part of the body while watching the video.

4. Rough matching with pattern data

Inside the system, pattern data is taken, and Rough Matching is processed using CSV corresponding to video time and each physical part (head, torso/arms and legs). The Rough Matching Engine compares pattern data with coordinated data at the time when a user clicked it in 3. If the error of the comparison result is not within an acceptable tolerance level, Rough Matching Engine returns to the photograph to try to repeat the process. Otherwise it continues and compares the next parts. This process is done using data from all three main parts of the body (head, torso/arms and legs).

Figure 10 shows the processing method of coordinate data. This makes it easy to process rough matching. The method for processing coordinated data is to move the origin from coordinated points at Motion Capture calibration to markers set up on each part of the body

5. Making a unit of the *Furicho*

The software gives back a part (head, torso/arms and legs) of the *Furicho* matched as one unit to a user. The user repeats the process until the *Furicho* is complete. Figure 11 shows the interface of the automatic *Furicho* system. A video is played on the left side, and a unit of the *Furicho* made on the right side is displayed. The *Furicho* that a user made can be put into a file, and also into the *Furicho* Editor developed in the previous research.

In addition, it is important to remember that *Kyogen* not only consists of the movement but also the part of the *Utai.* Other research groups are also involved in studying *Utai* [7].

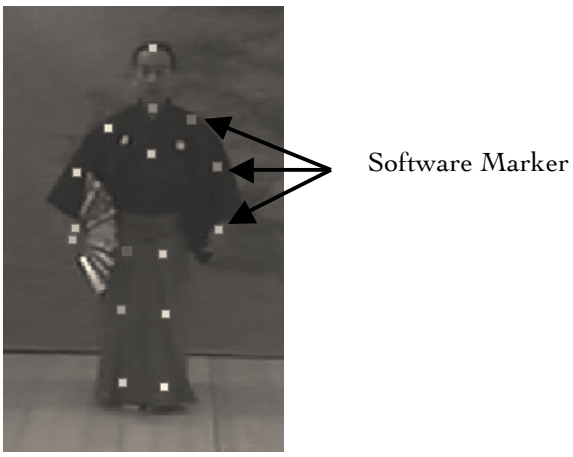


Figure 8: Marker location of Motion Capture

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<?xml version="1.0" encoding="utf-8" standal
- <head>
  - <DrawArea>
      <X>54</X>
      <Y>9</Y>
      <Width>197</Width>
      <Height>86</Height>
    </DrawArea>
  - <Parts>
      <Name>頭(正面)</Name>
      <ImageFile>頭(正面).png</ImageFile>
      <Favorite>True</Favorite>
    - <Location>
      - <Head>
          <X>0.0</X>
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Figure 9: A XML format for pattern data

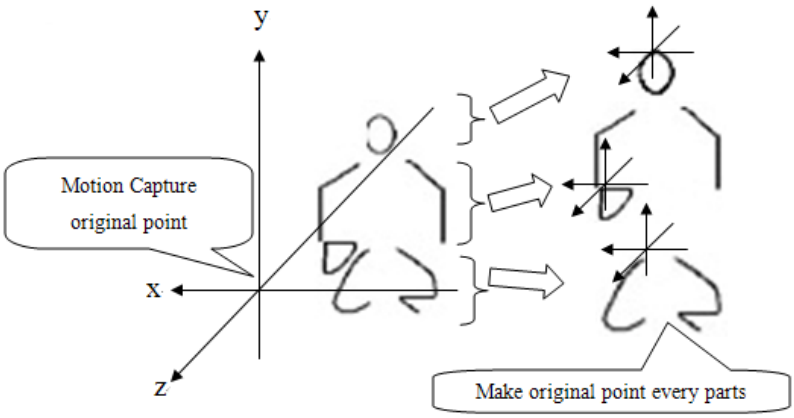

Figure 10: Coordinate transformation for rough matching

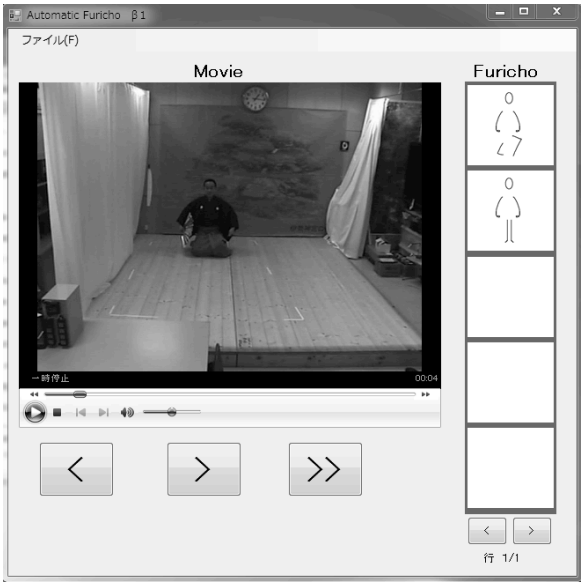

Figure 11: Automatic *Furicho* User Interface

4. CONCLUSIONS

This paper reported that we implemented software that can show the relationship between a model from *Kyogen Komai* (Explicit Knowledge) and the movement (Implicit Knowledge). The evaluation of the software is on going and we will report on it more fully in our future research.

Our future research will deal with software adapted for use in mobile computers (Android and iPhone). This will be of special interest for beginners. It is planned that functions, for displaying animations, tempo of movement, a trace of discontinuity and file compatibility with the *Furicho* Editor, will be added later.

ACKNOWLEDGMENTS

The authors would like to express their gratitude for receiving the Grant-in-Aid for Scientific Research of Japan No.10300289.

They would also like to thank Mr. Juro Zenchiku, a professional Noh & Kyogen actor of the Okura School and his students at Toho Gakuen College of Drama and Music Drama Course for their help in filling out the questionnaire and for giving a demonstration of a Kyogen lesson.

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