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Minako Nakamura
(Department of Performing Arts,
Ochanomizu University, Tokyo, Japan)
Kozaburo Hachimura
(Department of Media Technology,
Ritsumeikan University, Kusatsu, Japan)

AN XML REPRESENTATION OF LABANOTATION, LabanXML, AND ITS IMPLEMENTATION ON THE NOTATION EDITOR LabanEditor2

Abstract: We discuss concepts and facilities of an XML representation of Labanotation called LabanXML. We also show an example of LabanXML. Preliminary implementation of LabanXML in LabanEditor2 which is a Labanotation editor and a 3D dance animation system is also shown.

Key words: Dance, Labanotation, XML, Graphical Editor

1. Purpose of the study

Labanotation [1] is widely used as a general body motion notation, because it does not depend on any specific dance. Since Labanotation is based on graphical representations, it is also widely accepted as a readable and understandable notation.

There are number of graphical editors especially designed for Labanotation, but files for those editors are not designed for inputting, searching, and editing, as they are only designed for their internal file representations.

Text Representation of Labanotation is required for interchanging Labanotation data via Internet, searching specific motion patterns, analyzing dance movements, and archiving body motion data. There are several types of text representations. Among these, XML (eXtensible Markup Language) is widely used for the purpose. Especially on the Internet, XML is the choice for most applications. However, XML for Labanotation has not been developed.

In this paper, we discuss an XML representation of Labanotation, called LabanXML.

2. Music notation interchange format

There is no interchange format for Dance notations. However, as for interchange formats for music notation, there are several formats including SMDL, NIFF, and MusicXML [2]. SMDL, Standard Music Description Language is developed by ISO, International Organization of Standardization. SMDL is a variant of SGML and is universal but too complex. NIFF, Notation Interchange File Format, is designed to exchange only Graphic Notation. Recently, MusicXML is developed by Michael Good based on XML

and designed for Interchanging music data via the Internet and capable of searching. Dance is usually accompanied by Music. XML representation for Labanotation compatible with MusicXML is required. Thus we designed LabanXML compatible with MusicXML.

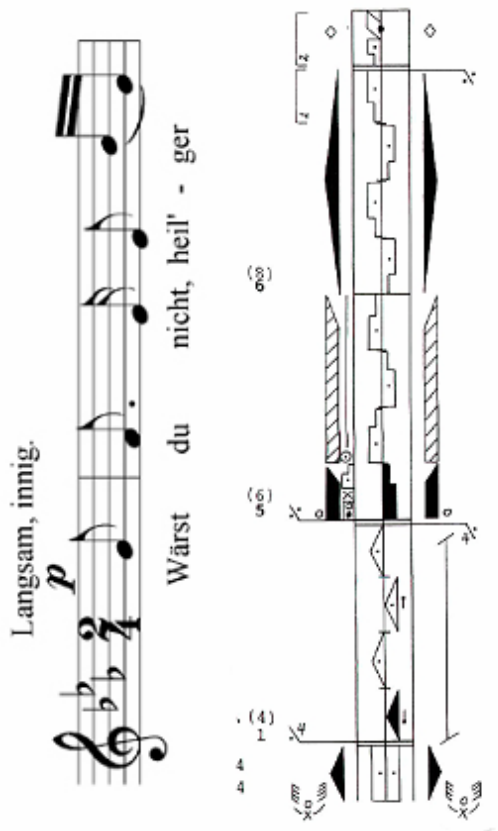


Fig. 1. Staff notation and Labanotation

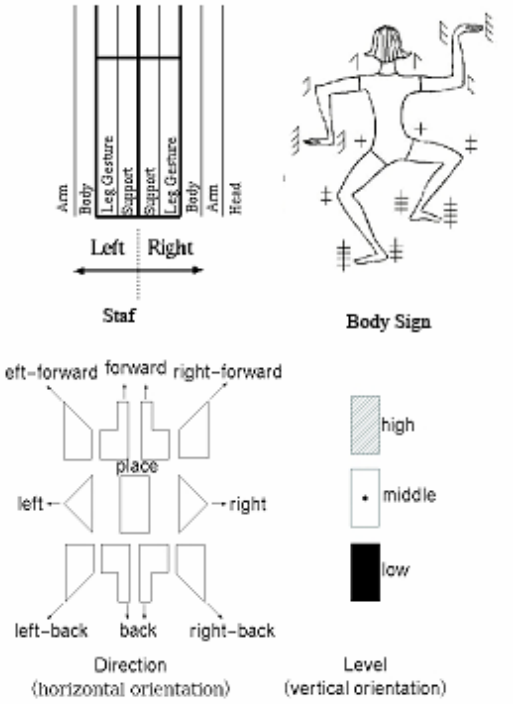


Fig. 2. Basic Symbols of Labanotation

3. Design concepts of LabanXML

Configuration of Labanotation is vertical while Music staff notation is horizontal (see Fig. 1). Both proceed with time line. Thus for the treatment of time, LabanXML follows the same approach taken by MusicXML.

In music staff notation, pitch and duration represented by music notes put on a line or between lines. In Labanotation, direction, heights and duration of body movement represented by symbols puts between lines. In Staff notation, lines represent pitch value. In Labanotation, between lines called column represent body parts. In Labanotation, symbols are drawn on the columns separated by horizontal line. This horizontal line represents measure, that is, time line. Direction of a body movement is represented by a shape of a symbol, level is represented by a texture, duration is represented by its length. To represent a movement of a specific body part is to put this symbol on a column of the staff. More detailed movement of a body part is represented by additional symbols called Body Sign.

In designing LabanXML, we choose that a measure includes columns and is the most basic XML element. A measure ELEMENT has an attribute “num” which represent a number of a measure.

A characteristic of LabanXML design is a separation of support column. For representing columns, XML elements, <left>, <support>, and <right> are included by <measure> element.

4. Major elements of LabanXML

The root element of LabanXML is the <laban> element. The <laban> element includes the <attribute> and <notation> elements. The <attribute> element includes <time> element. And the <time> element includes <beat> and <beat-type> elements.

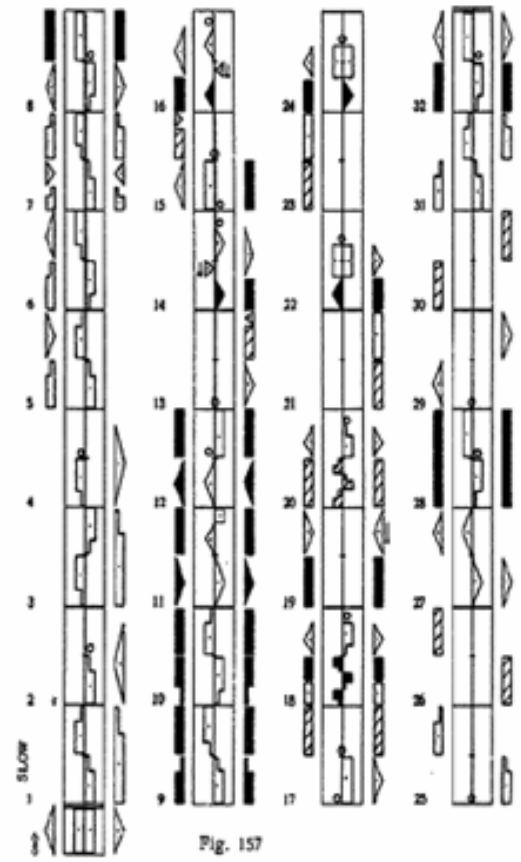


Fig. 3. Labanotation Score

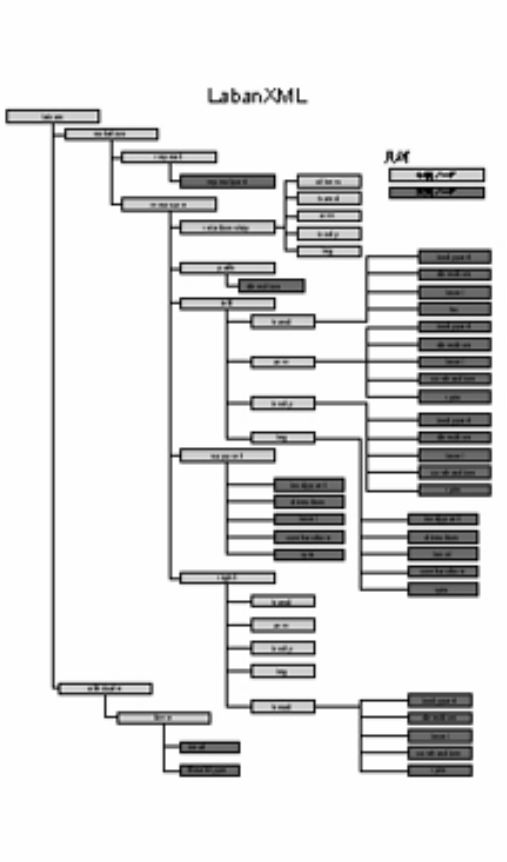
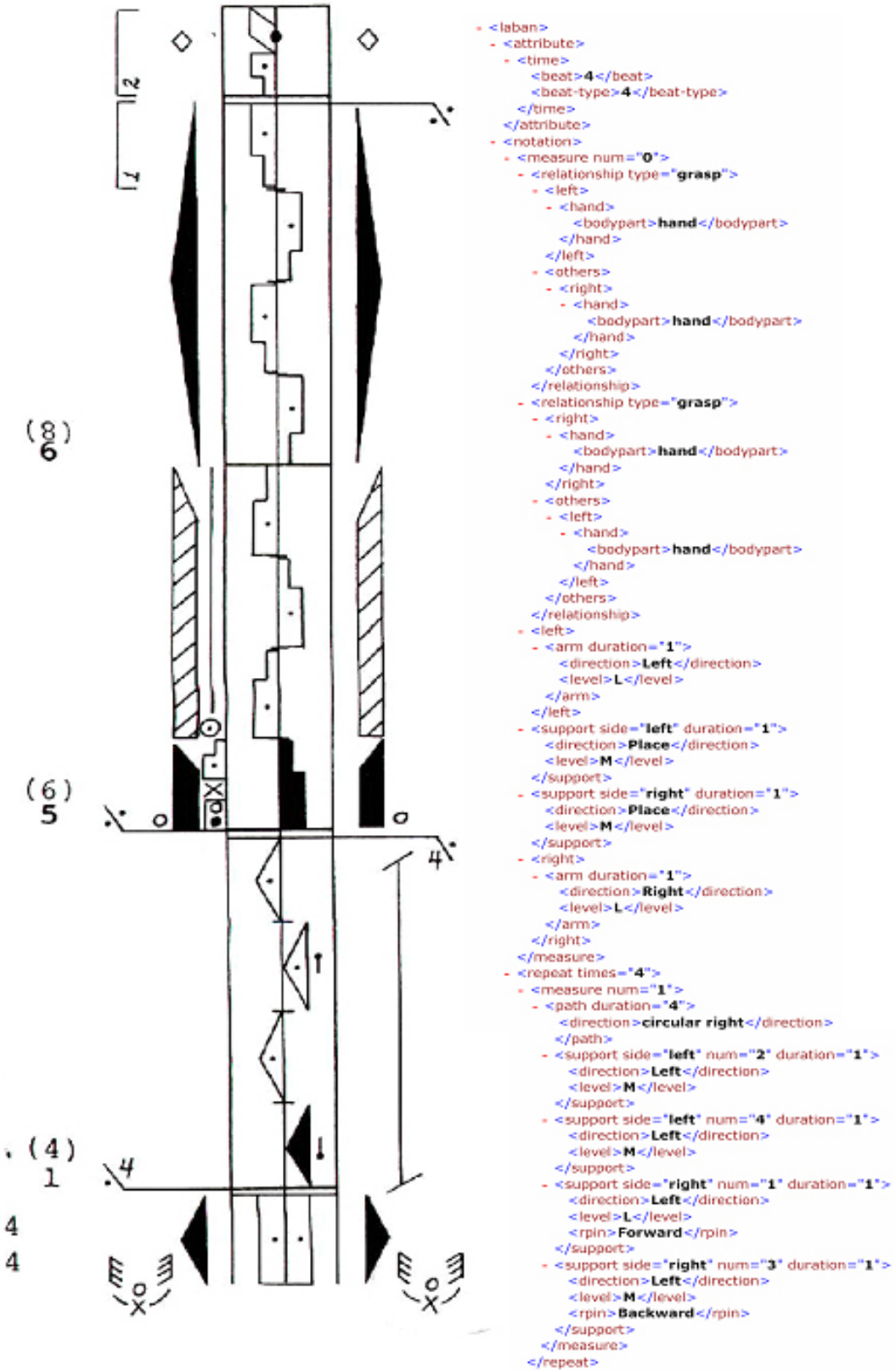


Fig. 4. Element structure of LabanXML

Most important part of Labanotation is represented by <notation> element. The <notation> element includes <repeat> element, which describes a repetition, and <measure> element. Columns of Labanotation is classified into <left>, <support>, and <right> elements. As explained before, separation of support column as <support> element and classify other left and right columns into <left> and <right> elements are one of our unique approach to design XML representation for Labanotation. Relationship between body parts are represented by <relationship> element.



```
- <laban>
  - <attribute>
    - <time>
        <beat>4</beat>
        <beat-type>4</beat-type>
      </time>
    </attribute>
  - <notation>
    - <measure num="0">
      - <relationship type="grasp">
        - <left>
          - <hand>
              <bodypart>hand</bodypart>
            </hand>
          </left>
        - <others>
          - <right>
            - <hand>
                <bodypart>hand</bodypart>
              </hand>
            </right>
          </others>
        </relationship>
      - <relationship type="grasp">
        - <right>
          - <hand>
              <bodypart>hand</bodypart>
            </hand>
          </right>
        - <others>
          - <left>
            - <hand>
                <bodypart>hand</bodypart>
              </hand>
            </left>
          </others>
        </relationship>
      - <left>
        - <arm duration="1">
            <direction>Left</direction>
            <level>L</level>
          </arm>
        </left>
      - <support side="left" duration="1">
          <direction>Place</direction>
          <level>M</level>
        </support>
      - <support side="right" duration="1">
          <direction>Place</direction>
          <level>M</level>
        </support>
      - <right>
        - <arm duration="1">
            <direction>Right</direction>
            <level>L</level>
          </arm>
        </right>
      </measure>
    - <repeat times="4">
      - <measure num="1">
        - <path duration="4">
            <direction>circular right</direction>
          </path>
        - <support side="left" num="2" duration="1">
            <direction>Left</direction>
            <level>M</level>
          </support>
        - <support side="left" num="4" duration="1">
            <direction>Left</direction>
            <level>M</level>
          </support>
        - <support side="right" num="1" duration="1">
            <direction>Left</direction>
            <level>L</level>
            <rpin>Forward</rpin>
          </support>
        - <support side="right" num="3" duration="1">
            <direction>Left</direction>
            <level>M</level>
            <rpin>Backward</rpin>
          </support>
        </measure>
      </repeat>
```

Fig. 5. Labanotation score of Mayim [4] and its LabanXML representation

XML view of data or information is to recognize data or information as a logical structure of elements. Basic construct of information is recognized as an element in XML. And logical structure is represented by Grouping, Occurrence Indicators, and Connectors. Grouping, Occurrence indicators, and Connectors are SGML terms and SGML, Standard Generalized Markup Language, is the ancestor of XML. XML can be viewed as a simplified SGML.

DTD of the LabanXML is shown on the annex.

Logical tree structure of elements are represented by Grouping. As in ELEMENT <laban>, <laban> includes <attribute> and <notation> elements. The element definition start with less than symbol followed by exclamation mark and capital ELEMENT. Next column is the name of an element. Content of the subject element is the next column, called content model.

Occurrence indicator is represented by asterisk, plus, and no special character after element name. Asterisk means the elements will occur zero or more, plus means one or more, no special character after element name means occurs exactly once in the content model. Connector is represented by Comma or Vertical bar. In this DTD, only Comma is shown. Comma means elements before the comma and after the comma occur in this order. Vertical bar means selection of elements.

XML has very limited abstraction mechanism. Sometimes same contents may appear in several elements. To represent this, ENTITY is the only way to represent this abstraction.

An entity BODYP is defined on the first line and referenced in the left ELEMENT definition. Percent BODYP appeared on the <left> element is replaced by a character string, "hand*, arm*, body*, leg*". #PCDATA means a real value. So, element <level> may has a value of high, middle, or low.

5. Preliminary implementation of LabanXML

We have developed most of LabanXML for symbols of Labanotation. Analysis of Labanotation and design of LabanXML has almost been completed. Labanotation score can be generated by using XSLT (eXtensible Style Sheet Language Transformation) and SVG (Scalable Vector Graphic) both developed by W3C.

Experimental implementation of LabanXML can be found in LabanEditor2. LabanEditor2 is an extension of LabanEditor. LabanEditor is an interactive graphical editor for writing and editing Labanotation scores and developed by the Ritsumeikan University. By using LabanEditor, a user can input and edit human body movement of dance and also display animation of a human body model in 3D graphics. LabanEditor2 can now read and write LabanXML data.

Dance analysis and dance archive using LabanXML is the next research challenges.

References

[1] Hutchinson, Ann Gust: *Labanotation: The System of Analyzing and Recording Movement*, Theatre Arts Books, New York, 1977
[2] Michael Good, http://www.musicxml.org/
[3] Topaz, Muriel: *Intermediate Reading Studies*, Princeton Book, 1996

monako@cc.ocha.ac.jp , hachi@media.ritsumei.ac.jp

Annex LabanXML DTD

```
<!ENTITY % bodyp    "hand?, arm?, body?, leg?" >
<!ENTITY % symbols "bodypart?, direction, level, contraction?, rpin?, hc?, hook?, vl?"
>
<!ELEMENT     laban (attribute, notation)>
<!ELEMENT     attribute     (beat, beat-type)>
<!ELEMENT     notation      (repeat*, measure+)>
<!ELEMENT     repeat        (repeatpart)>
<!ELEMENT     measure       (relationship*, path*, left?, support?, right?)>
<!ATTLIST     measure
              num   CDATA #IMPLIED>
<!ELEMENT     relationship(others, %bodyp)>
<!ELEMENT     path  (direction)>
<!ELEMENT     left  (%bodyp;)>
<!ELEMENT     support       (%symbols;, turn*)*>
<!ATTLIST     support
              side  CDATA #IMPLIED
              ticknum       CDATA #IMPLIED
              duration      CDATA #IMPLIED>
<!ELEMENT     turn  (#PCDATA)>
<!ATTLIST     turn
              type  CDATA #IMPLIED>
<!ELEMENT     right (%bodyp;, head)>
<!ELEMENT     hand  (%symbols;)*>
<!ATTLIST     hand
              ticknum       CDATA #IMPLIED
              duration      CDATA #IMPLIED>
<!ELEMENT     arm   (%symbols;)*>
<!ATTLIST     arm
              ticknum       CDATA #IMPLIED
              duration      CDATA #IMPLIED>
<!ELEMENT     body  (%symbols;)*>
<!ATTLIST     body
              ticknum       CDATA #IMPLIED
              duration      CDATA #IMPLIED>
<!ELEMENT     leg   (%symbols;)*>
<!ATTLIST     leg
              ticknum       CDATA #IMPLIED
              duration      CDATA #IMPLIED>
<!ELEMENT     head  (%symbols;)*>
<!ATTLIST     head
              ticknum       CDATA #IMPLIED
              duration      CDATA #IMPLIED>
<!ELEMENT     repeatpart    (#PCDATA)>
<!ELEMENT     beat  (#PCDATA)>
<!ELEMENT     beat-type     (#PCDATA)>
```

```
<!ELEMENT     bodypart    (#PCDATA)>
<!ELEMENT     direction    (#PCDATA)>
<!ELEMENT     level  (#PCDATA)>
<!ELEMENT     contraction (#PCDATA)>
<!ELEMENT     rpin   (#PCDATA)>
<!ELEMENT     hc     (#PCDATA)>
<!ELEMENT     hook (#PCDATA)>
<!ELEMENT     vl     (#PCDATA)>
```