

Geographic, Historical and Motion Characteristics of Bon Odori Dances in Akita Prefecture

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In Akita Prefecture, Japan, many Bon Odori dances have been passed down in respective regional communities (Bon Odori: one of the Japanese folk dance categories). A technique of map deformation was introduced in a previous study to effectively visualize the relationship between the motion characteristics of Bon Odori dances and the geographic elements of the regional communities. To provide the knowledge of historical factors in addition to the information on the geographic and motion characteristics of the dances indicated in the deformed map, we try to visualize the relationship between the historical items and the Bon Odori dances. Specifically, we analyze the documents describing the local history of the settlements where the regional communities passing down the dances have existed. This approach provides a scatter plot indicating the relevance of the historical items extracted from the documents to the settlements. As a result, the relationship among the geographic, historical and motion characteristics of the Bon Odori dances in Akita Prefecture is effectively visualized.

1. Introduction

In Akita Prefecture, Japan, many *Bon Odori* dances*¹ have been passed down in respective regional communities, and each dance has been strongly affected by the geographic and historical conditions of each region [1]. By investigating their regional motion-characteristic variation and analyzing its relevance to the geographic and historical factors of corresponding regions, we can clarify what kind of influence the surrounding environment has had on the culture of a respective community.

As for the relationship between the regional distribution of dance-motion characteristics and the geographic elements of the regional communities, a technique of map deformation was already introduced in a previous study [2]. This approach effectively visualizes geographically-referenced quantitative data, and helps intuitively understand the overview of the above data. We provided a deformed map having the style of a hybrid of circle and distance cartograms [2], [3], [4]. As a result, the regional distribution of the motion characteristics of the *Bon Odori* dances in Akita Prefecture was effectively visualized [2].

Although the above approach makes it possible to intuitively grasp the relationship between the motion characteristics of the dances and the geographic elements, it is difficult to understand the influence of historical factors, which are thought to be important in passing down the dances over a long period, from only the information on the obtained deformed map.

*¹ *Bon Odori* is a type of Japanese folk dance performed during the annual Buddhist festival called *O-Bon* (or simply *Bon*).

To provide the knowledge of the historical factors, we try to visualize the relationship between the factors and the *Bon Odori* dances passed down in Akita Prefecture. Specifically, we analyze the documents describing the local history of the settlements where the regional communities passing down the *Bon Odori* dances have existed. We adopt the technique of Ref. [5] in which the combination of qualitative and quantitative document analysis approaches is used.

The above approach provides a scatter plot indicating the relevance of the historical items extracted from the analyzed documents to the settlements where the dances have been passed down. As a result, the relationship among the geographic, historical and motion characteristics of the *Bon Odori* dances in Akita Prefecture is effectively visualized.

2. *Bon Odori* Dances of Akita Prefecture

Table 1 shows the *Bon Odori* dances of Akita Prefecture investigated in this study. The dances passed down in ten settlements are investigated. These dances have been traditionally categorized into three groups [6] as shown in the table*². To construct the deformed *Bon Odori* map in which the configuration of the settlements is changed based on the dance features, the motion characteristics of the above dances are quantitatively extracted by numerically analyzing

*² The *Bon Odori* dances of Akita Prefecture have been categorized into four groups: *Kazuno-Odori*, *Nanshū-Odori*, *Akita-Ondo* and *Yuri-Bon-Odori* Systems [6]. However, most of the dances belonging to the *Yuri-Bon-Odori* System have been lost until now [7]. Therefore, only the dances belonging to the remaining three groups are investigated in this study.

Table 1 *Bon Odori* dances of Akita Prefecture.

Group	Settlement	Dance	Mocap data (No., time)
<i>Kazuno-Odori</i> System	Kemanai	<i>Dainosaka</i>	3*, 10.8 s
		<i>Jinku</i>	3*, 9.9 s
<i>Nanshū-Odori</i> System	Hitoichi	<i>Dendenzuku</i>	3*, 6.6 s
		<i>Kitasaka</i>	6*, 5.5 s
		<i>Sankatsu</i>	4*, 11.6 s
	Yamada	<i>Kitasaka</i>	5#, 5.5 s
		<i>Dagasuko</i>	4#, 6.9 s
		<i>Sankatsu</i>	5#, 11.8 s
<i>Akita-Ondo</i> System	Kubota	<i>Akita Ondo</i>	1*, 67.8 s
	Nakasen	<i>Donpan Odori</i>	1*, 33.8 s
		<i>Emazō Jinku</i>	1*, 32.7 s
		(no name)	1*, 59.3 s
	Kakumagawa	<i>Ondo</i>	3*, 44.5 s
		<i>Ganke</i>	3*, 41.1 s
	Iwasaki	<i>Otoko Odori</i>	1*, 72.6 s
		<i>Onna Odori</i>	1*, 73.8 s
	Masuda	(no name)	2*, 69.2 s
	Innai	<i>Innai Ginzan Odori</i>	4*, 29.3 s
<i>Innai Ginzan Ondo</i>		2*, 39.3 s	

Mocap data: provided by Warabi-za Co., Ltd. (*) and the Center of Community (COC) Project of Akita University (#), time: mean time of all the Mocap data streams in a single dance.

the motion capture (Mocap) data shown in Table 1*³.

Figure 1 shows the geographic map of Akita Prefecture. The distribution of the ten settlements and the geographic elements including roads, rivers and lakes is indicated in the map. The configuration of these geographic elements will be deformed in the next section. It is seen in the map that the three *Bon Odori* groups are geographically separated.

3. Map Deformation

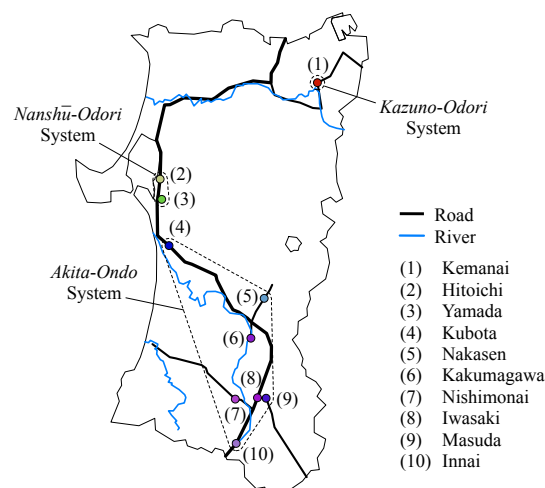
As already mentioned in Section 1, a technique of map deformation is used to visualize the relationship between the regional distribution of dance-motion characteristics and the geographic elements. We use the deformed map already constructed in Ref. [2]. The map has the style of a hybrid of circle and distance cartograms.

As shown in Table 1, there are several examples in each of which multiple dances are passed down in a single settlement. To represent the within-settlement motion-characteristic variation of multiple dances in such examples, the circle-cartogram part is adopted [2]. Each settlement is represented as a circle, and its radius represent the motion-characteristic difference in a plurality of dances passed down in it.

On the other hand, the distance-cartogram part is adopted to represent the between-settlement similarity of dance-motion-characteristic tendency [2]. The more similar the average dance motion characteristics of two settlements are to each other, the shorter the distance between them.

The above hybrid-type deformed map is constructed by the following procedures [2]. First, the procedure for the circle-cartogram part is executed. In

*³ The dataset identical to that in Ref. [2] is used.

**Fig. 1** Geographic map of Akita Prefecture.

this part, the motion characteristics of each Mocap data stream is extracted by phase plane analysis [8]. This approach provides motion-characteristic quantities of each Mocap data stream in the form of a simple low-dimensional feature vector having only six components (average motion amount (MA) and motion complexity (MC), each of which is quantified for each of the three axes of movement, i.e., the frontal, vertical and sagittal axes [9]).

The similarity between two dances is quantitatively evaluated by using a distance between two sets each of which comprises all the Mocap data streams belonging to either single dance of the two dances*⁴. The dances are plotted on a plane by applying a technique of multidimensional scaling (MDS) [10] to the obtained dataset of the between-dance distances. The radius of the smallest circle enclosing a set of all the plotted dances belonging to the same settlement is used as that of the settlement circle in the circle-cartogram part. On the other hand, each settlement circle is colored to indicate the average motion characteristics of the dances passed down in it*⁵.

Next, the procedure for the distance-cartogram part is executed. In this part, the similarity between two settlements is evaluated by calculating a distance between two sets each of which comprises a set of all

*⁴ In this case, the distance between two Mocap data streams is obtained by calculating the Euclidean distance between their feature vectors, and the between-set (i.e., between-dance) distance is obtained by calculating the Earth Mover's Distance (EMD) [11] in which a dataset of the above Euclidean distances is used [2].

*⁵ The smallest enclosing circle including all the dances plotted on the MDS plane is regarded as the HSV color space [12]. By drawing the axes of the motion-characteristic feature quantities on the plane in the prescribed manner, we can grasp the relationship between colors and motion characteristics. A color corresponding to the position of the center of a settlement circle is given to the settlement [2].

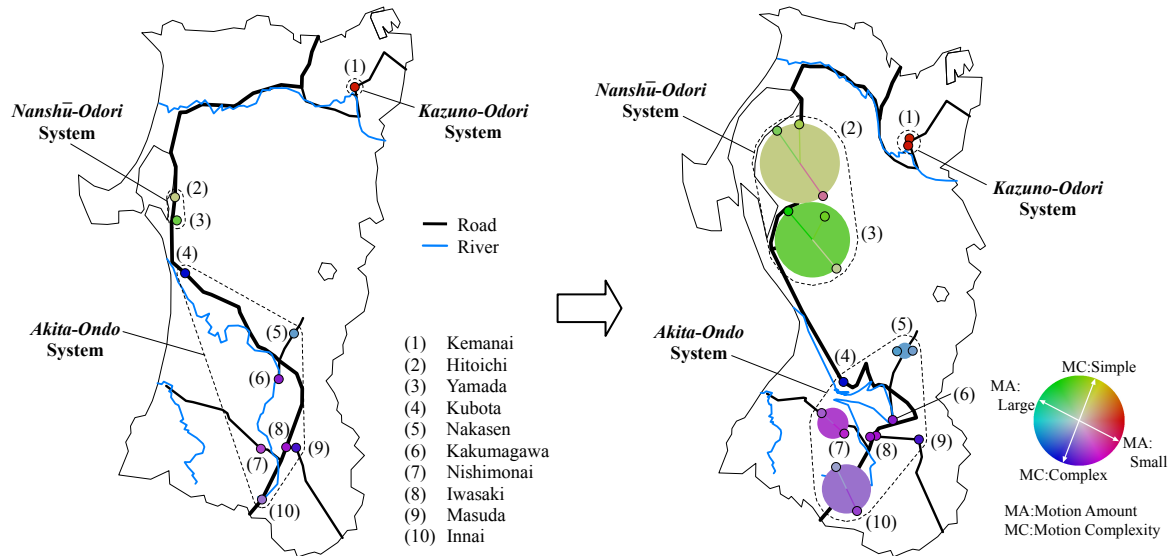


Fig. 2 Deformed map representing the distribution of motion characteristics of *Bon Odori* dances [2].

the dances belonging to either single settlement of the two settlements*⁶. By applying the modified circle-cartogram construction algorithm proposed in [2] to the combination of the settlement-circle-radius and between-settlement-distance datasets, we can finally obtain a deformed map having the style of a hybrid of circle and distance cartograms.

Figure 2 shows the obtained deformed map. As already mentioned in the first paragraph of this section, this map is identical to that obtained in Ref. [2] (constructed by analyzing the Mocap data shown in Table 1). It is seen in the map that each of the settlements belonging to the *Nanshū-Odori* System is largely expanded. This means that even the dances passed down in the same settlement have their respective different motion characteristics in the case of the *Nanshū-Odori* System. Geographically, these settlements exist in the coastal area of Akita Prefecture as shown in the map*⁷.

In contrast to the case of the *Nanshū-Odori* System, the circle of the Kemanai settlement belonging to the *Kazuno-Odori* System is extremely small, even though multiple dances exist in it. There is also contrast between the geographic location of the area of the *Nanshū-Odori* System (coastal area) and that of the *Kazuno-Odori* System (inland area).

On the other hand, the settlements belonging to the *Akita-Onodo* System are concentrated at a relatively narrow region in the southern part of Akita Prefecture. These settlements are connected by the traffic net-

work consisting of land and water routes (Ushū Kaidō Road and Omono River) as shown in the map.

As for the colors of the settlement circles, the relationship between motion characteristics and color is obtained as the color circle shown at the lower right part of Fig. 2 [2]. From this color circle, we can grasp that the three *Bon Odori* groups have different motion characteristics, respectively, as follows:

Kazuno-Odori: red (MA:Small)

Nanshū-Odori: green (MA: Large, MC: Simple)

Akita-Onodo: blue (MC: Complex)

(MA: motion amount, MC: motion complexity)

As already mentioned in Ref. [2], the above characteristics are almost consistent with those pointed out in previous studies (*Kazuno-Odori*: showing elegant and refined choreography [13], *Nanshū-Odori*: characterized by a simple but intense dancing style [14], *Akita-Onodo*: having a sophisticated dancing style including a variety of elaborate performance [15]).

4. Document Analysis

To visualize the knowledge of the historical factors that might be related to the motion characteristics of the dances, we perform document analysis using the historical documents of the settlements in which the dances have been passed down. The local-history documents shown in Table 2 are used in the analysis. These are the documents describing the local history of the municipalities*⁸ each of which includes one of

*⁶ The between-set (i.e., between-settlement) distance is obtained by calculating the EMD in which a dataset of the between-dance distances is used [2].

*⁷ Akita Prefecture faces the sea on the west.

*⁸ These municipalities are the ones existed prior to the so-called great merger of municipalities in the Heisei era carried out in the mid-2000s. We selected this situation to keep the extracted information on each settlement as pinpoint as possible.

Table 2 Documents of local history.

Settlement	Document	No. of coded paragraphs
Kemanai	“The History of Kazuno City” (Kazuno City, ed., Vol. 1: 1982 and Vol. 2, No. 1: 1986)	1,462
Hitoichi	“The History of Hachirōgata Town” (Hachirōgata Town History Compilation Committee, ed., 1977)	234
Yamada	“A Record of Shōwa Town” (Shōwa Town History Compilation Committee, ed., 1986)	413
Kubota	“The History of Akita City” (Akita City, ed., Vol. 2: 1999 and Vol. 3: 2003)	3,197
Nakasen	“The History of Nakasen Town” (Nakasen Town History Compilation Committee, ed., 1983)	882
Kakumagawa	“The History of Ōmagari City” (Ōmagari City, ed., 1999)	752
Nishimonai	“The Local History of Ugo Town” (Ugo Town History Compilation Committee, ed., 1966)	525
Iwasaki	“The History of Yuzawa City” (Yuzawa City History Compilation Committee, ed., 1965)	433
Masuda	“The History of Masuda Town” (Masuda Town History Compilation Committee, ed., 1997)	697
Innai	“The History of Ogachi Town” (Ogachi Town History Compilation Committee, ed., 1961)	236

All documents: written in Japanese.

1: There is no description about the medieval times in “Ōmagari.”

the settlements where the analyzed dances have been passed down*⁹. The parts of the documents related to the ages from the medieval times to the early-modern times (i.e., the period *Bon Odori* dances spread around the country) are used. As already mentioned in Section 1, we adopt the combination of qualitative and quantitative document analysis approaches [5].

First, we apply template analysis [16], one of the techniques of qualitative data analysis*¹⁰, to the documents. In template analysis, a list of codes (i.e., a template) representing items identified in document data is extracted. The template is generally organized in a hierarchical structure to easily grasp the relationship among the extracted items.

We regard each of the paragraphs constituting the documents as a segment coded in the analysis (Table 2 shows the number of the coded paragraphs in each document). As a result, a set of 77 items classified into 17 fields was extracted as a template. **Table 3** shows the extracted fields and items. As shown in the table, the fields are further classified into four categories.

Next, we apply correspondence analysis [17], one of the techniques of quantitative data analysis, to the

two-way table giving the relative frequencies*¹¹ of the items in each document (i.e., each settlement). As a result, the scatter plot indicating the relevance of the items shown in Table 3 to the settlements is obtained.

Figure 3 shows the obtained scatter plot. Focusing on the fields belonging to the category ‘Industry,’ it is seen that only the items related to ‘Agriculture’ (in particular, the items corresponding to rice cultivation) concentrated around the settlements belonging to the *Akita-Onodo* System. As already mentioned in Section 3, these settlements are concentrated at a narrow region connected by the traffic network in the deformed *Bon Odori* map. This suggests that the concentration of the industrial fields at a specific type in the ages from the medieval times to the early-modern times may be related to the unification of dance motion characteristics, and the traffic network may be the key to the above concentration/unification of this group.

On the other hand, the items corresponding to various industrial fields were scattered around the settlements of the *Nanshū-Odori* and *Kazuno-Odori* Systems. This suggests that the diversity of industry might have affected the motion characteristics of the dances. In particular, the items related to fishery, commerce and ‘Transportation by water’ are close to the settlements of the *Nanshū-Odori* System. As already mentioned in Section 3, these settlements exist in the coastal area, and are largely expanded in the deformed *Bon Odori* map. The influx of articles from other regions transported through sea routes might have brought about a cultural variety in this coastal area, and thereby the expansion of dance-motion characteristics might have been caused in the ages from the medieval times to the early-modern times.

As for the *Kazuno-Odori* system, the item ‘*Nanbu*’ is close to the Kemanai settlement. In the clans shown in Fig. 3*¹², only the *Nanbu* clan dominated the same area in Akita Prefecture, i.e., the inland northeastern part of Akita Prefecture, through the medieval and early-modern times. The long-term stable government might have affected the dance-motion characteristics of this area (i.e., elegant and refined choreography giving relaxing atmosphere).

The above discussion is based on the deformed *Bon Odori* map shown in Fig. 2 and the scatter plot representing the distribution of document characteristics shown in Fig. 3. From this fact, one can recognize that the combination of the deformed map and the visualized document-characteristic distribution makes

*⁹ However, these documents are ordinary history books and not specialized in the history of folk performing arts including *Bon Odori* dances.

*¹⁰ In qualitative data analysis, each of the ‘segments’ in a document (or a set of documents) is manually ‘coded’ by investigating their meanings and context.

*¹¹ We use the value of the relative frequency of each item, instead of the absolute frequency, to eliminate the influence of the difference in document length.

*¹² These are the typical clans in the medieval times of Akita Prefecture. Each of the clans other than the *Nanbu* clan was destroyed during the medieval times or transferred to another territory in the beginning of the early-modern times.

Table 3 Categories, fields and items extracted by template analysis.

Category	Field	Item	Category	Field	Item					
Industry	Agriculture	1. General matters	Community life	Transportation	42. Roads					
		2. <i>Kokudaka</i> (amount of rice yields)			43. Transportation by water					
		3. <i>Kenchi</i> (land survey for imposing tax)			44. Post towns					
		4. <i>Nengu</i> (rice paid as land tax)			45. Education					
		5. <i>Jinushi</i> (a landlord in landlord-tenant farmer system)		46. Medicine						
		6. Land ownership for rice fields		47. Hunting						
		7. Development of new rice fields		48. Belief and performing arts						
		8. Agricultural water		49. Castles						
		9. Crop failure		50. Palaces						
		10. Utilization of rice for commercial purposes		51. Housing						
		11. Income from jobs other than farming		52. Migration from other regions						
		12. Grass sampling		53. Flood damage						
		13. Fruit cultivation		54. Fire						
		14. Agricultural livestock		55. Earthquake						
Forestry	15. General matters	16. Firewood	Politics	Clan	56. <i>Andō</i> Clan					
					57. <i>Onodera</i> Clan					
Fishery	17. Export of forestry produce	18. Forestry management	Administration	63. General matters	58. <i>Asari</i> Clan					
					64. Organization					
					65. Population					
Manufacturing	19. Inshore fishery	20. River fishery	Battle	66. Law	59. <i>Tozawa</i> Clan					
					67. Financial affairs					
					68. Tax affairs					
					69. Northern region of Akita Prefecture					
					70. Southern region of Akita Prefecture					
					71. Other regions					
					Stockbreeding	21. Fishery in Hachirōgata Lagoon	22. General matters	Geography	72. Northern region of Akita Prefecture	60. <i>Satake</i> Clan
										73. Southern region of Akita Prefecture
					Mining	23. Ceramics	24. Metal work	History	74. Other regions	61. <i>Nanbu</i> Clan
										75. Northern region of Akita Prefecture
76. Southern region of Akita Prefecture										
77. Other regions										
Commerce	25. Lacquerware	26. Woodworking	72. Northern region of Akita Prefecture	73. Southern region of Akita Prefecture						62. Other clans
										74. Other regions
Commerce	27. Natural asphalt	28. Liquor	75. Northern region of Akita Prefecture	76. Southern region of Akita Prefecture						63. General matters
					77. Other regions					
Commerce	29. Fermentation	30. Textile	75. Northern region of Akita Prefecture	76. Southern region of Akita Prefecture	64. Organization					
					77. Other regions					
Commerce	31. Horse	32. Cow	75. Northern region of Akita Prefecture	76. Southern region of Akita Prefecture	65. Population					
					77. Other regions					
Commerce	33. General matters	34. Gold	75. Northern region of Akita Prefecture	76. Southern region of Akita Prefecture	66. Law					
					77. Other regions					
Commerce	35. Silver	36. Copper	75. Northern region of Akita Prefecture	76. Southern region of Akita Prefecture	67. Financial affairs					
					77. Other regions					
Commerce	37. Iron	38. Lead	75. Northern region of Akita Prefecture	76. Southern region of Akita Prefecture	68. Tax affairs					
					77. Other regions					
Commerce	39. Sulfur	40. <i>Ichi</i> (market)	75. Northern region of Akita Prefecture	76. Southern region of Akita Prefecture	69. Northern region of Akita Prefecture					
					77. Other regions					
Commerce	41. Trade	41. Trade	75. Northern region of Akita Prefecture	76. Southern region of Akita Prefecture	70. Southern region of Akita Prefecture					
					77. Other regions					

it possible to concisely and visually summarize the relationship among the geographic, historical and motion characteristics of the *Bon Odori* dances in Akita Prefecture.

5. Conclusion

As mentioned in the above, the proposed approach effectively visualizes the information on the relationship among the geographic, historical and motion characteristics of the *Bon Odori* dances in Akita Prefecture, and helps intuitively understand their overview to a certain extent. Further study is needed to validate the appropriateness of the proposed approach.

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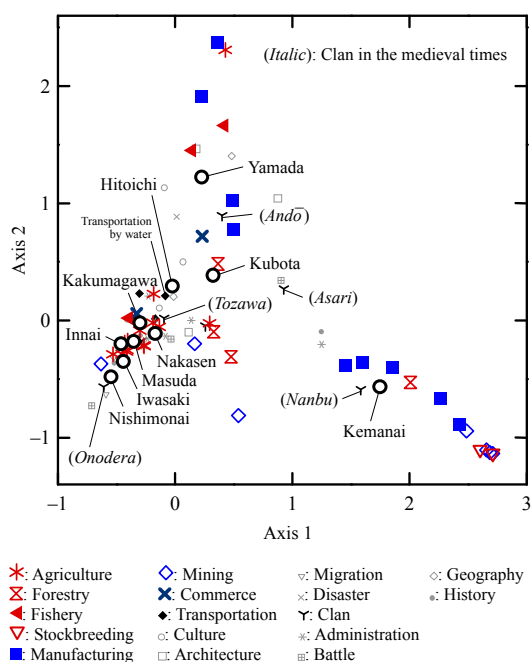


Fig. 3 Distribution of document characteristics (from the medieval times to the early-modern times).

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