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A Study on the Diagrams by Baien Miura and Sontoku Ninomiya

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Abstract. The diagrams drawn by Japanese thinkers in the Edo era are studied. Especially, the diagrams by two thinkers, Baien Miura (1723–1789) and Sontoku Ninomiya (1787–1856) are focused. They thought about human life and natural phenomena on each own unified principle, and formulated them into systems of the diagram. The interesting point is that their diagrams were drawn with similar forms, i.e. with 'circular' shapes and 'symmetry'. However, their symmetry properties are different; Baien's diagrams are mirror reflection but Ninomiya's ones are rotational symmetry. Therefore, this study aims at comparing the diagrams in terms of 'symmetry' and 'form'.

1. Introduction

1.1. Diagrams used in thinking process

Diagrams in general are mainly used for illustrating contents. However, the diagrams are also used as tools with which thinkers construct and develop their thoughts. This study focuses on this function of diagrams. This kind of diagram is intermediate representations between artistic icons and scientific signs such as mathematical formulas. In the western culture, examples of this kind of diagram are seen in the art of mnemonics in the Middle Ages. In the eastern culture, the diagrammatic representations were frequently used in order to expound theoretical ideas and religious doctrines. In addition, many diagrams were drawn by thinkers in Japan, especially in the Edo Tokugawa period (17th and 18th centuries). They represented their philosophical and theoretical ideas in diagrams, and used them in their thinking processes.

In this paper, a focus is given upon the diagrams drawn by two thinkers, Baien Miura (1723–1789) and Sontoku Ninomiya (1787–1856). They are called 'Gengo-zu' and 'Ichien-yugo-zu', respectively. Baien was a natural philosopher who was interested in investigating the universe. On the other hands, Ninomiya was the thinker and a policy maker for farmers to reform the agriculture. They have been regarded as the different types of thinkers from each other. However, an attention is paid to the common aspect that they showed in formulating their thoughts by the use of diagrams.

1.2. Forms of diagrams

An important point to be noted first is that the forms of their diagrams are similar to each other. Their common features are ‘symmetrical and circular forms’. Furthermore, another common point is that each thinker had his own regular symmetrical pattern of diagrams, and it was used as a prototype to extend to many diagrams for representing a great variety of contents. Forms of diagrams are considered to provide a valuable commentary in the study of diagrams for thinking process. Particularly, ‘symmetrical and circular form’ may offer a key to this study.

Therefore, it is reasonable to compare their diagrams from the following two points of view. First, the symmetry properties are analyzed. Secondly, their circular forms are analyzed.

2. Symmetrical Forms

Baien’s diagrams and Ninomiya’s ones are drawn with similar forms. However, the details of their symmetry properties are quite different. Let us start with the analysis of the differences of their symmetry properties.

2.1. Baien’s diagrams with mirror reflection

Baien’s philosophy is based on the unified principle as a dichotomy. He thought about nature and universe by dividing everything into two contrasting opposite concepts. Although Baien drew many diagrams over one hundreds, almost all of them had ‘mirror reflection’. For instance, the diagrams have mirror reflection with reverse colors (Fig. 1).

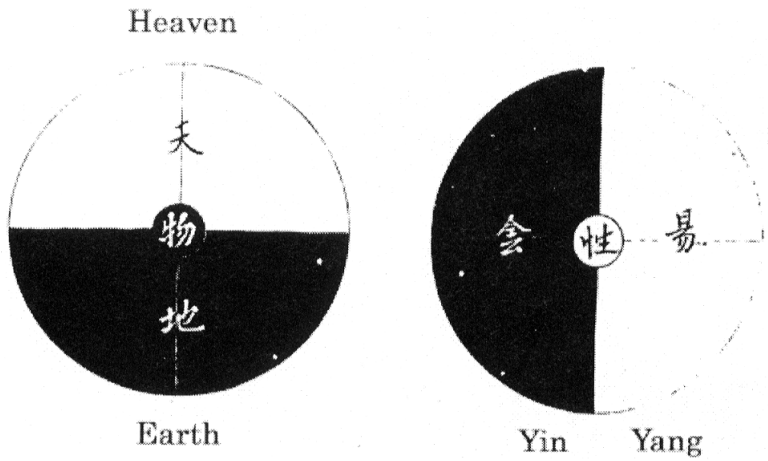


Fig. 1. ‘Gengo–zu’ (MIURA,1787) with additional explanations by the author. (The left diagram is called ‘Kibutsu-souto-sanritsu-zu’ and the right one is called ‘Ichiichi-souto-sanritsu-zu’.)

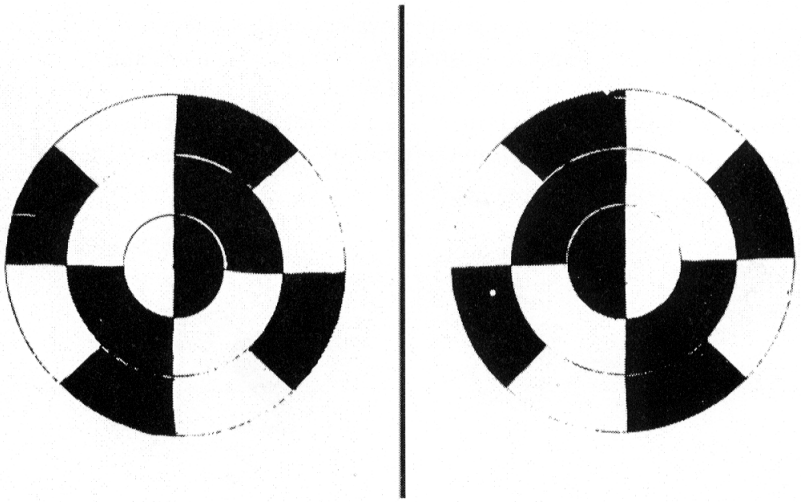


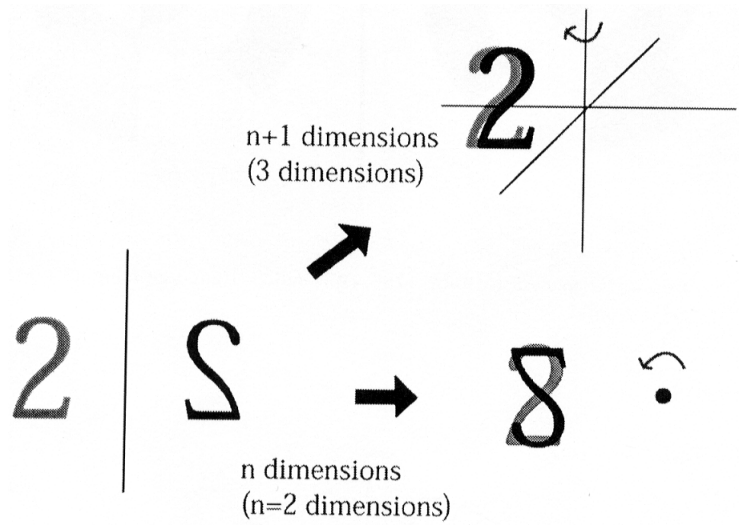
Fig. 2. ‘Gengo-zu’ (MIURA, 1787) (It is called ‘Bungo-zu-ichigou’.)

Fig. 3. ‘Gengo-zu’ (MIURA, 1787) (It is called ‘Ichiichi-seiso-zu’.)

The mirror reflection is also formed in the meanings of the Chinese characters. That is, the left diagram in Fig. 1 includes the opposite physical worlds, the heaven and the earth. The right diagram includes the opposite abstract meanings, Yin and Yang.

The diagram shown in Fig. 2 consists of two circular diagrams drawn on two facing pages of his book. In this case, a vertical line standing for a mirror is placed between the facing pages. It represents a dichotomic relation in an abstract manner.

(a)



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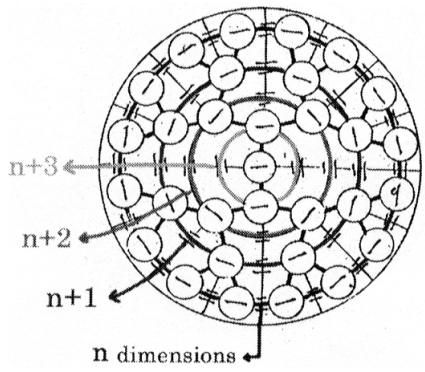


Fig. 4. (a) An example showing the definition of mirror reflection symmetry (Izuhara, R.). (b) 'Gengo-zu' (MIURA, 1787) with additional explanations by the author. (If concentric circles are supposed to represent levels of dimensions, two contrasting concepts in *n* dimensions would be treated as the same one concept in *n*+1 dimensions.)

The diagram shown in Fig. 3 is composed of concentric circles and branching lines expanding from the center to the circumference of the outer circle. The branching lines are connected with pairs of Chinese characters representing opposite meanings. This kind of diagrams has mirror reflection symmetry, whose mirrors are vertical planes including four diameters through the center.

Here, let us consider about the definition of mirror reflection in general (SHUBNIKOV, 1974; ROSEN, 1995). Geometrically, the mirror reflection is understood as follows, "In every space of *n* dimensions an asymmetric figure can be made to coincide with its reflection by rotating it through a space of *n*+1 dimensions" (GARDNER, 1964), as shown in Fig. 4a.

In the Baien's circular diagrams, two concepts placed at opposite points of branching lines on an outer circle are treated as contrasting concepts. Furthermore, these are treated as the same concept, which is placed at an upper convergent point of branching lines on an inner circle. If we suppose that each of the concentric circles of Baien's diagrams is looked upon as representing a level of the dimensions, inner circles should represent higher dimensions than outer circles. That is, it is interpreted that the diagrams represent the similar logical structure to the definition of mirror reflection (see Fig. 4b). Therefore, Baien's diagrams are mirror reflection in not only the forms but also the contents. In addition to this, it means that Baien treated relational concepts in hierarchical structures.

2.2. Ninomiya's diagrams with rotational symmetry

Ninomiya thought about natural phenomena and human life and even agricultural

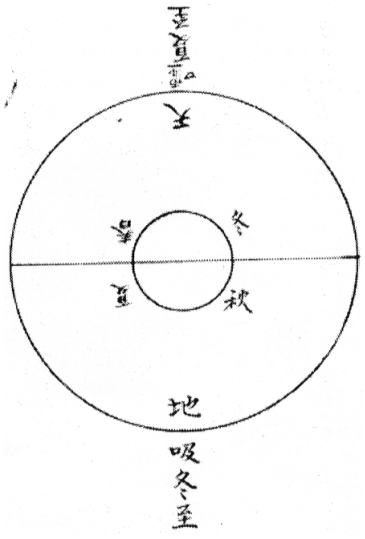


Fig. 5. 'Ichien-yugo-zu' (NINOMIYA, 1836) with additional explanations by the author. (It is called 'Tenmei-shijo-henka-no-zu'.) The picture source of Ninomiya's diagrams is the manuscript, 'Sansai Houtoku Kinmouroku', in Houtoku Museum.

policy. Almost all of his diagrams have rotational symmetry. For example, one of his diagrams represents a circulation of four seasons with a cycle of respiration (Fig. 5). His idea is that the spring and the summer are seasons of breathing out when plant life grows. On the contrary, the autumn and the winter are seasons of breathing in when plant life is harvested.

Another diagram represents a circular relationship between the opposite concepts, Yin and Yang (Fig. 6). Characters described in the diagram are 'fire and wind' with 'Yang' in the upper circle and 'water and earth' with 'Yin' in the lower circle. Although it looks like mirror reflection, it is rather a two-fold rotational symmetry with reverse concepts because each character in the upper circle corresponds to the opposite character in the lower circle by rotating the diagram by 180 degree.

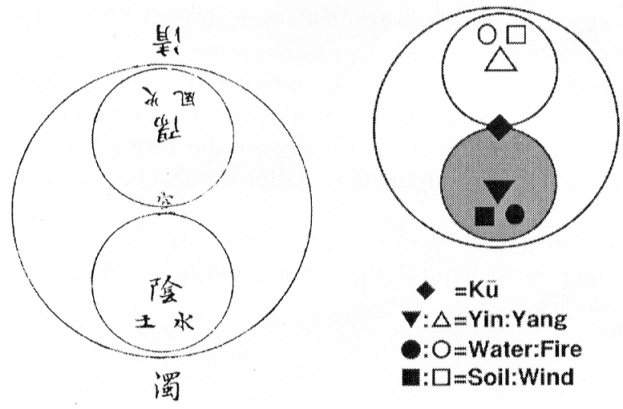


Fig. 6. Left diagram is 'Ichien-yugo-zu' (NINOMIYA, 1836). (It is called 'Inyou-seibou-no-zu'.) Right one is the interpretative diagram by the author.

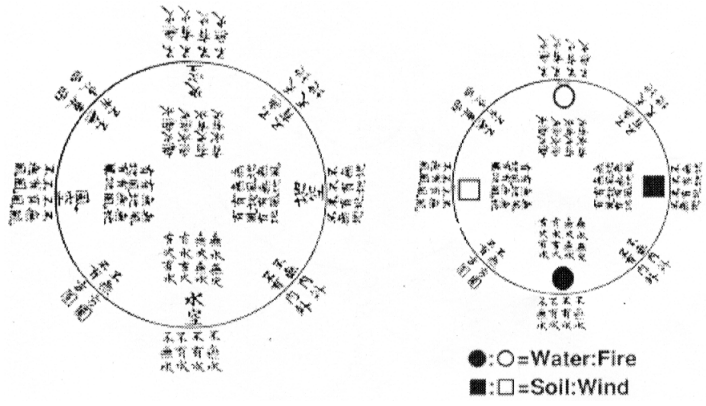


Fig. 7. Left diagram is 'Ichien-yugo-zu' (NINOMIYA, 1836). (It is called 'Ichigen-no-ron-zu'.) Right one is the interpretative diagram by the author.

More complicated diagram shown in Fig. 7 represents two pairs of opposite elements. It has also rotational symmetry with reverse concepts. Fig. 8 shows a circle of twelve fan-shaped elements corresponding to twelve months of a year. It represents the rotational causality for the affluent society. Twelve concepts arranged on the circle are linked by the circular relationship with the cause and effect. He drew many diagrams of this form for various circular concepts.

We may say that Ninomiya focused upon the processes. He thought that everything was related by rotational causality with the passage of time. It means that Ninomiya treated the relational concepts in circular structure. It is similar to the cyclic interpretation of reincarnation in Buddhism. After all, the unified principle of Ninomiya is connected to the rotational symmetry.

In summary, while the symmetry properties of their diagrams are different, their attributes to reflect their ways of thinking on regular symmetrical patterns have much in common.

3. Circular Forms

We go on to the next point, i.e. that all their diagrams are drawn with the circular form. Why did they draw the diagrams in a circle? This question should be analyzed from basic natures of circle and sphere.

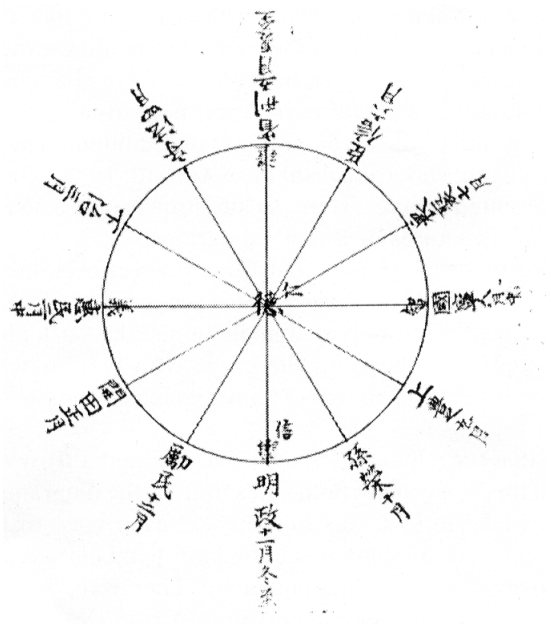


Fig. 8. ‘Ichien-yugo-zu’ (NINOMIYA, 1836.) (It is called ‘Tenmei-chisei-rinne-no-zu’.)

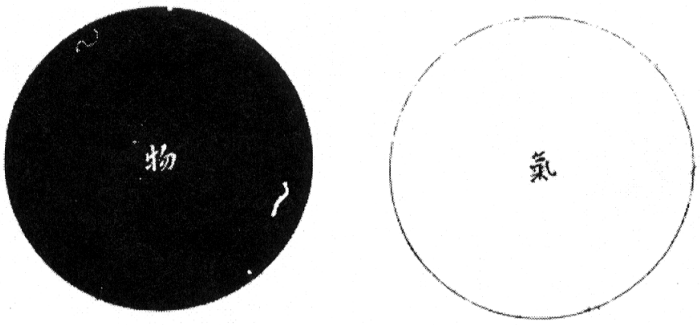


Fig. 9. The one of 'Gengo-zu' (MIURA, 1787) consisting of two circular forms. (It is called 'Kibutsu-soushoku-konsei-zu-ichigou'.)

3.1. Baien's diagrams with spherical forms

Although all Baien's diagrams are drawn with circles, they may be divided into two kinds of patterns. The first one is consisted of two circular diagrams (Fig. 9), while the second one is consisted of only a circle with branching lines and concentric circles in it (Fig. 10). We consider the problem for the two kinds of patterns separately.

For the former pattern Baien wrote, 'The earth is a sphere like a handball. The rough form of the earth is drawn in the left side of the page. We should see the form through piling up two diagrams in front and back pages, because the form is a sphere like a handball.' (MIURA, 1765). This quotation is useful to interpret not only the three-dimensional form of the earth but also the images of the diagrams Baien thought. The first scholar to give much attention to this writing was Takahashi (TAKAHASHI, 1977, 1981). He supposed that Baien's diagrams represented spheres. Here, an attention is paid also to his description and to the three-dimensional structures of Baien's diagrams.

There are two types in the diagrams consisting of two circles. In the first type, the two circles are drawn on the front and back pages. In the second type, they are drawn on the left and right pages. It is suggested strongly that he imagined the earth globe as models of the diagrams and represented the polarity of the globe with two circles. Furthermore, two drawing ways of two circles are considered to represent his view of the world from different angles.

We usually think that the paper is two-dimensional media. However, Baien regarded it as three-dimensional media by using both sides of it. In the diagrams with two circles on front and back pages, each circle seems to represent each view of hemisphere so as to express opposite concepts. As we cannot see the both hemispheres at the same time, we cannot recognize opposite concepts simultaneously. Therefore, he may have drawn each concept on the front or back page separately (Fig. 11).

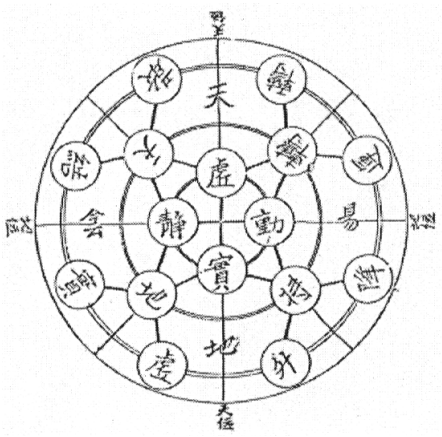


Fig. 10. The one of ‘Gengo-zu’ (MIURA, 1787) consisting of one circular form. (It is called ‘Taibutsu-zu’.)

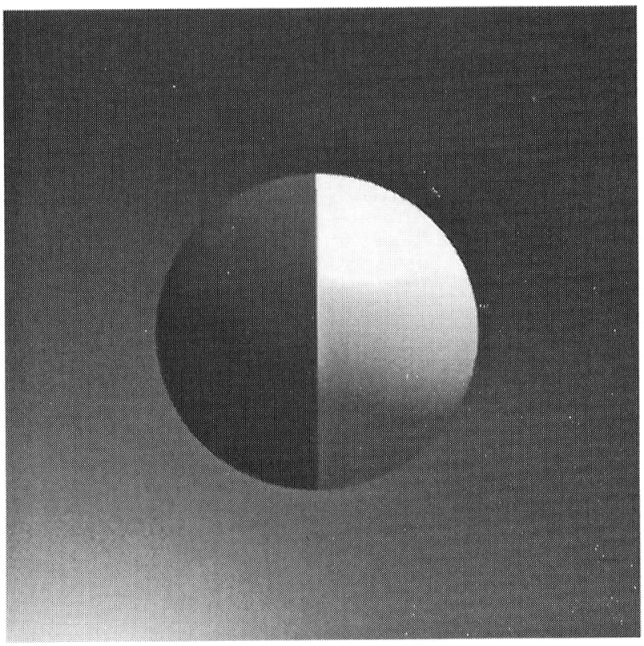


Fig. 11. 3-D Image of a diagram with two circles on front and back pages (Izuhara, R.).

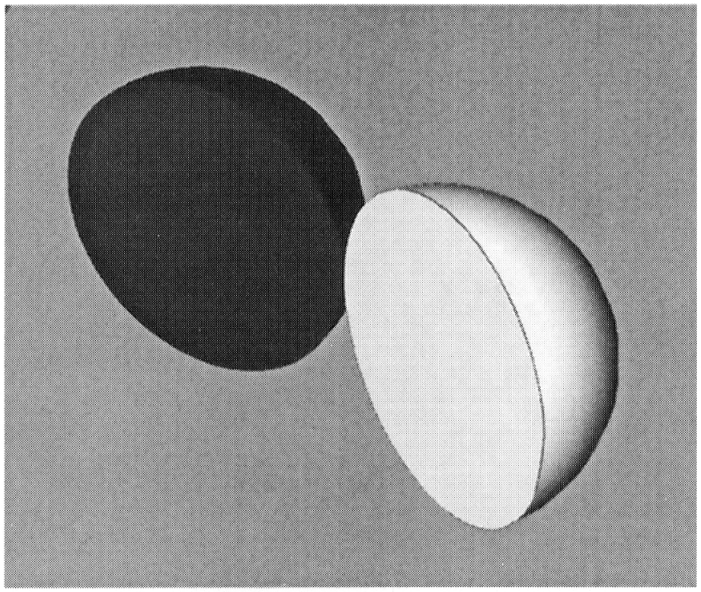


Fig. 12. 3-D Image of a diagram with two circles on left and right pages (Izuhara, R.).

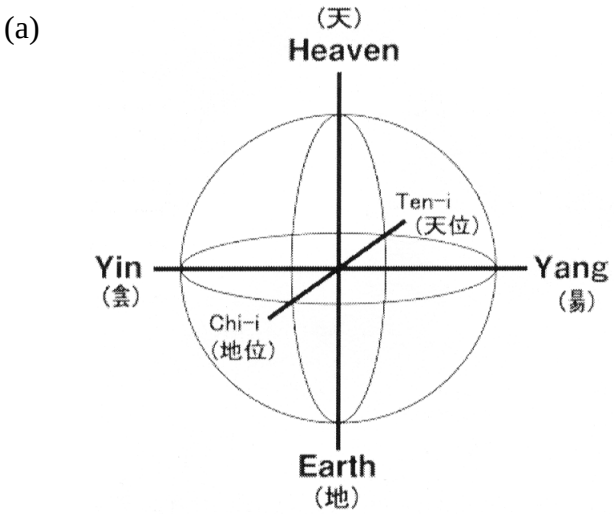
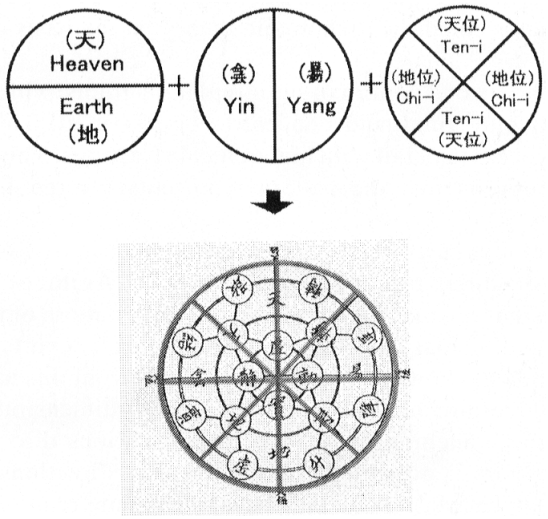


Fig. 13. (a) Three basic poles corresponding to three pairs of the basic opposite concepts (Izuhara, R.). (b) Three pairs of the basic opposite concepts (Izuhara, R.). (c) Schematic diagram showing Baien's drawing method (Izuhara, R.).

(b)



(c)

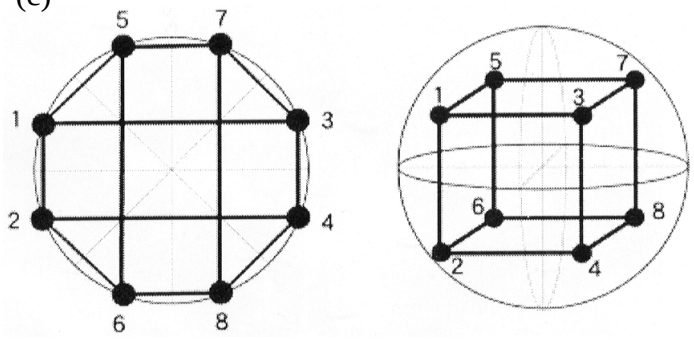


Fig. 13. (continued).

On the other hand, in the diagrams with two circles on the left and right pages, both circles seems to represent cross sections by dividing a sphere into two. Baien inscribed that we should compare the opposite concepts and recognize the universe by unifying the both concepts. That the two cross sections are placed side by side seems to urge a comparison of the opposite concepts (Fig. 12). Note that the two cross sections are put together by

closing the page, i.e. it unifies the both concepts.

After all, Baien's circular diagrams are considered to represent spherical forms. It is guessed that Baien represented the dichotomic theory on the basis of the polarity of the earth.

Let us consider the second pattern of his circular diagrams, which is consisted of one circle including branching lines and concentric circles in it. This kind of diagrams represents dividing process in detail with hierarchical structures. This author would like to put forward the hypothesis that the pattern represents a three-dimensional structure (IZUHARA, 1999).

This kind of diagrams is based on the three circles divided into two or four corresponding to three pairs of opposite directions of the space (Fig. 13a). As three circles are layered up, eight fan-shaped divisions are made up, which is the basic pattern of this kind of diagrams (Fig. 13b). These eight divisions can be replaced with the eight parts of a sphere by using Baien's drawing method as shown in Fig. 13c. It follows from this idea that the diagrams are projections of a three-dimensional structure into two-dimensional one. In the three-dimensional image, the branching lines grow toward various directions (Fig. 14). The mirror reflection symmetry is possible by fixing the grow directions.

In summary it is emphasized that Baien's circular diagrams represent three-dimensional spheres. The diagrams have elements for representing the three-dimensional structure. Therefore, his diagrams with mirror reflections are drawn on the basis of the polarity in the space.

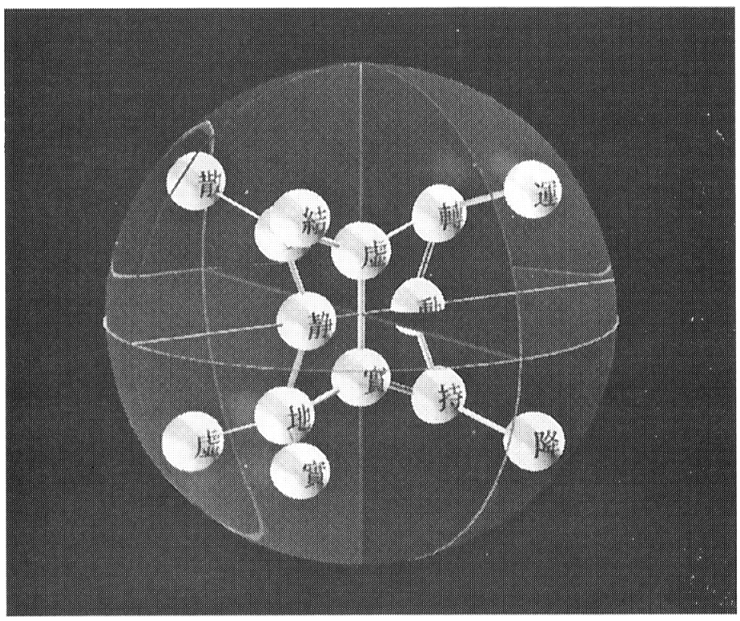


Fig. 14. 3-D Image of 'Gengo-zu' (Izuhara, R.).

3.2. Ninomiya's diagrams with flat circles

Ninomiya's diagrams have similar circular forms as Baien's ones. Then, did he imagine a spherical image, too? According to the opinion of this author his diagrams do not represent spherical images, but flat two-dimensional circles. The reason is that Ninomiya's diagrams do not have elements consisting of three-dimensional structure as Baien's ones. Furthermore, he did not need a three-dimensional structure to express his principles, because his relational concepts are formed with the circular flow along one curve.

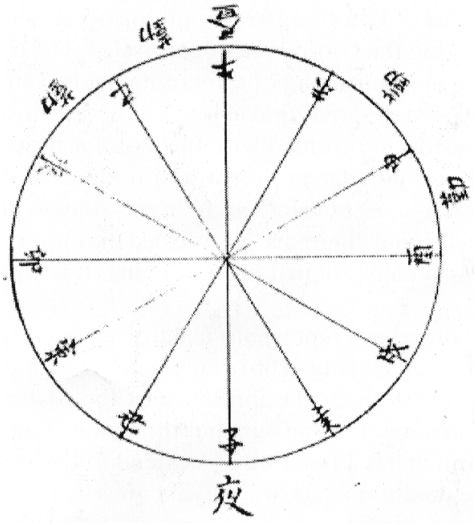
This kind of diagrams is popular in the eastern traditional diagrams (NAGY, 1995; WASHBURN, 1988). Ninomiya is considered to have drawn his diagrams under the influence of the eastern traditional diagrams. He grasped the opposite concepts in rotational relation, so that the diagram can be rotated in a flat plane. It is similar to the famous Yin-Yang symbol (Fig. 15).

One of Ninomiya's diagrams represents a daily cycle (Fig. 16a), while another diagram represents a yearly cycle (Fig. 16b). This pattern with division of a circle into twelve is also considered to be under the influence of the eastern traditional diagrams, which are based on the movement of the sun and the moon. Figure 17 shows a Chinese diagram of the Yi-King, which has a function of a calendar. In the diagram, each month or time is placed at the same position as in Ninomiya's ones.

In addition, the Chinese character meaning 'oneself' is frequently placed at the center in Ninomiya's diagrams. It seems to suggest that he regarded ourselves as the central

Fig. 15. The Chinese diagram called 'Taikyoku-zu' (KO, 1796). (The picture source is the manuscript, 'Ekizu-meiben', in Toyo Bunko.)

(a)



(b)

Fig. 16. (a) ‘Ichien-yugo-zu’ (NINOMIYA, 1836.) (It is called ‘Kenseimin-gongyo-no-zu’.) (b) ‘Ichien-yugo-zu’ (NINOMIYA, 1836) (It is called ‘Zaihou-zougen-no-kai’.)

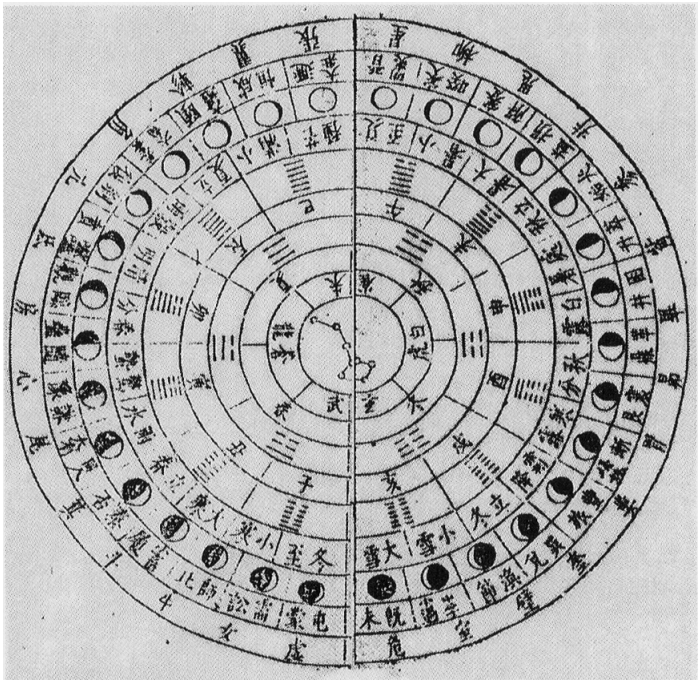


Fig. 17. The diagram of 'Yi-King' (KO, 1796). (The picture source is the manuscript, 'Ekizu-meiben', in Toyo Bunko.)

existence of any thought. It means that his way of thinking was influenced by the geocentric theory. Therefore, this author would like to think that Ninomiya's diagrams were drawn on the basis of the revolution of the sun or the circular movement of the universe with passage of the time. His circular diagrams are planer representations to express circular flow.

The discussion in this section has shown that Baien's diagrams and Ninomiya's ones were drawn with the same circular forms, yet Baien's ones represent spherical images while Ninomiya's ones represent flat circles.

4. Conclusion—Space and Time

In this study, a difference of their ways of thinking is made clear through analyzing the forms of their diagrams. The both thinkers drew circular and symmetrical diagrams which represent their principles of thoughts, and used them as prototypes for developing their thoughts. It is emphasized that they were aware of the 'symmetrical rule' in natural phenomena and regarded it as a unified principle for all, nature, human activities and even spiritual concepts. Although their symmetrical rules were different, both of them observed nature and found laws in it. Therefore, they schematized the symmetrical rules in diagrams with 'symmetrical forms'.

A discussion is made on ‘circular forms’, which is another noteworthy point of this study. To draw the world with a circle is the common method over the world since the ancient times. Since circle means ‘complete’ and ‘whole’, the circular diagrams were applied to symbolize the unified principle of comprehensive world. The point to be stressed is that the idea to draw symmetrical and circular form might be based on the view that the principle of natural phenomena could be applied to a unified principle for all affairs.

In conclusion, Baien’s diagrams made of spherical images with mirror reflection are based on the polarity of the earth. On the other hand, Ninomiya’s diagrams of flat circles with rotational symmetry are based on the circular movement of the universe. That is to say, Baien schematized his principle from spatial concepts, while Ninomiya schematized his principle brought from the passage of time.

‘Space and time’ and ‘symmetry’ are the fundamental viewpoints in human culture. ‘Mirror reflection’ is closely related to the spatial perception, while ‘rotational symmetry’ is connected with change of the time. It is the basis of their diagrammatic representations.

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