Conditions of Bon Odori Dances Belonging to Akita Prefecture's Nanshu-Odori System in the Era of Sugae Masumi

TAKESHI MIURA[†1] TAKAAKI KAIGA[†2] TAKESHI SHIBATA[†3]
HIROAKI KATSURA[†1] MADOKA UEMURA[†1] DAIZO SASAKI[†4]
KATSUBUMI TAJIMA[†1] HIDEO TAMAMOTO[†5]

Abstract: In this study, we focus on an investigation into the Bon Odori dances belonging to Akita Prefecture's Nanshu-Odori System in the era of Sugae Masumi, a travelogue writer in the later Edo period. To examine the relationship between the depictions of the old dances in Sugae's travelogue and the current situation, we use motion-capture data of the Bon Odori dances currently existing in the Nanshu area. As a result of investigation, a corresponding relationship was suggested between the dancing poses illustrated in the travelogue and the keyposes extracted from the motion-capture data. This information is expected to serve as an important material to examine the historical transition of the dances.

Keywords: folk performing art, folk dance, Bon Odori, Akita Prefecture, Sugae Masumi, motion capture

1. Introduction

In Akita Prefecture located in the Tohoku region of Japan, a lot of attractive folk dances have been passed down. In particular, the Nanshū area[*1] is known as an area where *Bon Odori* dances[*2] have been most actively performed in the prefecture [1], [2]. By investigating the *Bon Odori* dances of this area in detail, therefore, much valuable information contributing to understanding the folk performing arts of Akita Prefecture is expected to be obtained.

Bon Odori dances are thought to have been passed down over the centuries [3]. In most cases, however, much information on the old days of them is now lost. Therefore, it is not sufficiently clear how they were performed in the old days, and how their old choreography relates to the present one.

As for the *Bon Odori* dances of the Nanshū area, fortunately, some descriptions about them in the later Edo period remain in a travelogue written by Sugae Masumi[*3] (1754-1829, a travelogue writer in the early-modern times of Japan [4], [5]). Although its information is not necessarily sufficient due to the fact that at that time there was no means to accurately record dance motion, his detailed descriptions with illustrations may serve as important materials to estimate the conditions of the old dances.

Taking the above situation into consideration, we focus on an investigation into the conditions of the Nanshū-area *Bon Odori* dances in the era when Sugae was alive. To examine the relationship between the depictions of the old dances in Sugae's travelogue and the current situation, we use motion-capture (Mocap) data of the *Bon Odori* dances currently existing in the Nanshū area. Specifically, we compare the dancing poses appearing in an illustration in Sugae's travelogue with the keyposes[*4] extracted from the Mocap data.

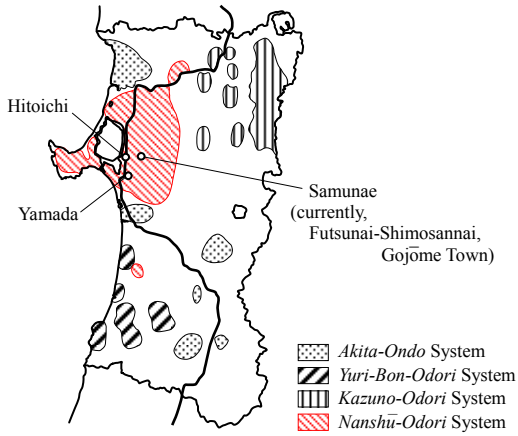


Fig. 1 Distribution of *Bon Odori* systems in Akita Prefecture around 1937 (created by tracing the map on page 17 of Ref. [2]).

2. Old *Bon Odori* Dances Described in Sugae's Travelogue

2.1 Classification of *Bon Odori* dances in Akita Prefecture

According to Kodama's classification[*5] [2], *Bon Odori* dances of Akita Prefecture are grouped into four systems as shown in **Fig. 1**. In this classification, the *Bon Odori* dances of the Nanshū area comprise an independent single system called *Nanshū-Odori* System. From Fig. 1, one can recognize that *Nanshū-Odori* System occupies a relatively large non-separated area, whereas the areas of the other systems are sparsely scattered. Moreover, Ref. [8] suggests that the settlements

†1 Akita University
†2 Warabi-za Co., Ltd.
†3 Muroran Institute of Technology
†4 Akita Industrial Technology Center
†5 Tohoku University of Community Service and Science

*1 The word 'Nanshū' means the southern part of the old Akita County (currently, the area including Minami-akita County, Oga City, Katagami City and part of Akita City, i.e., the area enclosing Hachirōgata Lagoon).
*2 *Bon Odori* is a type of Japanese folk dance performed during the annual Buddhist festival called *O-Bon* (or simply *Bon*).
*3 'Sugae' is the family name followed by the given name 'Masumi' (this is the Japanese-style name order.). As for the authors of this paper, on the other hand, the English-style name order (given name-family name) is used.
*4 A keypose is defined as each of the representative poses in a motion sequence, and provides a highlight moment in the sequence [6].
*5 While working as an elementary school teacher, Kodama Gyōson (in the Japanese-style name order, 1881-1942) engaged in studying the folk performing arts of Akita Prefecture [7].

ⓒ2016 Information Processing Society of Japan

Table 1 Descriptions about the *Nanshū-Odori*-System *Bon Odori* dances in Sugae's "Hina no Asobi."

Original description (in old Japanese, reproduced from page 172 of Ref. [4])	English translation (translated by the authors)
十三日．魂斎するゆふべより，廿日夜かけて盆踊ぞせりける．其躍に品あり，「あねこもさ」「袖子おどり」「ばらゝおどり」「ちらしおどり」「三脚」「打小身」「三勝」などとりゞなれど，さんかつは，さうがもあらず，たゞはやしのみして踊りぬ．そがくさゞの諷辞など，いとふるめかし．おほつゞみを二ッも三ッも肩に掛てうち鳴らし，こと村に入れば「他郷へ越へて来た，僻とるな，ふしが揃はぬ御免なれ」と唄ふを聞て，その村の踊子等声を揃へて，「俄おどりを掛られた，足がそろはぬごめんなれ」亦「唄の地を聞けふしをきけ，ふしがそろはねでやごめんなれ」とも答へ唄諷ふ也． (The above descriptions are followed by the lyrics of the songs performed with the dances. They are omitted here.)	July 13[*a]. From the night of the Spirit Festival to July 20, *Bon Odori* dances are performed. There are a variety of dances: *Anekomosa*, *Sodeko Odori*, *Barabara Odori*, *Chirashi Odori*, *Miashi*, *Uchikomi*, *Sankatsu*, and so forth. *Sankatsu* is performed with an instrumental accompaniment that has no song. Their melodies and lyrics are quite old fashioned. Performers who beat several large drums slung over their shoulders enter a village and sing the phrase "I've come to another land, don't run away, pardon me for singing badly." While listening to the phrase, dancers of the village sing reply phrases such as "I've been abruptly challenged to a dance match, pardon me for stepping badly," or "Listen to the sound and melody of the song, pardon me for singing badly."

*a: Dates are in the old lunar calendar.

Fig. 2 An illustration of the *Nanshū-Odori*-System *Bon Odori* dances in Sugae's "Hina no Asobi" (Picture 28 in page 59 of Ref. [9] is reproduced.).

located in the area of *Nanshū-Odori* System are characterized by a remarkable diversity of dance-motion styles. These tendencies may have some relevance to the briskness of *Bon Odori* activity in the Nanshū area.

2.2 Descriptions of *Bon Odori* dances in Sugae's travelogue

Descriptions about the old *Bon Odori* dances belonging to *Nanshū-Odori* System exist in Sugae's "Hina no Asobi[*6]" [4], [5]. This is a travelogue written in a diary form, describing events that occurred in and around the Samunae settlement (currently, Futsunai-Shimosannai, Gojōme Town, location: shown in Fig. 1) in the summer of 1809.

Table 1 shows the descriptions about the *Bon Odori* dances seen in "Hina no Asobi." The second sentence of the English translation says that at least seven dances were performed at that time. According to Ref. [8], the number of dances performed in a settlement of the Nanshū area is generally larger than that of other areas. The descriptions of Table 1 suggest that this tendency might have already existed in the later Edo period.

Besides the above descriptions, there is also an illustration depicting two *Bon Odori* dancers dancing together. **Figure 2** shows the illustration. This was painted by Igarashi Ranji[*7], one of Sugae's acquaintances [4], [9]. This illustration is regarded as an important material to estimate the motion styles of the old *Bon Odori* dances, since visualized information on dancing poses hard to be described by textual information is provided. From Fig. 2, one can recognize that there are two different poses existing simultaneously, and grasp the state of each body part visually. We use this illustration to examine the conditions of the old dances comparatively with those of the extant dances.

Table 2 Analyzed *Bon Odori* dances.

Settlement	Dance	Motion capture data		
		Number of frames (Time)	Sensor	Dancer
Hitoichi	*Dendenzuku*	778 (25.9 s)	A	(a)
Yamada	*Dagasuko*	2403 (20.0 s)	B	(b)

Data: acquired through motion-capture experiments in which experienced dancers danced.

Sensor system
A: MotionStar Wireless (Ascension Technology Corporation) (30 fps)
B: MVN (Xsens) (120 fps)

Dancer
(a), (b): Female

3. Motion-capture Data Analysis of Extant *Bon Odori* Dances

3.1 *Bon Odori* dances used in motion-capture data analysis

Here, we introduce Mocap data as samples of the extant *Bon Odori* dances belonging to *Nanshū-Odori* System. To examine the relationship between the illustration of Fig. 2 and the extant dances, we extract keyposes from the above sample Mocap data and compare them with the poses in the illustration.

Table 2 shows the analyzed *Bon Odori* dances and the parameters of the Mocap data. We selected these dances from a set of dances passed down in the Hitoichi and Yamada settlements (location: shown in Fig. 1) through a preliminary keypose-extraction analysis; dances each giving a keypose highly relevant to any of the poses in Fig. 2 were selected (a method to extract keyposes and the extracted ones will be shown later). The selected dances are *Dendenzuku* and *Dagasuko*. The former has been passed down in the Hitoichi settlement,

*6 "Hina no Asobi" is a title written in old Japanese, meaning dance and musical performances in front of a god, carried out in a rural area.

*7 Igarashi Ranji (in the Japanese-style name order, ?-1814) was a townsman of Akita Domain (Akita Han). He engaged in Akita-Ranga paining (Dutch-style painting in the early-modern times of Akita Domain) [10].

ⓒ2016 Information Processing Society of Japan

whereas the latter in the Yamada settlement. These dances are performed with the same musical accompaniment, even though the locations of the settlements are different.

3.2 Keypose extraction

We use a keypose-extraction method proposed in Ref. [6]. This method extracts keyposes on the basis of the temporal variation of motion speed. Specifically, the moments giving local minima in a motion-speed time series are first detected. Each local minimum is rated by its intensity value obtained from the degree of speed drop, and the ones categorized as those of little significance are ignored. The remaining local minima are finally selected as those giving keyposes. The actual procedure is shown below.

We first obtain the one-dimensional motion-speed time series $\boldsymbol{V}$ from the displacement of $J = 16$ joints (shoulders, elbows, wrists, fingers, knees, ankles, toes, neck and head, including end effectors):

$$v(n) = \frac{\sqrt{\sum_{j=1}^{J} \sum_{\gamma=x,y,z} \{p_{j,\gamma}(n+1) - p_{j,\gamma}(n)\}^2}}{\Delta t}$$

$$\boldsymbol{V} = [\, v(1) \quad v(2) \quad \cdots \quad v(N) \,]^{\mathrm{T}} \tag{1}$$

where $p_{j,\gamma}(n)$ (γ: x, y or z) is the γ-coordinate of the jth joint at the nth frame (coordinate system: fixed to the pelvis), $v(n)$ is the motion speed at the nth frame, Δt is the sampling time and N is the total number of frames, respectively. The values of $p_{j,\gamma}(n)$'s are filtered to eliminate jitter (by using a Gaussian filter, cut-off frequency: 10.0 Hz), and normalized by the body height to reduce the influence of difference in body constitution.

Next, the keypose-extraction algorithm shown in **Fig. 3** is applied to $\boldsymbol{V}$. The parameter values used in the algorithm are as follows: $f_{\min} = 0.2$ Hz, $f_{\max} = 8.0$ Hz, $r_{\mathrm{f}} = 0.95$ and $k = 2.75$ [6]. Finally, the structure of a set of extracted keyposes is examined based on their intensity values and the timing of appearance.

3.3 Results of keypose extraction

Figure 4 shows the result of keypose extraction for *Dendenzuku* passed down in the Hitoichi settlement. The musical accompaniment of this dance has the time signature 2/2, and a sequence of its dance choreography consists of five measures [12]. A score in the bottom of Fig. 4 shows this structure. The Mocap data used in the analysis include three and four-fifths repetitions of the sequence. In Fig. 4, each of the extracted keyposes is shown with its intensity value. The dark-colored keyposes are the ones each corresponding to the down beat of each measure in the musical accompaniment.

The obtained result indicates that high-intensity keyposes appear at almost regular interval, and their occurrence is synchronized with that of the down beats of the musical accompaniment. Besides, their intensity values are almost the same. This enhances the regularity of rhythmic style, and, in addition, suggests the simplicity of rhythmic style.

Figure 5 shows the result for *Dagasuko* passed down in the Yamada settlement. As already mentioned in Section 3.1, the musical accompaniment of this dance is the same as that of *Dendenzuku*. The Mocap data used include three repetitions of a sequence of its dance choreography. In Fig. 5, the extracted keyposes and their relationship with the musical accompaniment are shown in the format identical to that of Fig. 4.

The obtained result shows that the rhythmic style of *Dagasuko* has a relatively high complexity compared with that of *Dendenzuku*. In fact, the intensity of the keyposes corresponding to the down beats of the musical accompaniment considerably fluctuated, and the other keyposes irregularly appeared. It would be worth noting that the two dances have such remarkably different characteristics, even though their

```
/* τ(m, i): Frame number of the mth local minimum at the ith time scale */
/* μ(m, i): Candidate number of the mth local minimum at the ith time scale */
/* M(i): Number of local minima at the ith time scale */
/* λ(m): Intensity of the mth candidate */
/* γ(m): Cluster number of the mth candidate */
/* τ_KP(m): Frame number of the mth keypose */
/* λ_KP(m): Intensity of the mth keypose */
/* M_KP: Number of keyposes */
/* ----- Extracting keypose candidates ----- */
input V, f_min, f_max, r_f, k
i ← 0
M(i) ← Number of local minima in V
for m = 1 to M(i) do
    τ(m, i) ← Frame number of the mth local minimum in V
    μ(m, i) ← m
    λ(m) ← 0.0
end for
f ← f_max
/* ----- Calculating the intensity of keypose candidates ----- */
while f > f_min do
    i ← i + 1
    M(i) ← Number of local minima in F_LP[V, f]
    for m = 1 to M(i) do
        τ(m, i) ← Frame number of the mth local minimum in F_LP[V, f]
    end for
    Correspondence(τ, μ)
    for m = 1 to M(i) do
        Δλ ← Speed-descent value of the mth local minimum
        λ(μ(m, i)) ← λ(μ(m, i)) + Δλ
    end for
    f ← f · r_f
end while
/* ----- Deleting candidates of little significance ----- */
Categorization(λ, γ, k)
M_KP ← 0
for m = 1 to M(0) do
    if γ(m) > 0 then
        M_KP ← M_KP + 1
        τ_KP(M_KP) ← τ(m, 0)
        λ_KP(M_KP) ← λ(m)
    end if
end for
output τ_KP(m), λ_KP(m) (1 ≤ m ≤ M_KP)
```

$\boldsymbol{F}_{\mathrm{LP}}[\boldsymbol{V}, f]$: application of a low-pass filter with the cut-off frequency f to the one-dimensional motion-speed time series $\boldsymbol{V}$.

$\Delta\lambda$ for the mth local minimum at the ith time scale: the absolute value of the $\tau(m, i)$th coordinate of the time series $\boldsymbol{F}_{\mathrm{LP}}[\boldsymbol{V}, f] - \boldsymbol{F}_{\mathrm{LP}}[\boldsymbol{V}, f/2]$.

Correspondence(τ, μ): a procedure to fix the correspondence of local minima at the ith time scale ($\tau(m, i)$) to the keypose candidates (result: outputted to $\mu(m, i)$) (A dynamic programming technique is used.).

Categorization(λ, γ, k): a procedure to categorize the keypose candidates based on their intensity values ($\lambda(m)$) (result: outputted to $\gamma(m)$) (A hierarchical clustering algorithm with Mojena's Stopping Rule One [11] is used.).

Fig. 3 The keypose-extraction algorithm [6].

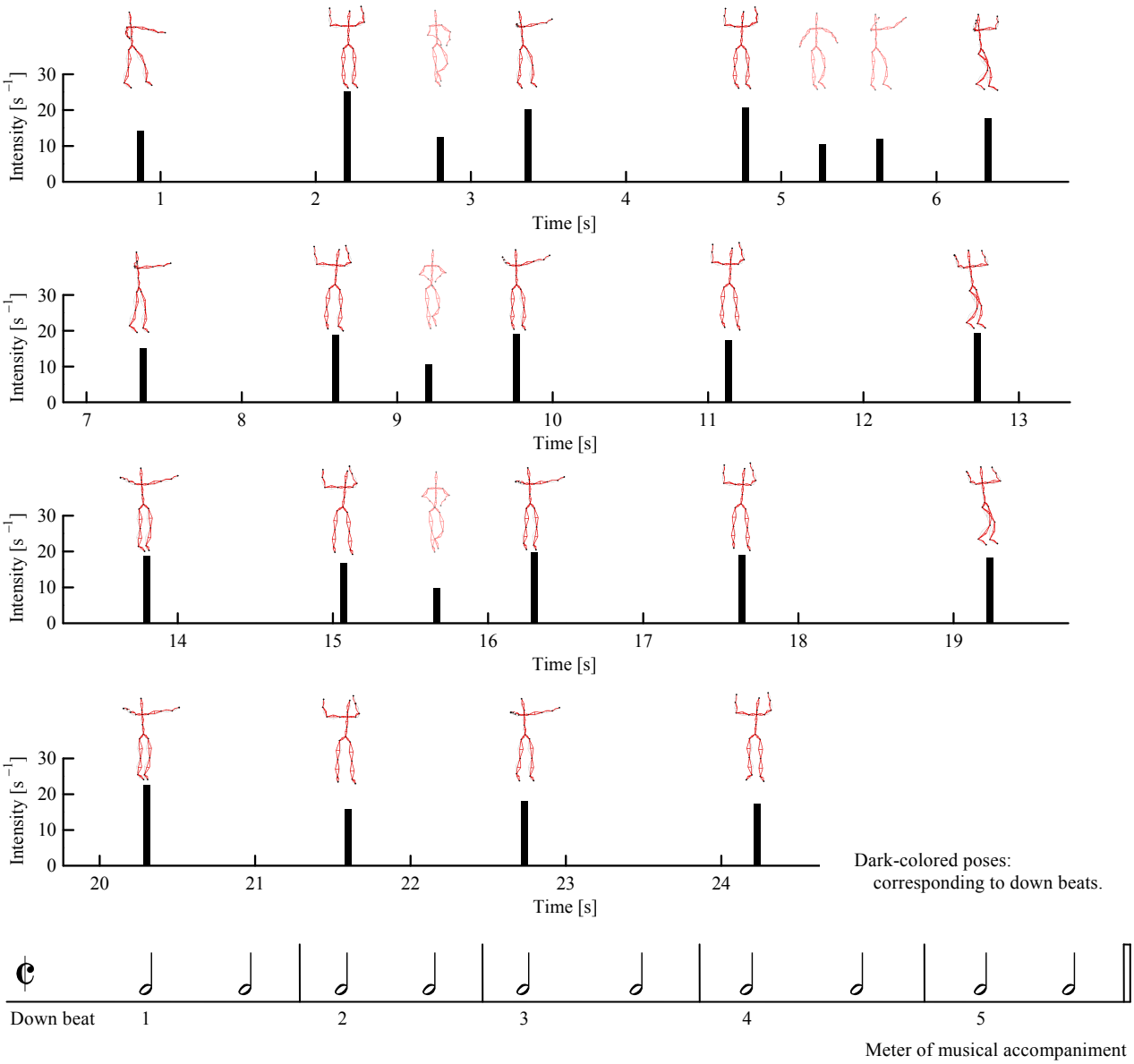


Fig. 4 Keyposes extracted from *Dendenzuku* of the Hitoichi settlement.

musical accompaniments are identical.

3.4 Keyposes corresponding to the down beats of the musical accompaniment

Here, we focus on the keyposes corresponding to the down beats of the musical accompaniment, since these poses are often regarded as important ones indispensable for illustrating the choreography of the dances[*8].

Figure 6 shows the average intensity values of the keyposes corresponding to the down beats. In the case of *Dendenzuku* passed down in the Hitoichi settlement (Fig. 6 (a)), all the keyposes gave almost the same intensity values as already mentioned in Section 3.3. However, if one can venture to say, the keypose corresponding to the third down beat gave the maximum intensity value.

As for the case of *Dagasuko* passed down in the Yamada settlement (Fig. 6 (b)), on the other hand, the intensity values considerably fluctuated as already mentioned in Section 3.3, and the keypose corresponding to the third down beat gave the maximum value. This is the same down beat as that of *Dendenzuku*. In other words, the most important keypose in the motion sequence of *Dendenzuku* appears simultaneously with that of *Dagasuko*.

4. Comparison of the Poses in Sugae's Travelogue with the Keyposes Extracted from Motion-capture Data

We compare the poses in Fig. 2 (i.e., the dancing poses of the old *Bon Odori* dances depicted in Sugae's travelogue) with the

*8 In Ref. [12], the choreography of *Dendenzuku* was explained by using these poses (additional poses were also used as needed). As for *Dagasuko*, these poses were used in a choreography-explanatory material created by the local residents of the Yamada settlement (additional poses were also used in this case as well). This material was distributed in a *Bon Odori* practice meeting in the summer of 2015.

ⓒ2016 Information Processing Society of Japan

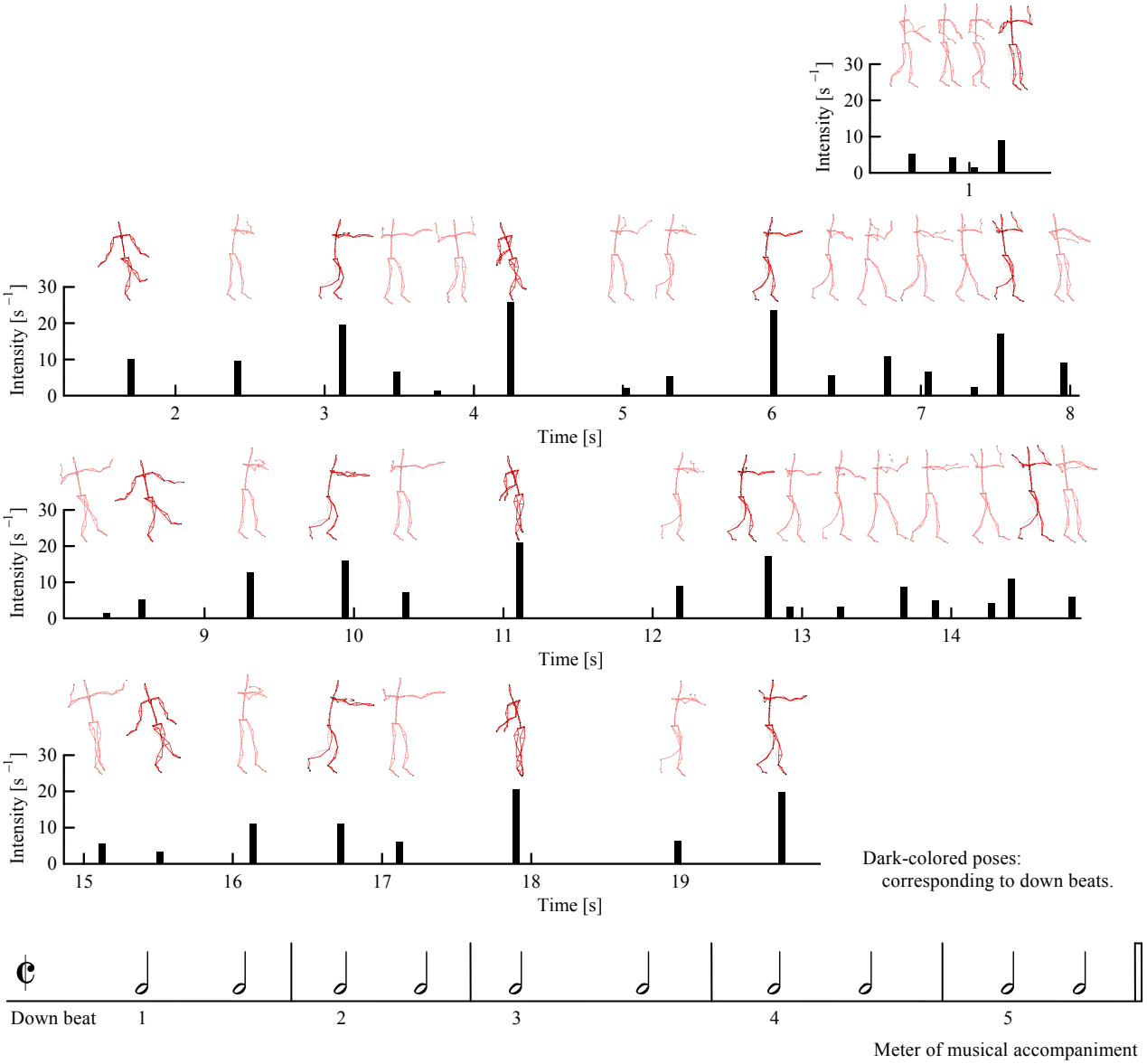


Fig. 5 Keyposes extracted from *Dagasuko* of the Yamada settlement.

keyposes selected from Fig. 6 (i.e., the maximum-intensity keyposes extracted from the extant *Bon Odori* dances). These poses are shown together in **Fig. 7**. One can recognize from Fig. 7 that the keypose of *Dendenzuku*, in which both arms are extended sideways, corresponds to the pose wearing a blue kimono in the illustration, whereas the keypose of *Dagasuko*, in which the upper body is rotated clockwise, corresponds to the pose wearing a red kimono. This suggests that the very moment of the third down beat was depicted in the illustration.

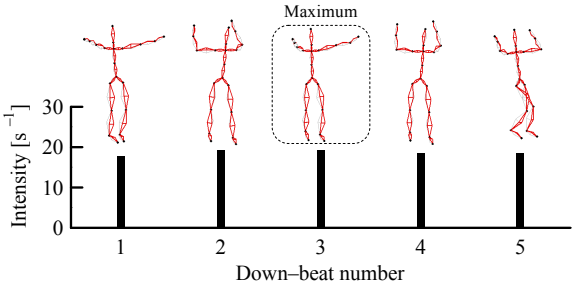
At the present time, *Dendenzuku* and *Dagasuko* are not performed simultaneously in the same location. Nevertheless, Fig. 7 suggests that in the era of Sugae a dance resembling *Dendenzuku* were performed simultaneously with another dance resembling *Dagasuko*. In the descriptions of Table 1, there is a scene in which dance performers visit another village and challenge its residents to a dance match. Such a custom might have provided a situation in which different dances were performed simultaneously, and is estimated to have become obsolete in the later period due to some reason.

As for the shape of the poses in the illustration, the blue-kimono pose in which both arms are extended sideways is now seen in multiple *Bon Odori* dances belonging to *Nanshū-Odori* System. All of them have the dance names similar to *Dendenzuku* (e.g., *Daidaizuku* [13], etc.), and are performed with almost the same musical accompaniments. Their dance-choreography sequences are also almost the same as that of *Dendenzuku*[*9].

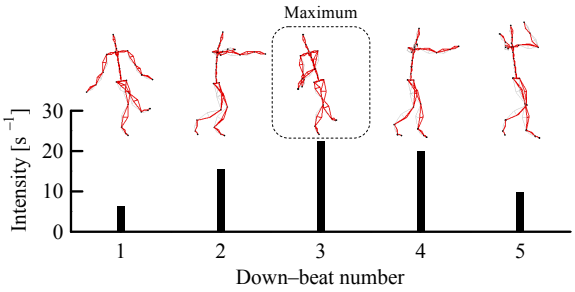
To our knowledge, on the other hand, the red-kimono pose in which the upper body is rotated clockwise now remains only in the choreography of *Dagasuko*. This suggests that only the Yamada settlement has kept one of the old-fashioned styles passed down from the era of Sugae. Additional work is needed

*9 This can be confirmed by the videos opened to the public at the web page of Ref. [13].

ⓒ2016 Information Processing Society of Japan



(a) *Dendenzuku* of the Hitoichi settlement.



(b) *Dagasuko* of the Yamada settlement.

Fig. 6 Average intensity values of the extracted keyposes corresponding to the down beats of musical accompaniment.

to clarify why the choreography similar to *Dendenzuku* has been passed down widely in multiple locations, and why a particular old-fashioned style remains only in the Yamada settlement, even though the musical accompaniment of *Dagasuko* is the same as that of *Dendenzuku*.

5. Conclusions

In this study, we focused on an investigation into the *Bon Odori* dances belonging to *Nanshū-Odori* System in the era of Sugae. As a result of investigation, a corresponding relationship was suggested between the dancing poses illustrated in Sugae's travelogue and the keyposes of the extant dances. The obtained information is expected to serve as an important material to examine the historical transition of the dances.

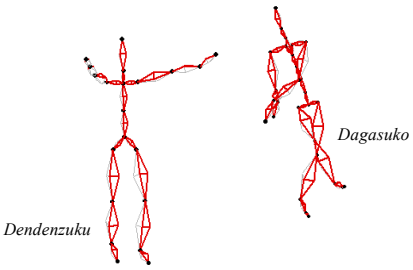


Fig. 7 Comparison of the dancing poses in Sugae's "Hina no Asobi" with the extracted keyposes. (Illustration in Sugae's travelogue: part of Picture 28 in page 59 of Ref. [9] is reproduced.)

Reference

[1] Akita Kyōdo Geijutsu Kyōkai (Akita Local Arts Association), ed.: *Akita Kyōdo Geijutsu* (*Akita Local Arts*), Akita Kyōdo Geijutsu Kyōkai (1934) (in Japanese).

[2] Japan Broadcasting Corporation, ed.: *Tōhoku Min'yōshū Akita Ken* (*A Collection of Folk Songs of Tōhoku Region: Akita Prefecture*), Japan Broadcast Publishing Association (1957) (in Japanese).

[3] Lancashire, T. A.: *An Introduction to Japanese Folk Performing Arts*, Ashgate (2011).

[4] Uchida, T. and Miyamoto, T., ed.: *Sugae Masumi Zenshū Daiyonkan* (*Sugae Masumi's Complete Works*, *Vol.4*), Miraisha (1973) (in Japanese)

[5] Uchida, T. and Miyamoto, T., trans. and ed.: *Sugae Masumi Yūranki 5* (*Sugae Masumi's Travel Records*, *Vol.5*), Heibonsha (1968) (in Japanese).

[6] Miura, T., Kaiga, T., Katsura, H., Tajima, K., Shibata, T. and Tamamoto, H.: Adaptive Keypose Extraction from Motion Capture Data, *Journal of Information Processing*, Vol.22, No.1, pp.67-75 (2014).

[7] Minzoku Geijutsu Kenkyūjo (Ethno-Arts Research Center), ed.: *Akita Min'yō Sodate no Oya Kodama Gyōson* (*Kodama Gyōson, The Fosterer of Akita Folk Songs*), Mumyosha Shuppan (2013) (in Japanese).

[8] Miura, T., Kaiga, T., Shibata, T., Katsura, H., Uemura, M., Tajima, K. and Tamamoto, H.: Motion Characteristics of Bon Odori Dances in Areas along Ushu Kaido Road in Akita Domain, *IPSJ Symposium Series* (*JINMONCOM 2015*), Vol.2015, No.2, pp.269-276 (2015).

[9] Taguchi, M., ed.: *Sugae Masumi Zueshū Akita no Fūkei* (*A Collection of Sugae Masumi's Illustrations - The Landscape of Akita*), Mumyosha Shuppan (2006) (in Japanese).

[10] Taguchi, M.: *Sugae Masumi Tokuhon 4* (*The Sugae Masumi Reader, Vol.4*), Mumyosha Shuppan (2000) (in Japanese).

[11] Mojena, R.: Hierarchical Grouping Methods and Stopping Rules: An Evaluation, *The Computer Journal*, Vol.20, No.4, pp.359-363 (1977).

[12] Akita-ken Hachirōgata-machi Kyōiku Iinkai (Education Board of Hachirogata Town, Akita Prefecture), ed.: *Hitoichi Bon Odori Chōsa Hōkokusho* (*The Search Report on Hitoichi Bon Odori*), Akita-ken Hachirōgata-machi Kyōiku Iinkai (2005) (in Japanese).

[13] CRESI, Akita International University, ed.: *Akita Minzoku Geinō Ākaibusu* (*Akita Folk Performing Art Archives*), CRESI, Akita International University (2013) (in Japanese, available from <http://www.akita-minzoku-geino.jp>).

Acknowledgments This study was supported by Grants-in-Aid for Scientific Research (No. 26370942) of Japan Society for the Promotion of Science. The motion-capture data of *Dagasuko* passed down in the Yamada settlement were provided by Akita University's Center of Community Project "Regional Development Aimed at Promoting an Independent Aging Society in Which All Individuals Have Value."

ⓒ2016 Information Processing Society of Japan