

Improving ThaiLabanXML Standard for the Automatic Thai Laban Drag & Drop System

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Abstract—Thai dance has a long history in Southeast Asia. Preserving Intangible Cultural Heritage is a challenging task that requires the use of a combination of technologies to record and represent the dance as a three-dimensional human figure. The Labanotation System had been used to record many kinds of dances such as the Thai dance. To represent the Thai dance as a 3D animation based on Thai Laban Scores, the first version of ThaiDanceXML standard was developed to convert the data manually from Human-Readable data to Machine-Readable data. There are some issues occurred such as the human error regarding reading Thai Laban scores and writing ThaiLabanXML. Hence, a Thai Laban Drag & Drop system has been created to reduce such issues and to assist the notator to write Laban scores by displaying the movements in a 3D human figure animation. Therefore, a new version of the ThaiLabanXML standard must be improved to support the Thai Laban Drag & Drop system. This paper is focusing on improving the ThaiLabanXML standard to support the automatic Thai Laban Drag & Drop system in order to write Thai Laban scores and represent the Thai dance movement in 3D animation.

Keywords—Thai dance, Intangible Cultural Heritage, Labanotation System, ThaiLabanXML standard, Thai Laban Drag & Drop system,

I. INTRODUCTION

A nation with a long history, Thailand has preserved its unique identity and traditions over the centuries. Intangible Culture Heritage is passed on from generations to generations. Arts and Dramatic Arts have always been important elements of this country’s civilization due to their valuable emotional impacts. Thai dance is part of the dramatic arts and is performed with musical instruments, divided into upper class performances such as Khon, Lakhon and Fon which all have movement as their key element [1]. However, the influence of other cultures affects the Thai dance movements from time to time. Therefore, traditional Thai performance is at a risk of transforming and disappearing from the living cultural heritage [2].

In many counties, the dance movement is recoded by using dance notation systems such as the Labanotation system which is used worldwide to record and analyze dance movements. The Ohio State Department of Dance had been developed the system to recode the movement digitally as called “LabanWriter”. In this system, user can edit the abstract symbol on the system [3]. Previously, a few systems were able to translate the abstract symbols into 3D animation such as the LabanDancer, GenLaban [4] [5] however, these programs do not support the newer versions of operating systems.

To represent the Thai dance movement in three dimensions, the ThaiDanceXML was created step by step manually to interpret the abstract symbols of the Labanotation system in the ThaiDanceXML language and translate it into 3D in the Unity 3D program. Consequently, an automatic system had been created to translate the ThaiDanceXML into 3D animation called “Drag&Drop system”. Hence, this paper is focusing on developing the ThaiDanceXML standard based on the previous version [6]. The new version of the ThaiLabanXML standard must be compatible with the automatic drag & drop transformation system using the Unity 3D program.

II. LITERATURE REVIEW

A. Labanotation

Labanotation also known as Kinetography Laban system is a dance notation system for recording the movement of the human body. It is a great and popular way to represent and share the knowledge on dance scores among choreographers, originally created by Rudolf Laban in the 1920’s. Rudolf von Laban studied architecture, was attentive towards arts, and was very interested in analyzing and studying dance movement [7].

It proposes two innovations: a vertical staff to present the body movement, which allows the correct interpretation of the right and left sides of the body as well as a continuity in indicating the flow of movement.

In 1977, Ann Hutchinson Guest and other researchers at the Dance Notation Bureau, New York improved the Labanotation system to be used in the contemporary dance and developed some information, and edited the way to write Laban scores.

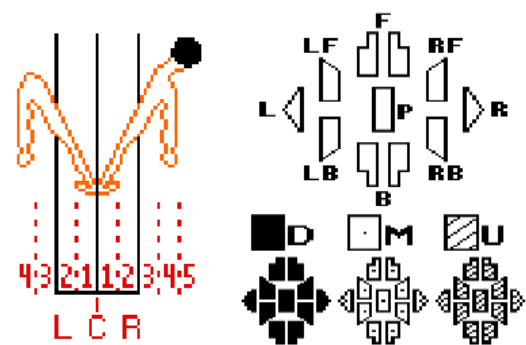


Fig. 1. The columns of the parts of body and horizontal direction symbols.

In 2013, Dr. Chommanard introduced the Labanotation System in Thailand. He had been having experience in learning and teaching Thai performing arts since he was young. Later Dr. Chommanard also had the chance to study and get trained using the Labanotation system so it became an opportunity for research and to concentrate on using Labanotation to teach and learn Thai performing arts. As a next step, Labanotation was used by Dr. Chommanard to archive and record Thai dance performances with special attention to hand and finger movements as key elements of the traditional Thai dance [8]. In learning Thai dance, Chernbumrong et al. mentions that the combination of Thai dance and game-based learning could provide an interesting and challenging learning environment for the users [9]. Developing Thai Laban XML standard will facilitate transferring intangible knowledge to Thai-dance student since they are keen with digital technology [10]

B. Extensible Markup Language (XML)

XML, which is a software and hardware independent tool for storing and transporting data, stands for eXtensible Markup Language. It was designed to be self-descriptive and XML is actually simple and easy-to-use. It simplifies data sharing, gets along with other platforms and is also compatible with most applications, therefore XML is not predefined so you can define tags, and new data can be added or removed [11].

Thus, the user can define any tags which are suitable for certain projects. And when assigning data there is no need to predefine the structure to store the data. Because of the extensibility of XML, XML functions similarly like the internet where different systems and platforms are supported. [12].

1) *LabanXML Standard*: Minako Nakamura and Kosaburo Hachimura, found that the Principles of Labanotation resembles both staff notation and music notes. Thus, they created LabanXML based on the principles of MusicXML [11]. In XML, Laban score is presented in the root element of LabanXML which is the <laban> element. The <laban> element includes:

The <attribute> and <notation> elements. The <attribute> element contains the <time> element. The <time> element contains the <beat> and <beat-type> elements. The main part of LabanXML is represented by the <notation> element. The notation element contains the <repeat> element which explains repetition, and contains the <measure> element [2].

For the Thai Dance movement, the beat of the song is always changing in the same song. Nevertheless, the beat of the song in LabanXML is defined strictly and cannot be changed. Thus, LabanXML is inapplicable to be translated from the Thai Dance Laban Score. Elements in LabanXML such as the <repeat> element are unavailable attributes and parameters for the support of the translation. Accordingly, LabanXML has its restrictions when it comes to Thai Dance [2].

2) *MovementXML Standard*: The Structure of the MovementXML is a representation of the human movement similar to LabanXML based on Labanotation but MovementXML had been developed from LabanXML, so it is more flexible than LabanXML [13]. The structure of

MovementXML begins with elements. The Movement Element is also assigned to a <measure> element and it has parameters that are assigned to the measure number, beat, beat-type, beat-duration and meter (beats per minute). The measure includes two elements, <support> and <gesture> which explain the performance of the body parts. The <description> element found in both <support> and <gesture> explains how the body part moves and each includes element such as <direction> and <level> to assign the movement and performance. MovementXML also has a <repeat> element that includes parameters that define how to repeat the movement. And so forth, <repeat count = "4" repeat-type = "exact" exclude-path = "false" the movement is more elastic because the movement is repeated 4 times [2].

However there are quite some limitations when come to Thai Dance movement even through MovementXML is more flexible than LabanXML.

As regards the Thai dance movements, hands and feet terminologies are quite complicated and specific. The Lorkaew terminology for instance focuses on the figure movement where the whole body is executing harmonized moves at the same time and the performance is based on the beat of the song. Hence, it is difficult to translate the large amount of information in MovementXML. In contrast, the advantage of MovementXML is that the elements and time duration can be explained effectively.

3) *ThaiDanceXML Standard*: In 2018, researchers developed the way to create ThaiDanceXML standard that translates the Thai dance Laban Score [2]. The core determination of ThaiDanceXML is to store a representation of the Laban Notation System. Advantages of the standards of both LabanXML and MovementXML structures were analyzed to understand and find common points in order to create the ThaiDanceXML standard for the archiving the Thai dance movement performance as Human-Readable information and to be able to transfer that into Machine-Readable information [2]. Therefore, the method of writing ThaiDanceXML is to represent the parameter of the dance movement. ThaiDanceXML adapts from both LabanXML and MovementXML.

ThaiDanceXML data uses machine readable information that represent the Thai dance performances in 3D animation. First of all, the ThaiDanceXML can describe some of the Thai dance movements by 3D Unity but when you run ThaiDanceXML it cannot be read because it has more than 1 attribute in the parameter so that it confuses the machine. Therefore, a second version of ThaiLabanXML has been improved to support the Thai Laban Drag & Drop system.

III. METHODOLOGY

This paper is focusing on developing ThaiLabanXML standard by using the Labanotation system as Human-Readable Information changing it into Machine-Readable information. It also auto-generates ThaiLabanXML to ThaiLabanXML. There are two standards to be used for translating Laban notation scores to 3D human figure animation. ThaiDanceXML stores a representation of the Laban Notation system. The main purpose is to archive the Thai dance movements using Laban notation systems as Human-readable data transferring it into Machine-readable

data. Then, Machine-readable data is analyzed and submitted to be represented in the 3D Unity program.

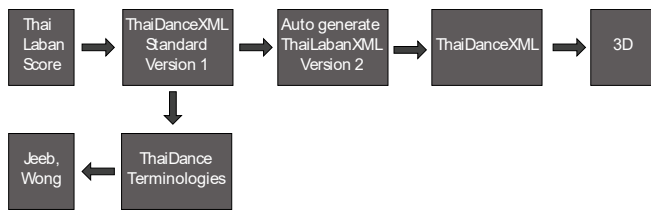


Fig. 2. Interpreting Thai Notation Score to ThaiLabanXML diagram.

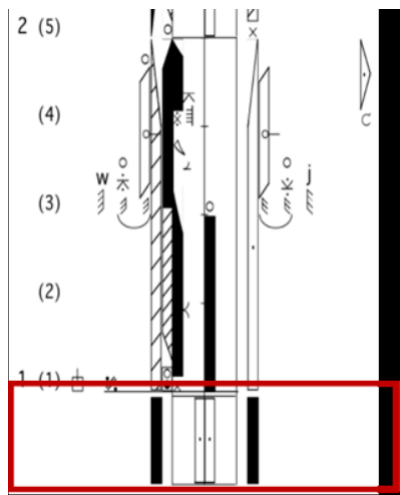


Fig. 3. Thai Dance Notation Score on Krai-Mue terminology

Thai Laban Notation Score (red box) translated into ThaiDanceXML in figure 4 and ThaiLabanXML in figure 5.

A. Comparison of the First and Second Version

1) First Version

ThaiDanceXML is an Extensible Markup Language that was created based on LabanXML and MovementXML using Labanotation Systems for the interpretation of the Thai dance movement. The structure of the ThaiDanceXML starts with the creation of a name. <ThaiDanceXML> contains all elements of the score. <The main purpose of XML in ThaiDanceXML is to store a representation of the Laban Notation System. Therefore, the way of writing ThaiDanceXML is to represent the parameter of the dance movement. ThaiDanceXML adapts elements from both LabanXML and MovementXML. The structure of ThaiDanceXML begins with <Laban> As the root of each element, the <Laban> element contains the <Notation> element. The <Notation> element contains the <attribute> element. The <attribute> element signifies the beat count of a measure. The <attribute> element contains the <Measure> element. The <Measure> element includes the number parameter, and the <Beat>, <Beat-type>, <support>, <leg>, <body>, <arm>, <hand> and <head> elements. The maintenance, leg, body, arm, hand and head elements

probably include the <Level>, <Direction>, <Speed>, <Hold>, <Sign>, <Degree>, <Contact>, <Rotate>, <Rpin>, <Relationship>, <Bodypart> and <Terminology> elements. However, the Thai dance hand sign has its own <Direction>, <Level> etc. [2].

```

<Laban>
  <Notation>
    <attribute>

      <Measure num="0">
        <Beat-Type>4</Beat-Type>

        <Support side ="Left">
          <Level>M</Level>
          <Direction>Place</Direction>
        </Support>

        <Support side ="Right">
          <Level>M</Level>
          <Direction>Place</Direction>
        </Support>

        <Arm side ="Left">
          <Level>L</Level>
          <Direction>Place</Direction>
        </Arm>

        <Arm side ="Right">
          <Level>L</Level>
          <Direction>Place</Direction>
        </Arm>
      </Measure>
    </attribute>
  </Notation>
</Laban>
  
```

Fig. 4. Frist Version: ThaiDanceXML (Krai-Mue)

2) Second Version

The main purpose of XML in ThaiLabanXML is to translate data using the translation program Drag & Drop system. The ThaiLabanXML is adapted from ThaiDanceXML and has a similar purpose. Its Machine-Readable information is analyzed and exported into the 3D unity to represent the Thai dance performance in VDO. The information in VDO can be transferred back into ThaiLabanXML form.

The structure of ThaiLabanXML starts with the <ThaiLabanXML> root element containing all data. The </ThaiLabanXML> element contains the <Attribute>element. The <Attribute>element includes the beat count of a measure. The <Measure> element stores the number of each room <room> and the count of beats in each room <beat>. The <Measure> element contains the <Body> element. The <Body>element includes the body part <part>, and the time of body part moves counted from the <start>. The <start>parameter refers to the time when the body part starts to move. The <end>parameter shows when the body stops moving. The <Body>element contains <Direction>, <Level>, <Turn> and each body part's performance. The <Direction> includes thebody movement positions such as <place>, <forward>, <backward>, <left> and <right>. The <Level> includes the position against the Y-axis like <low>, <middle> and <high>.

```

<ThaiLabanXML>
<Attribute>

  <Measure room="0" beat="1">

    <Body part="left_support" start="0" end="1">
      <Direction>place</Direction>
      <Level>middle</Level>
    </Body>

    <Body part="right_support" start="0" end="1">
      <Direction>place</Direction>
      <Level>middle</Level>
    </Body>

    <Body part="left_arm" start="0" end="1">
      <Direction>place</Direction>
      <Level>low</Level>
    </Body>

    <Body part="right_arm" start="0" end="1">
      <Direction>place</Direction>
      <Level>low</Level>
    </Body>

  </Measure>
</Attribute>
</ThaiLabanXML>

```

Fig. 5. Second Version: ThaiDanceXML (Krai-Mue)

B. Process to write ThaiLabanXML

First of all, to write ThaiLabanXML, it is needed to know all the structure and tags in ThaiLabanXML as shown in figure 6, and the tags of ThaiLabanXML, that are taken from the ThaiDanceXML version using the Drag & Drop system.

TABLE I. STRUCTURE AND TAGS IN THAILABANXML

Tags	Descriptions
<ThaiLabanXML>	This tag is used for indicating the start of the Laban score record
<Attribute>	Identity that the element data within is recorded from the notation
<Measure>	The counter tag for room and beat
room	Variable defining the number of rooms in staff In Thai dance 1 room = 2 or 4 beats
beat	Variable counting the number in each room
start, end	Variable defining the time from when the body starts to perform until the end in each body part in score
<Body>	It is used when the writer wants to be more specific about the part of the body mentioned.
part	Variable defining a specific part of body (leg, arm etc.)
<Direction>	Identifies the direction of the mentioned body part according to Laban notation.
<Level>	Identifies the height of movement of the mentioned body part according to the Laban notation.
<Turn rpin>	Defines the rotation action of a body part clockwise and anti-clockwise.
<Space>	Defines a specific action of a body part (fold, wide, narrow)
degree	Variable defining the number of quantity sign levels
<Contact>	Indicates the part of the foot that is in

Tags	Descriptions
<Hold>	Addresses the action of keeping a dance move at its position.
<Gesture>	Indicates extended option for appropriate Thai dance is Jeeb and Wong.

C. ThaiLabanXML Standard

- 1) It Begins to record the lowest Labanotation score moving up beat by beat.
- 2) Within a staff count by beat from the support, it records the left side first until finishing 1 row in y-axis, followed by the right side and moving on to the legs and other body parts etc.
- 3) Starting channel record to record in staff is prepared-posture and Up-beat score before start perform predefine 2 beat in this room.
- 4) Counter beat in each room by the measure tag.

IV. RESULT

A. Developing the ThaiLabanXML standard for Thai Laban Drag&Drop system

The ThaiLabanXML is developed from ThaiDanceXML to be automatically translated in the Thai Laban Drag and Drop. Thus, the Labanotation system has too many elements and some of them have to be defined more specifically so we have to improve the structure and the way of utilizing the old version.

The beat count in the starting channel needs to be defined before performing. This Prepare-posture and Up-beat input data of the program can be read, and the beat can continue similarly to an actor performing in real, as shown in figure 6 (red box).

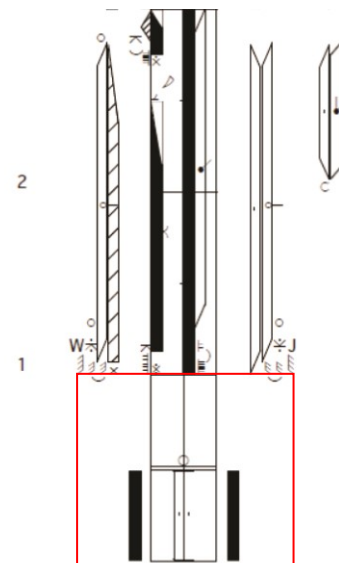


Fig. 6. Thai Laban Score on Krai-Mue

B. Export ThaiLabanXML from Drag&Drop system

Thai Laban Drag and Drop system was developed from the LabanWriter to export the XML file when Draw score on program similar expert Laban writing in the old way in program Laban Writer. Therefore, the ThaiLabanXML Standard was created to support the Drag and Drop system because the Draw element of the program can be immediately translated to an XML file and be transferred to the 3D unity program where it can be represented on the user interface. This way, it is not necessary to write an XML file anymore. This can be helpful to represent generated data in 3D unity.

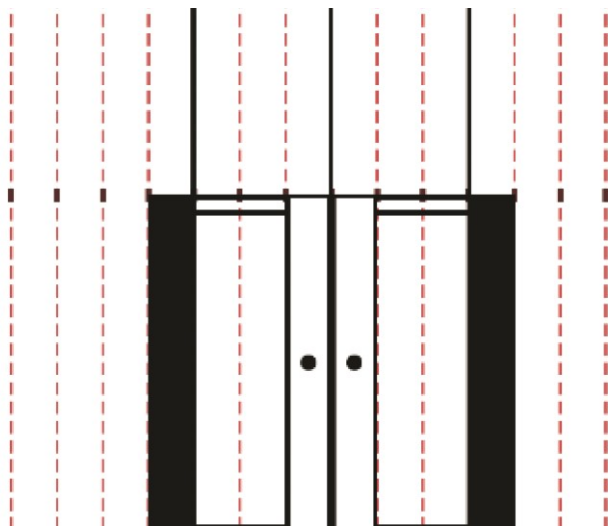


Fig. 7. Thai Laban score in Drag & Drop system

```
Formatted XML
1 <ThaiLabanXML>
2 <Attribute>
3 <Measure room="0" beat="2">
4 <Body start="0" end="0.5" index="-1">
5 <Level>middle</Level>
6 <Direction>Place</Direction>
7 </Body>
8 <Body start="0" end="0.5" index="1">
9 <Level>middle</Level>
10 <Direction>Place</Direction>
11 </Body>
12 <Body start="0" end="0.5" index="-4">
13 <Level>low</Level>
14 <Direction>Place</Direction>
15 </Body>
16 <Body start="0" end="0.5" index="4">
17 <Level>low</Level>
18 <Direction>Place</Direction>
19 </Body>
20 </Measure>
21 </Attribute>
22 </ThaiLabanXML>
```

Fig. 8. Export file ThaiLabanXML from Drag & Drop system.

V. CONCLUSION

Thai performing arts such as Khon is disappearing from the living cultural heritage. To preserve such knowledge, the Labanotation system is used to record the delicate dance movements. Nevertheless, to represent the movement from Thai Laban scores as 3D animation, a standard must be

developed to convert Human-Readable Information to Machine-Readable Information. The ThaiDanceXML standard was created to manually write and insert the ThaiDanceXML file into the Unity 3D program to create 3D human figure movements. The second version of the ThaiLabanXML standard was developed to support the automatic generation of the ThaiLabanXML file from the Thai Laban Drag & Drop system to reduce the human error related issues and to generate an accurate ThaiLabanXML file for the system to represent the proper 3D animation gesture. The comparison of the first and second versions of the ThaiLabanXML standards showed a process of improvement and also the limitations of the standard. Possible related future work could be the improvement of the ThaiLabanXML standard on Thai Laban syntax, more complex movements, and enhanced compatibility with the Thai Laban Drag & Drop system.

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