Environmental Value Orientation Between Residents and Visitors in Kuranda Tropical Rainforest

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1. Introduction

Some anthropologists and environmental scientists have studied the Kuranda Tropical Rainforest for more than 30 years (see Bottoms 1992: 7–29; 1999, Harris 1978: 113–137; Henry 1994: 294–305; Humston 1998; Toohey 1994: 122–133). The site is world famous for its richness of ethnological artifacts and natural resources. Nowadays the borders of environmental science have been extended considerably, especially regarding the ecological aspects of environmental value (Beinat 1997; Ouderkirk and Hill 2002; Poltorzycki 2001). Firstly, the components of environmental value orientation are related with historical and economical background of each community. Secondly, environmental value is defined as cognition toward the surroundings by human beings. Thirdly, environmental value is bound up with the historical and social existence of human beings related with land (see Hiatt 1982: 13–26). In other words, environmental value is a kind of human cognition limited by the way we live at a give time (Rowlands 2000: 17–33). For example, it means the basis of all aspects of life in traditional Aboriginal society (Edwards 1988: 12–25). In Western society, on the other hand, environmental value can also take into account the economic cost (price) of the environment. However, we wonder if it is useful to put a price on the changeable ambiguity of natural resource. We wonder if it is useful to discriminate culture from nature and discriminate man-made systems from ecosystems. Indeed, several environmental impact studies have distinguished culture from nature in Queensland (Hilbert, D. W et al. 2001: 590–603; Mercer 1991: 110–123; Tracy 1982).

This is the background against which, in Section 2, we will illustrate differences in environmental cognition over Kuranda between 150 residents and 150 visitors revealed by interviews. Section 3 will analyze the environmental value orientation in both a resident group (n=3) and a visitor group (n=3) using the photo projection method. Section 4 will estimate the balance in environmental value through vector analysis. The reason why the method used in Section 2 differs from that used in Section 3–4 is that interview seemed to be optimal as a means of analyzing conceptual cognition (environmental value and landscape) of community people (Section 2), while analysis of experimental perception photographs seemed to be more suitable in Section 3–4. By using these two methods which complement each other, this article aimed at suggesting that the conflict occurring in a given community between residents and visitors actually reflects the conflict between everyday life and non-everyday life of individuals.

Since a host-guest approach for studies of tourism was proposed in the 1970s (Smith 1989: 1–17), studies on natural resource management conducted in the United States have been primarily based on the view that the viewpoints of residents as a group can be placed in opposition to the viewpoints of visitors as a group. Meanwhile, tourism and recreation can be viewed as issues in a common framework for both hosts and guests since these activities promote sustainable development for both groups (Curtis 2002: 27–36). For example, Marion studied the relationship between visitors' perceptions and managers' responses (Marion and Lime 1986). Peterson clarified the congruence between perception and aspiration (Peterson 1974: 169–193). In these studies, greater importance was attached to the conceptual cognition of researchers than to the experimental perception of visitors. In contrast, studies on the Barron River that flows through Kuranda emphasized the reality of the areas along this river (Pearson and Penridge 1992), the experiences of visitors (Scenic Spectrums 1995) or the residents' situation (Environmental North 2002). The present study will focus on the preferential environmental value in Kuranda by comparing the concepts of researchers with the experiences of test subjects. This study is based on a hypothesis that residents and visitors do not necessarily have opposed viewpoints but are contiguous members of a pool of individuals, with their cognition of the moment varying depending on their immediate situation. However, individual changes over time are difficult to analyze by means of interviews. For example, the contingent valuation method, which assesses the value of different dimensions on a uniform scale, "price", is not valid for a multicultural society like Kuranda where the population is composed of a mixture of Aborigines, Torres Strait Islanders, Europeans, Asians and Muslims, with diverse lifestyles (Cameron 1988; Carson 1995; Freeman 1933). The travel cost method, which involves indirect determination of the price of the environment on the basis of data pertaining to economic trends, is also not valid as a means of adequately assessing the diversity and variability of this kind of society (Qiu et al. 2003: 47–62). In environmental science, a viewpoint characterized by asymmetric evaluation of positive and negative elements (Kahneman and Tversky 1979) is important. Moreover, there is ambiguity in the way by which individuals reach "positive" or "negative" judgments.

2. 1. Environmental Value between Residents and Visitors in Kuranda

In Australia, national policies based on economical unity function, as reflected in environmental assessments (Marsden 2002: 31–66), the economic impact of greenhouse abatement in the energy sector (Diesendorf 1998: 1–12) and environmental investment (Fayers et al. 2000: 173–201), are likely to be discrepant from community needs based on local history. This discrepancy is attributable to the differences between experiential cognition from everyday life and conceptual cognition from scientific experiment (Liberatore 1995: 59–83). In addition, the environmental issues in Northern Queensland, whose population is composed of a mixture of Aborigines and non-Aborigines, cannot be explained by a theory of opposition between Aboriginal and non-Aboriginal cognitions although this theory was valid when addressing anthropological issues such as a cultural park (Nakanishi 1998: 159–182) and sacred places (Nakanishi 1999: 187–212). When dealing with these issues, we must use indigenous knowledge to build ecological health, in collaboration with Aborigines (Muchena and Vanek 1995: 505–511, WTMA 2000: 3–9). Cultural diversity impacts ecosystem management processes and outcomes throughout Australia (Hill et al. 1999: 205–223). Recently, Aborigines have accepted urbanism symbolized by a nuclear family (a one-generation household composed of only parents and children) and urban consumerism. As a result, the environmental identity of Aborigines has begun to dissolve. In the past, Aborigines experienced inner conflict between the need of practicing their traditions to retain the “native title” and the necessity of adaptation to social changes. Early in the 1990s, construction of the Skyrail, passing through the tropical rainforest, was begun in Kuranda. At that time, residents of Kuranda were required to update their cognition. That is, Aboriginals who had been wavering in an indecisive manner between tradition and modernity were forced to take a clear stand. People against Kuranda Skyrail, including Aborigines, initially attached importance to ecological health (preservation of tropical rainforest, and protection of heritage), but many Aborigines and non-Aborigines later attempted to make use of the tropical forest in their own interests (Henry 1995: 6–8).

Therefore, when discussing environmental values in Kuranda, we need to adopt an approach that distinguishes between residents who attempt to preserve natural resources and visitors who attempt to make use of natural resources, rather than an approach which emphasizes ethnic origin of the people involved. The author thus investigated differences in environmental cognition between 150 residents and 150 visitors in Kuranda by interviews. The investigation examined the following three questions.

(A) What are the differences and similarities between residents and visitors?

(B) What aspects of environmental value on the part of residents changed after Skyrail construction, as compared to the pre-construction period, and what are differences between residents and visitors in this respect?

(C) Can the environmental cognition of residents and visitors be modified by the prevailing situation?

By resolving these three questions, the author attempts to demonstrate that the relationship between residents and visitors does not necessarily continue in a framework of opposition or confrontation. The author additionally attempts to show that individuals may have diverse cognitions when selecting a value tailored to a given situation.

2. 2. Residents and Visitors on a Dynamic Range of Value

Kuranda can be divided into seven areas. The number of residents is 660 in Central Kuranda, 930 in the directly northwest area of Kuranda, 634 in the McAlister Range area, 757 in South Kuranda, 48 in Southern Kuranda down the range, 420 in South Barron Falls National Park, 185 in North Kuranda, Kowrowa and Oak Forest. In total, 3,634 individuals reside in Kuranda, accounting for about 20% of the total population of Mareeba Shire (Mareeba Shire Council 2001: 215–222).

According to the records, the number of visitors to Kuranda was 665,000 in 1994/95, 732,000 in 1995/96, 803,000 in 1996/97, 867,250 in 1997/98, 936,500 in 1998/99, 1,011,500 in 1999/2000 and 1,092,500 in 2000/01(Mareeba Shire Council 2002: 8–11). It is noteworthy that the number of visitors in 2000/01 was 300 times the number of residents in the same years. This indicates that the cognition of visitors cannot be ignored when discussing the reality prevailing in Kuranda.

Two examiners interviewed residents and visitors along Coondoo Street, a downtown section of Kuranda, during the period from August 1 to 15, 2002, with a target of interviewing 10 individuals per day. Responses to the questionnaire were collected from 59 males (39.3%) and 90 females (60.0%) of all the residents interviewed, and one resident (0.7%) returned an unfilled questionnaire. Among all visitors interviewed, 66 males (44.0%) and 81 females (54.0%) responded to the questionnaire, with 3 visitors (2.0%) returning unfilled questionnaires. Among the responding residents, the percentage of females was higher than that of males, although this difference was not significant ($p > 0.05$). The number and percentage of residents and visitors were 6 (4.0%) and 13 (8.7%) in the age 0–9 group, 2 (1.3%) and 0 (0%) in the age 10–19 group, 16 (10.7%) and 8 (5.3%) in the age 20–29 group, 22 (14.7%) and 44 (29.3%) in the age 30–39 group, 20 (13.3%) and 16 (10.7%) in the age 40–49 group, 31 (20.7%) and 18 (12.0%) in the age 50–59 group, 35 (23.3%) an 29 (19.3%) in the age 60–69 group and 18 (12.0%) and 22 (14.7%) in the age over 70 group. The distribution of ages differed significantly between residents and visitors when tested by chi-square test ($p < 0.05$), while it did not differ significantly between residents and visitors when tested by Mann-Whitney test. Although some biases in age were noted, we cannot definitely conclude that the age distribution was prejudiced toward young or elderly groups. The interview used simple questions which could be readily answered so that even by children below 10 years of age who were not familiar with conceptual thinking and the visitors who had little local knowledge would be able to understand the intentions of the survey and to give answers to the questions without difficulty. Responses of residents and visitors to the above-mentioned three questions are compared below.

Regarding Question (A), significant differences between residents and visitors were noted in 8 of the 30 elements pertaining to environmental cognition and 4 of the 30 elements of environmental value ($p<0.05$, chi-square test). Residents attached greater importance than visitors to the following elements: economy, generation, revitalization of community, native title, owner's decision making, practical land use, tourism value, real estate value and biophysical value. Visitors attached greater importance than residents to the following elements: commons, government decision making, wilderness value and natural conservation value. These results indicate that residents attached importance to practical issues from everyday life while visitors emphasized ideal issues from non-everyday life. At a glance, the stance of the residents seems to be opposed to that of visitors. However, it seems more rational to say that the basic stances of individual residents and visitors show a gradational variation within a dynamic range.

Regarding Question (B), the prioritizing of major aspects of environmental value before and after Skyrail construction are shown for the resident group and the visitor group in Tables 1 to 10 and Figures 1 to 10. Chi-square test was employed to test the significance in the following differences: (1) wilderness value of residents between the pre- and post-Skyrail construction periods, (2) between biophysical value of residents before Skyrail construction and that of visitors, and (3) between natural conservation value of residents after Skyrail construction and that of visitors. These analyses yielded the following results.

(i) Among the residents, tourist resource value was the only aspect of environmental value which differed significantly between pre- and post-Skyrail construction periods ($p<0.05$). When signed Wilcoxon test was additionally used, significant differences were also noted in biophysical value, natural conservation value and art/craft value, in addition to tourism resource value.

(ii) When compared between residents before Skyrail construction and visitors, significant differences were noted only in real estate value ($p<0.05$).

(iii) When compared between residents after Skyrail construction and visitors, significant differences were noted only in wilderness value and natural conservation value ($p<0.05$).

(iv) After Skyrail construction, the number of residents placing first, second or third priority on biophysical value increased, while the number of residents placing first, second or third priority on the other 9 aspects decreased.

Table 1 Wilderness Value

	Before	After	Visitor
1	38.7	36.0	48.0
2	20.0	12.0	14.0
3	11.3	11.3	12.7

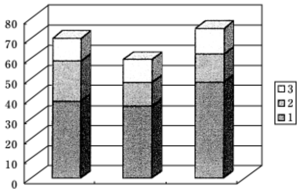


Figure 1 Wilderness Value

Table 2 Biophysical Value

	Before	After	Visitor
1	4.7	7.3	8.7
2	12.0	18.7	21.3
3	14.7	11.3	14.0

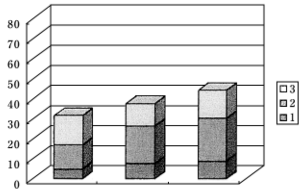


Figure 2 Biophysical Value

Table 3 Natural Conservation Value

	Before	After	Visitor
1	19.3	12.7	22.7
2	24.0	20.0	18.0
3	23.3	18.7	28.7

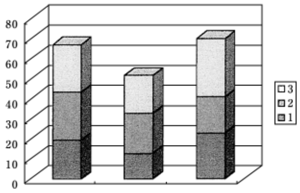


Figure 3 Natural Conservation Value

Table 4 Pastoral Value

	Before	After	Visitor
1	1.3	1.3	0.7
2	1.3	2.0	0.7
3	2.7	2.0	0.7

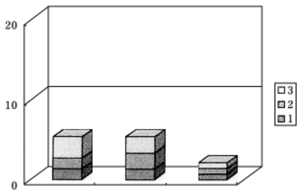


Figure 4 Pastoral Value

Table 5 Horticultural and Cropping Value

	Before	After	Visitor
1	1.3	0.7	0.7
2	1.3	2.7	2.7
3	4.7	3.3	4.7

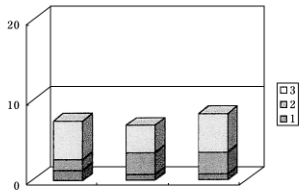


Figure 5 Horticultural and Cropping Value

Table 6 Key Timber Species Value

	Before	After	Visitor
1	1.3	2.0	1.3
2	3.3	2.7	3.3
3	6.7	3.3	1.3

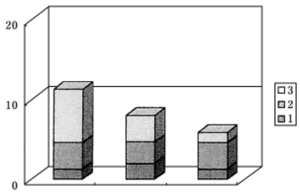


Figure 6 Key Timber Species Value

Table 7 Mining Resource Value

	Before	After	Visitor
1	0.7	0.0	0.0
2	0.0	0.0	1.3
3	1.3	2.0	2.0

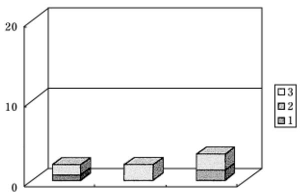


Figure 7 Mining Resource Value

Table 8 Tourism Value

	Before	After	Visitor
1	21.3	12.7	15.3
2	18.0	10.7	16.0
3	17.3	12.7	13.3

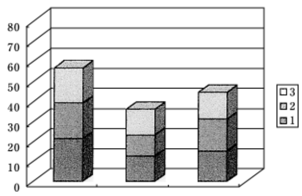


Figure 8 Tourism Value

Table 9 Art and Craft Value

	Before	After	Visitor
1	14.7	8.7	6.0
2	15.3	10.7	17.3
3	12.7	13.3	13.3

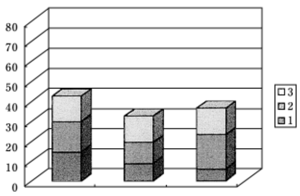


Figure 9 Art and Craft Value

Table 10 Real Estate Value

	Before	After	Visitor
1	3.3	2.0	0.7
2	4.0	3.3	0.0
3	2.0	2.0	4.7

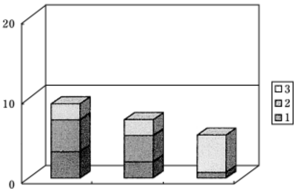


Figure 10 Real Estate Value

In Analysis (i), Skyrail construction was found to have stimulated tourism among residents, but it caused no major change in the other aspects of environmental value. Analysis (ii) revealed that the needs to real estate trade among residents decreased following Skyrail construction. Analysis (iii) showed that visitors placed high priority on wilderness value and natural conservation value, indicating their strong needs to environmental protection. Analysis (iv) revealed that for residents who attach importance to economical development, biophysical value specific to Australia is a common value that serves as a key factor when resolving sustainable development problems.

Question (C) is difficult to answer by a survey with interview. However, even for visitors who attach priority on wilderness value or natural conservation value, it is not easy to overlooked the economy, generation and local history closely related to everyday life, once these visitors have moved to Kuranda to live or have returned to their homeland. It is therefore quite probable that value orientation of residents and visitors changes depending on the prevailing situation.

The interview sheet used for this survey is shown in Appendix 1. Subjects were asked to choose one answer from among several for each question, except for the questions pertaining to profile and meaning of land which required a free answer. This method of survey is not capable of adequately assessing the diversity and variability of individual people. The free answers to the question on the meaning of land were classified on a seven-category scale. The time course of the situation surrounding individual subjects of the survey was not followed. In Section 3, diversity of value orientation in individual subjects will be analyzed by the photo projection method which gives adequate time to each individual and allows him/her to take pictures of objects in the environment which he/she finds interesting.

3. 1. Vector Analysis for Photo Projection Data

We have designed a kind of vector to measure the direction and length of main environmental value orientation based on the historical and social background of a community. We have called it the Environmental Value Orientation Vector (EVOV). Value orientation means selection based on some value standards. It pertains to assessment of the situation for performers using the three standards proposed by Parsons (cognitive standard, appreciative standard and moral standard) (see Parsons 1951: 256–325). EVOV aligns cultural and natural factors in a straight line and aligns man-made systems and ecosystems straight. In Kuranda research, we have cited eight factors of environmental value according to the Cape York Peninsula Land Use Strategy (Cape York Peninsula Land Use Strategy 2001: 50–65), because the strategy interpreted the historical and social background of Northern Queensland, including Kuranda, in a neutral manner. For example, according to the historical land use process in Northern Queensland, we have considered: 1) Wilderness Value, 2) Mining Resource Value, 3) Key Timber Resource Value, 4) Art and Craft Value, 5) Pastoral Value, 6) Horticulture and Cropping Value, 7) Natural Conservation Value and 8) Biophysical Value. We have thus attempted to express each factor with one of the 8 vectors of varying directions and lengths.

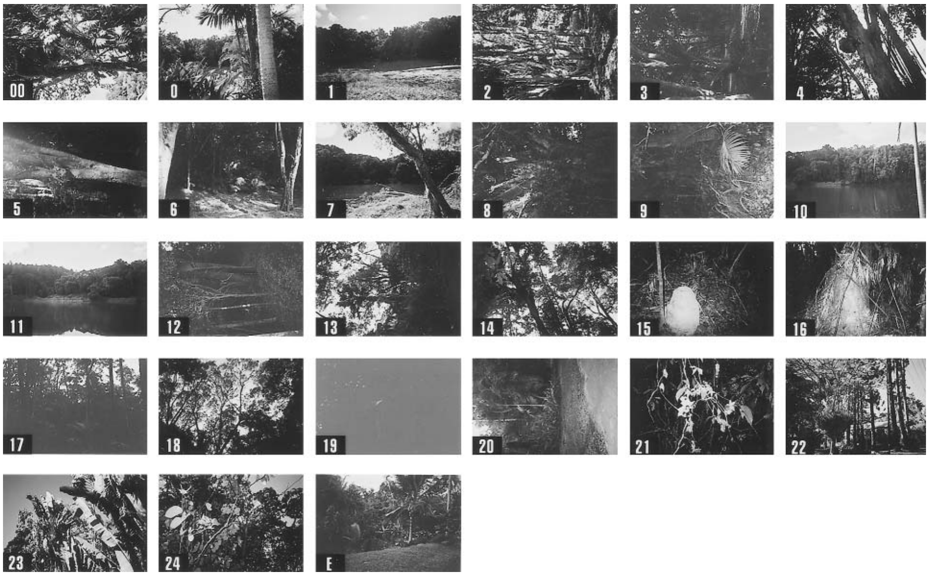
In Table 11, eight elements of value have been identified, which will serve as key factors for the future usage of the environmental value in Kuranda. According to Dr. Nassauer, if we align the aesthetic experience that people already value with ecological health they do not yet know how to recognize, we can build a landscape ecological structure while we are building new cultural expectations for ecological health (Nassauer 1997: 67–83). Her concept of ecological health is very important but ambiguous to estimate. If ecological health means balance of environmental value between natural/ecological factors and cultural/man-made factors, it is possible to estimate the balance through vector analysis.

Figure 11 shows the photographs taken by 3 residents and 3 visitors of Kuranda selected at random. The subjects were coded *a, b, c, d, e* and *f*. *a, b* and *c* refer to residents, while *d, e* and *f* denote visitors. The photo projection method (PPM) was developed by Dr. Noda. It is designed to illustrate the cognition held by human beings against the environment through projection of photographs (Noda 1990: 13–15). Before the Kuranda research, we modified the PPM into one that would allow dialogue-based confirmation of the main focus attempted by the subject in taking a given photograph. PPM is expected to make up for the shortcoming of the interviews (employed in the previous chapter), which relies on limited questions and hence cannot adequately assess the diversity or variability of the subjects. First, each of the residents and visitors was asked to take 27 photographs during the 6-hour period from 9:00 am to 3:00 pm. After the films were developed,

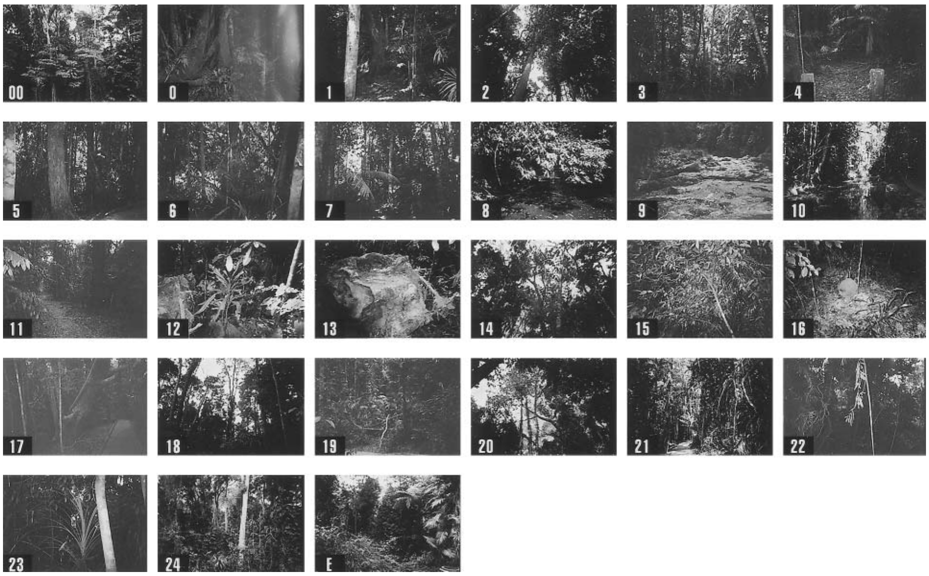
Table 11 The key factors of environmental value in Kuranda

Key factor	Example
Wilderness Value	River, Falls, Gorge, Biodiversity
Mining Resource Value	Opal, Marble,
Key Timber Resource Value	Oak, Pine, Eucalyptus,
Art and Craft Value	Aboriginal art, Didjeridu, Station,
Pastoral Value	Cow, Horse, Sheep, Dog, Cat,
Horticultural Cropping Value	Flower, Strawberry, Mango, Peanuts, Rice
Natural Conservation Value	World heritage, Park, Riverside, Road
Biophysical Value	Water, Soil, Air, Bird, Insect, Botany

*Tourism and Real Estate Value are subdivision of Art and Craft Value.



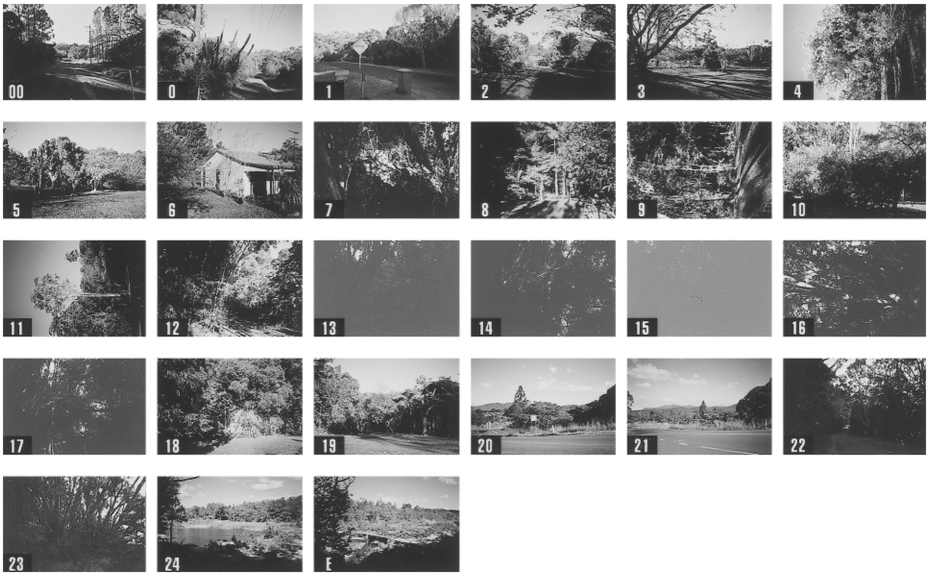
a: 15 years old, female, Australian student



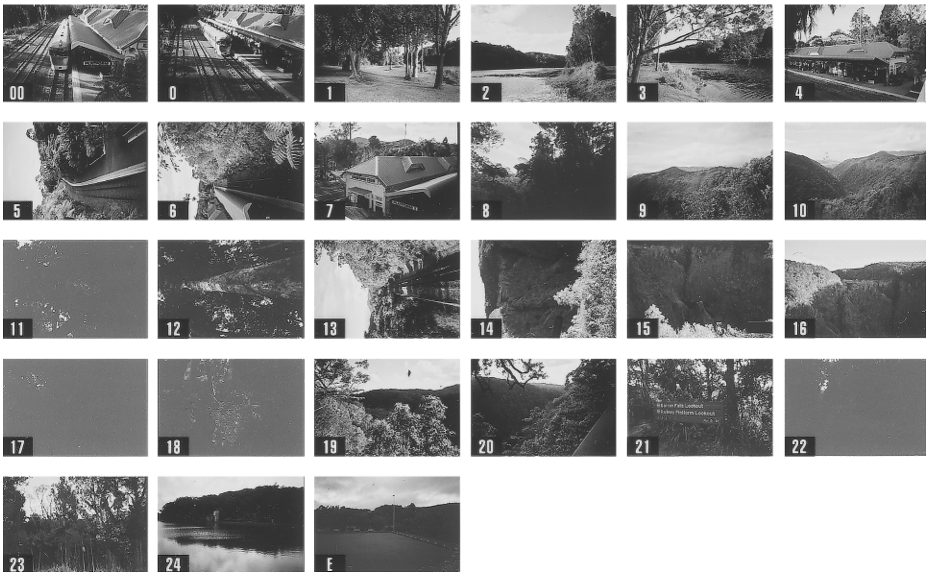
b: 20 years old, male, Aboriginal ranger

c: 52 years old, female, Spanish French artist

d: 22 years old, female, Japanese tourist



e: 53 years old, female, English estate agent



f: 62 years old, male, Australian pensioner

Figure 11 Environmental photos by 6 test subject the examiner asked each subject to explain the design and main focus of each photograph. Then, the focuses of the 27 photographs taken by each subject were classified on the eight-category environmental value scale. The photo projection data (PPD) shown in Table 12 were obtained in this way.

Here, we emphasize 4 essential points pertaining to our method of PPM. Firstly, the subjects were simply instructed to take photographs freely, without any accompanying instruction or guidance which could affect the selection of targets by the subjects. Secondly, the subjects were asked to verbally report the main focuses they selected. For example, Subject d, who took photographs of the richest contents, focused on bushes in 6 photographs (Photo No. 00, 0, 1, 2, 3 and 9), on a gorge in 4 photographs (No. 4, 5, 6 and 7), on a natural park in 2 photographs (No. 21 and 22), on a promenade in 2 photographs (No. 8 and 18), on signboards in 2 photographs (No. 16 and 23), on a railway in 2 photographs (No. 14 and 17), on artifacts in 2 photographs (No. 19 and 24), on architecture in 2 photographs (No. 11 and 20), on garden flowers in 2 photographs (No. 10 and 15), on fresh air of the sky in 2 photographs (No. 12 and 13) and on soil of the ground in one photograph (No. E).

Thirdly, when applying each focus to the 8 factors of an environmental table within the 2-dimensional scheme composed of the axis of orientation (cultural-natural) and the system composed of two categories (ecological and man-made), one analyzer endeavored to give careful classification to the data and the other attempted to check the validity of such classification. Fourthly, so that the value orientation of each subject could be calculated under an identical rule, the scores of the focuses of the same category were superimposed on the vectors placed at intervals of 45 degrees (an angle selected for the purpose of convenience) in the range from 0 to 360 degrees. Thus, the PPM we devised for this study is reliable in terms of reproducibility (same results in repeated measurements), but whether or not this method is valid as a means of accurate measurement depends on the success/failure in careful classification of data.

In subsequent sections of this chapter, vector analysis will be conducted of the eight elements of environmental value, based on the expectation that each focus of photographs reflects orientation based on some environmental value standards. Figure 12 graphically represents the relationship among orientation B through N. In this case, unlike observation of points along a line of real numbers, the features of orientation become progressively more different from B as the point leaves B and approaches A. However, as the point is further advanced beyond A to the right, the features of orientation become closer to B again. Therefore, each orientation can be expressed in angle as shown in the second column of the table. These analyses indicate that it is difficult to process PPD by the method of ordinary statistics involving lines of real numbers, but that it can be processed by statistics over circumference (Watson 1983).

Table 12 Photo Projection Data

Orientation	B	W	M	K	A	P	H	N	
Direction	0°	45°	90	135	180°	225°	270°	315	Total
a	5	13	0	3	0	0	4	2	27
b	8	14	0	3	0	0	1	1	27
c	1	4	0	0	9	3	9	1	27
d	3	10	0	0	8	0	2	4	27
e	9	8	0	0	1	0	3	6	27
f	4	14	0	0	7	0	0	2	27

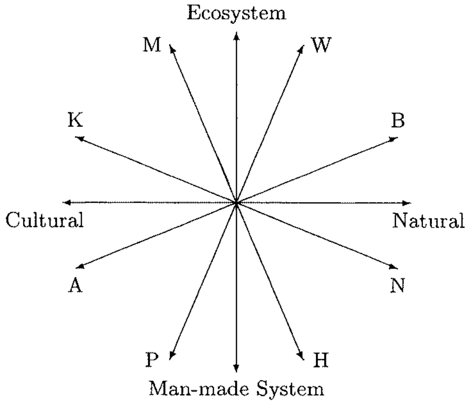


Figure 12 Scheme of eight value orientations

3. 2. Analysis of Environmental Value Orientation

This analysis involved 6 subjects (*a* through *f*). Subject *a* was a 15-year-old female Australian student, Subject *b* was a 20-year-old male Aboriginal ranger, Subject *c* was a 52-year-old female Spanish French artist, Subject *d* was a 22-year-old female Japanese tourist, Subject *e* was a 53-year-old female English estate agent and Subject *f* was a 62-year-old male Australian pensioner. PPD was obtained by converting the photographs, taken by each subject, numerically (into 0 to 360 degrees). Usually, the focus of photographs taken by individuals represents some value (e.g., beauty), the PPD obtained may be viewed as projecting the value orientation of individual subjects. Here, we face the following questions.

(A) Does orientation differ among individuals? For example, is the orientation of Subject *b* (an Aboriginal ranger living in a rainforest distant from urban districts) similar to or different from the orientation of Subject *d* (a Japanese tourist living in an urban district)?

(B) How about the intensity of orientation? For example, assumed that the orientation of Subject *e* (an estate agent having immigrated from England) is identical to that of Subject *c* (an artist having immigrated from France), is the intensity of orientation similar or different between them? Furthermore, assumed that the orientation differs between Subjects *b* and *d*, is the intensity of orientation equal or different between the two?

(C) Do individual subjects have orientation biased to the same direction or have orientation in a different direction? For example, may we conclude that the orientation of Subject *b* is biased to W, or that the orientation of Subject *c* differs?

Here, a preliminary examination is carried out prior to analysis of PPD. First, a rough analysis is conducted of the distribution of PPD among individual subjects, using circle plots. The circle plots shown in Figures 13 to 18 differ from ordinary circle plots. A circle with a radius of 1 is depicted around the point of origin on a plane. The direction of 3 o'clock is defined as degree 0. Then, the radius vector is moved semi-clockwise in 45-degree steps. In each figure, the point of intersection along the circumference is labeled as B, W, M, K, A, P, H or N. Then, with the point of

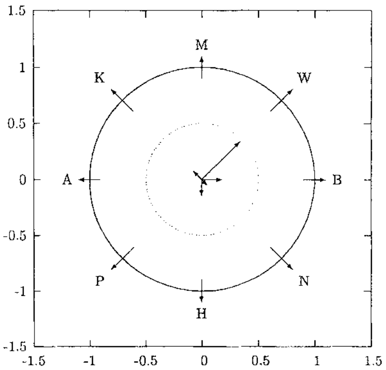


Figure 13 Circle plot of *a*

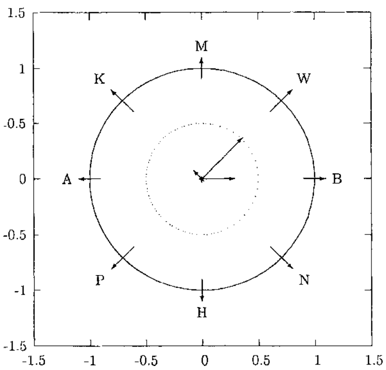


Figure 14 Circle plot of *b*

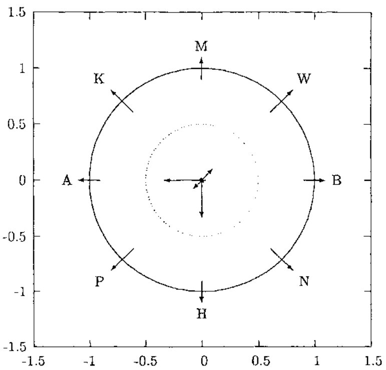


Figure 15 Circle plot of *c*

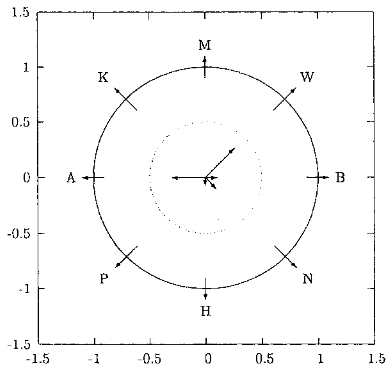


Figure 16 Circle plot of *d*

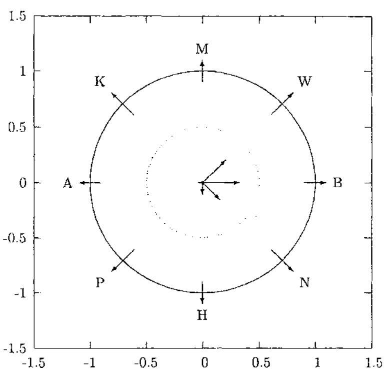


Figure 17 Circle plot of *e*

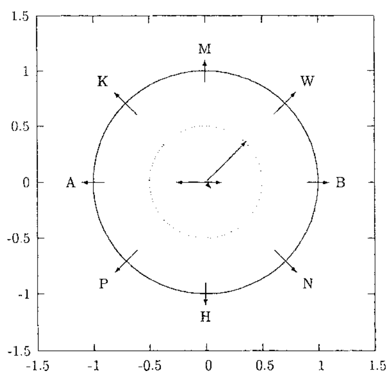


Figure 18 Circle plot of *f*

Table 13 Statistic by circle data

	MD	MRL	SD	Skewness	Kurtosis
a	23.6280	0.5452	1.1015	0.5669	0.7464
b	32.0310	0.7202	0.8102	−0.4808	2.2663
c	233.8000	0.4131	1.3298	−0.2280	0.4978
d	24.5950	0.1996	1.7953	−0.1495	0.6001
e	354.9371	0.6655	0.9024	0.6126	0.4112
f	45.5850	0.4400	1.2814	−0.9936	1.2708

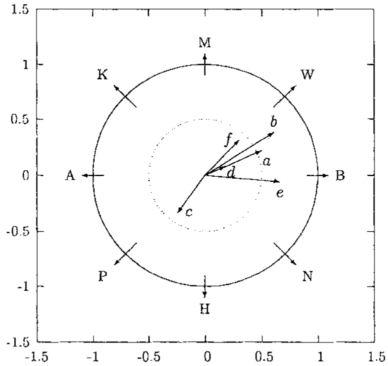


Figure 19 Environmental Value Orientation Vector

origin serving as the starting point, a vector is depicted with a norm of n_{ik} /27 (n_{ik}=the number of readings for the orientation k=B, W, M, K, A, P, H, N of each individual subject i=*a, b, c, d, e, f*).

Next, several statistical values, describing the distribution of circular data, are calculated. In this case, five statistical values (mean direction, mean result length, standard deviation, skewness and kurtosis) were calculated. Table 13 shows the results of the calculation. Figure 19 shows vectors with a direction identical to the mean direction of PPD in each individual and a norm identical to the mean result length, depicted on the plane same as the plane used for depiction of circle plots (Mardia and Jupp 2000). This figure presents an example of the above-mentioned Environmental Value Orientation Vector. EVOV was thus shown to be a useful means of objective comparison of PPD among multiple individuals.

3. 3. Testing the Hypothesis

Now, let's begin analysis of PPD. The questions (A) and (B), mentioned above, can be statistically viewed as problems of testing the two-sample hypotheses shown below, when the following relationships exist for $i, j=a, \cdots, f$ $(i \neq j)$:

$$\theta_{i1}, \cdots, \theta_{i27} \sim \mathrm{M}(\mu_i, \lambda_i),\ \theta_{ik} \perp \theta_{il},\ k \neq 1,$$

$$\theta_{j1}, \cdots, \theta_{j27} \sim \mathrm{M}(\mu_j, \lambda_j),\ \theta_{jk} \perp \theta_{jl},\ k \neq l$$

$$\theta_i=(\theta_{i1}, \cdots, \theta_{i27}) \perp \theta_j=(\theta_{j1}, \cdots, \theta_{j27})$$

Hypothesis ① H_0: $\mu_i=\mu_j$ vs. H_1: $\mu_i \neq \mu_j$,

Hypothesis ② H_0: $\lambda_i=\lambda_j$ vs. H_1: $\lambda_i \neq \lambda_j$,

Here, M(μ_i,λ_i) means a von Mises distribution with mean direction μ_i and concentration λ_i. Regarding the method of testing hypothesis, involving assumption of a von Mises distribution of population, D. R. Cox attempted a test of von Misesness to examine the validity of applying the von Mises distribution to such data.

Because PPD pertains to angles corresponding to 8 points at maximum along a unit circumference, it is plausible to imagine that application of the von Mises distribution (a continuous distribution along a unit circumference) to such data is criticized as being unnatural. However, considering that the PPD was obtained by roughly classifying the photographs with diverse factors on an 8-category scale and subsequently converting them into angles corresponding to 8 points along a circumference, if the most detailed classification, which is feasible, is adopted, such data can be converted into angles corresponding to points along a circumference. Here, we assume a von Mises distribution when analyzing population distribution for two reasons: (1) no distribution along a circumference, other than von Mises distribution, has been theoretically supported to some extent for use in two-sample testing of hypothesis; and (2) no additional distribution is likely to be developed in the near future.

Testing of the equivalent of the mean of two Gauss populations $N(\mu_1,\sigma_1^2)$ と $N(\mu_2,\sigma_2^2)$ on a line of real numbers (H_0: $\mu_1=\mu_2$) can be divided into three types:

(a) If σ_1^2 and σ_2^2 are known ⇒ testing with Gauss distribution,

(b) If σ_1^2 and σ_2^2 are unknown but are assumed to be equal ⇒ t test,

(c) If σ_1^2 and σ_2^2 are unknown and are not assumed to be equal ⇒ t test with Welch approximation.

However, concerning testing of the equivalence of the mean direction of two von-Mises populations $M(\mu_1,\lambda_1)$ and $M(\mu_2,\lambda_2)$ along a unit circumference (H_0: $\mu_1=\mu_2$) is concerned, adequate theory is available only in cases (a) or (b) mentioned above, i.e., only when λ_1 and λ_2 are known or when they are unknown but are assumed to be equal (Mardia et al. 1979). In cases corresponding to (c), i.e., when λ_1 and λ_2 are unknown and are not assumed to be equal, the question remains unresolved. So, we first test hypothesis ② on Question (B), and then test hypothesis ① on Question (A) only for the pair of two individuals for whom the hypothesis ② has not been rejected. The level of significance is set as $\alpha=0.05$, in accordance with the custom.

Table 14 Testing of the equality of concentration

	$\bar{r}$	case	$T^{(i)}$	result
a, b	0.6310	2	−1.3031	accept
a, c	0.1401	1	0.7859	accept
a, d	0.3724	1	1.8960	accept
a, e	0.5867	2	−0.8542	accept
a, f	0.4837	2	0.6289	accept
b, c	0.1849	1	2.1533	dismiss
b, d	0.4592	2	3.0886	dismiss
b, e	0.6570	2	0.4489	accept
b, f	0.5763	2	1.9320	accept
c, d	0.1290	1	1.1101	accept
c, e	0.2869	1	−1.6547	accept
c, f	0.0334	1	−0.1515	accept
d, e	0.4224	1	−2.7648	dismiss
d, f	0.3152	1	−1.2616	accept
e, f	0.5020	2	1.4831	accept

Hypothesis ② on equivalence of concentration is tested as shown below. The results of the test are given in Table 14. Here, the tested statistical value $T^{(i)}$ ($i=1$,

2) is known to follow the standard Gauss distribution N(0, 1) in an asymptotic manner. Therefore, if $|T^{(i)}| > 1.96$, hypothesis ② is rejected, allowing a conclusion that the two von Mises populations differ in concentration from each other.

Then, excluding the three pairs *(b, c) (b, d)* and *(d, e)* for which hypothesis ② has been rejected, we test hypothesis ① on equivalence of the mean direction. The results of this test are given in Table 15. Here, $\bar{r}'$ is a tested statistical value, and $\bar{r}'_{0.05}$ is a 5-percentile point of its asymptotic distribution. If $\bar{r}' > \bar{r}'_{0.05}$, hypothesis ① is rejected, allowing a conclusion that the two von Mises populations differ in mean direction from each other.

3. 4. Results of Analysis

Now, let's summarize the results of analysis pertaining to PPD.

1. Regarding Question (A), described in Section 3–2, it was concluded that the following six pairs had different orientation:

   (a, c), (b, e), (c, d), (c, e), (c, f), (e, f)

   Testing was skipped for the 3 pairs shown below in Result 2.

2. Regarding Question (B), it was concluded that the three pairs, shown below, differed in terms of the intensity of the strongest orientation from each other:

   (b, c), (b, d), (d, e)

   Here, the strongest orientation means the orientation in the mean direction. For Subject *b*, the strongest orientation is the orientation with an angle of 32.0310° and is closest to W. For Subject *c*, it is the orientation with an angle of 233.8000° and is closest to P. For Subject *d*, it is the orientation with an angle of 24.5950° and is closest to W. For Subject e, it is the orientation with an angle of 354.9371° and is closest to B. As stated in Section 3–3, it is not possible to test whether or not the orientations for these subjects differ in direction from each other. However, when estimated from the results of the testing of hypothesis in the same section, the strongest orientation for Subject *b* is identical to that for Subject *d*, but that the intensity of orientation differs between these two subjects. In the other pairs, the strongest orientation differs between the two subjects and the intensity of orientation also differs between them.

3. Here, PPV described in Section 3–2 is discussed again. Results 1 and 2 are almost identical to what are noticeable from EVOV. The only discrepancy is that the hypothesis about the equivalence of concentration between *a* and *d* cannot be rejected. Therefore, EVOV allows visual assessment of the relationship between the direction and intensity of orientation held by multiple individuals to a considerable extent.

In the end, Question (C) is discussed. The circular plot shown in Section 3–2 indicates that the analysis of data for Subjects a and b assumes a unimodal form with the W direction serving as a peak, while the analysis of data for Subject e assumes a unimodal form with the B direction serving as a peak. On the other hand, the analysis of Subject c data is bimodal with A and H directions serving as peaks, and the analysis of the data from Subjects d and f is bimodal with directions W and A serving as peaks. Thus, it is estimated that Subjects c, d and f have two orientations with considerably different features. Furthermore, the mean resultant length and standard deviation, calculated in the same section, indicate that the data from Subject d are more scatters than the data from the other 5 subjects, and that the data from Subject b are most concentrated in a direction. Question (C) is difficult to resolve by means of statistical inference, and how to resolve this question is an open issue (Fraser 1979).

4. 1. Statistical Concept of Ecological Health

As discussed in Section 3, the statement that a given individual is ecologically healthy means that an increase in the individual's PPD makes the mean result length closer to zero. Regarding this definition, let's deem $\theta_1, \cdots, \theta_n$ as representing PPD for a given individual in the unit of "in radian" and consider the following relationship.

$$a_n(\theta_1, \cdots, \theta_n)=\frac{1}{n}\sum_{i=1}^{n}\cos\theta_i,\ b_n(\theta_1, \cdots, \theta_n)=\frac{1}{n}\sum_{i=1}^{n}\sin\theta_i$$

If so, the mean result length can be expressed as follows.

$$\bar{r}_n(\theta_1, \cdots, \theta_n)=\sqrt{a_n(\theta_1, \cdots, \theta_n)^2+b_n(\theta_1, \cdots, \theta_n)^2}$$

Therefore, the statement that an individual is ecologically healthy can be defined as follows, if $N \in \mathrm{N}$ adequately large relative to a given $\varepsilon > 0$ is selected:

$$\| \bar{r}_n(\theta_1, \cdots, \theta_n) \| < \varepsilon, \text{ if } n > N$$

If a given individual has taken photographs of a single orientation, the mean result length for this individual's PPD is equal to 1. The mean result length approaches zero if photographs of multiple orientations are taken. When there is conflict between developers and environmentalists, compromise cannot be found if each party adheres to its own orientation and rejects any other orientation. During a conflict between individuals who accept multiple orientations, it will be highly probable that compromise can be reached. We adopted the above-mentioned definition of ecological health because sustainable development would be difficult to achieve if we adhere to commercialism or environmentalism alone (Cooper 1998: 100–112) or aestheticism alone (Eaton 1997: 85–106) and because it seems advisable that each individual accepts multiple orientations. In other words, individuals can be viewed as having ecological health if they can coexist with other individuals and can explore points of compromise with other diversifying values. The individual can also be viewed as having ecological health if he/she takes pictures of multiple orientations and thus attempts to offset the direction of each orientation, to allow EVOV to return to the origin. Multipolar offsetting, which involves offsetting among diverse orientations, is more desirable than bipolar offsetting which involves offsetting between two opposing orientations.

As stated above, the mean result length is a measure of the concentration of circle data. Roughly speaking, the mean result length becomes closer to 1 as the data becomes more concentrated and becomes closer to 0 as the data becomes more dispersed. Here, the phrase "roughly speaking" means that the mean result length becomes equal to 0 if the following relationship is present between $2n$ circle data $\theta_1, \cdots, \theta_{2n}$.

$$\theta_{n+1} = \theta_1 + \pi,\ \theta_{n+2} = \theta_2 + \pi,\ \cdots,\ \theta_{2n} = \theta_n + \pi$$

For example, when an individual takes 24 photographs, the mean result length is 0 in the following cases: (i) three photographs are taken for each of the all 8 orientations; and (ii) 12 photographs are taken for each of the two of the 8 orientations ("biophysical value" and "art and craft value"). We do not distinguish between these two cases when we assess individuals from the viewpoint of ecological health. However, when conducting analysis of diverse environmental values, it is desirable to distinguish between these two cases. Subsequent discussions will be based on assumption of such a situation.

Ecological health is defined on the basis of the assertion about the behavior of $\bar{r}_n(\theta_1, \cdots, \theta_n)$ when n $\to \infty$. It cannot be directly analyzed in this form. Therefore, the following auxiliary definition is introduced.

If $\theta_1^{(k)}, \cdots, \theta_n^{(k)}$ and $\theta_1^{(l)}, \cdots, \theta_n^{(l)}$ are used to indicate n pieces of PPD for individual k and individual l, the statement that individval k possesses relative ecological health under the data yielded from observation of individval l means the presence of the below-shown relationship.

$$\bar{r}_n^{(k)}(\theta_1^{(k)}, \cdots, \theta_n^{(k)}) < \bar{r}_n^{(l)}(\theta_1^{(l)}, \cdots, \theta_n^{(l)})$$

If n changes, the definition of ecological health becomes a natural one, but the direction of the inequality sign may be reversed. This shortcoming is inevitable in modern statistics, since there is no other strategy available in current statistics than introducing concepts whose validity can be tested in finite samples of limited size that can be derived in a natural manner from ecological health. Relative ecological health under a given “*n*” will be discussed in Section 4–3.

4. 2. Diversity of Orientation

The analysis of PPD, described above, left the following questions unresolved.

Does an individual has orientation biased to a single direction unique to the individual or diverse orientations? For example, is it rational to consider that the orientation of Subject *b* is biased W or that the orientation of Subject *c* is diverse.

When we statistically discuss whether or not an individual possesses diverse orientations and to which extent the orientation possessed by individuals is diverse, we need to define diversity of orientation using concepts of statistics.

When we state that an individual possesses diverse orientations, the statement means that the individual concerned attaches value to multiple orientations and take photographs belonging to multiple orientations. Roughly speaking, this is identical to the statement that the PPD of the individual concerned is dispersed. However, in view of the following relationship,

Taking photographs belonging to multiple orientations $\dot{\Leftrightarrow}$ PPD is dispersed
$\dot{\Leftrightarrow}$ mean result length is close to 0

possession of diverse orientations is essentially identical to possession of ecological heath which is based on harmonic and well-balanced environmental values.

On the other hand, a definition of define possession of diverse orientations based on more detailed accounts of the way of dispersing of PPD is possible, e.g., a definition that possession of diverse orientations means that the individual shows a multimodal distribution of PPD. However, when we attempt to introduce the concept of EVOV and give priority to testing whether or not the mean direction of EVOV in two individuals differs from the norm which is equivalent to the mean result length, we are forced to assume a von Mises distribution (unimodal distribution) for the distribution in a given population. For this reason, the above-mentioned definition cannot be adopted if we intend to keep an ongoing analysis coherent with previous analyses. Furthermore, even when we give priority to analysis of diversity by adopting this new definition, we can only performed analyses based on descriptive statistics since the current theory of statistical inference does not provide any means of analyzing multimodality.

Thus, we test whether or not the PPD in a given individual is dispersed, by analyzing ecological health. This test is designed to ascertain whether or not the way of dispersing assumes a uniform and ideal form along the circumference. For example, when an individual takes 24 photographs, it is ideal that he/she takes 3 photographs for each of the 8 orientations. This ideal state is called “harmonic balance.” If PPD is uniformly distributed along a circumference, the mean result length should be 0. For this reason, harmonic balance leads to ecological health, but the reverse ("ecological health leads to harmonic balance") is not true. Thus, harmonic balance is a stricter concept than ecological health, and it formulates a maximally-balanced ideal state in which the individual satisfies the requirements for coexistence with other individuals. Subsequent parts of this paper will address issues pertaining to harmonic balance.

4. 3. Analysis of Ecological Health

Analysis of the dispersion of PPD will be carried out, using the following three principles. Firstly, analysis is not made in cases where only photographs of the most biased state or photographs of only one orientation have been taken, since these cases do not deserve much interest. Secondly, the degree of dispersion is assessed in connection with analysis of ecological health. Thirdly, the ideally dispersed state is analyzed in connection with harmonic balance.

First, issues related to ecological health are analyzed. We assume that the 27 photo projection data from each individual $k=a, \cdots, f$ are extracted from the von Mises population $\mathrm{M}(\mu_k, \lambda_k)$ with a mean direction μ_k and concentration λ_k. What we need to determine is the order among the mean result length $\rho_a, \cdots, \rho_f$ for the population distribution of each individual $k=a, \cdots, f$. Of course, this order is unknown and needs to be estimated from the mean result length, $\bar{r}_a \cdots \bar{r}_f$,. Generally, the von Mises distribution $\mathrm{M}(\mu, \lambda)$ usually involves a below-shown important relationship between concentration λ and mean result length ρ.

$$\rho = A_2(\lambda)$$

Here $A_2(\lambda)$ is equal to $I_1(\lambda)/I_0(\lambda)$, and $I_0(\lambda)$ and $I_1(\lambda)$ serve as the modified Bessel function of the first kind defined by the following equation.

$$I_p(\lambda) = \frac{1}{2\pi} \int_0^{2\pi} \cos p\theta \exp(\lambda \cos\theta) \mathrm{d}\theta, \; p=0, 1$$

Because A_2 is monotone transformation, estimation of $\rho_a, \cdots, \rho_f$ and subsequent inference of the order among these factors is identical to estimation of $\lambda_a, \cdots, \lambda_f$ and subsequent inference of the order among these factors. Considering that the parameters involved in the von Mises distribution are μ and λ, rather than μ and ρ, estimation of $\lambda_a, \cdots, \lambda_f$ will be more natural from the standpoint of statistical inference. Therefore, in subsequent parts of this paper, $\lambda_a, \cdots, \lambda_f$ will be used instead of $\rho_a, \cdots, \rho_f$.

Now, point estimation and interval estimation are done on the concentration λ_k for each individual $k=a, \cdots, f$. Maximum likelihood estimator, defined below, is used as an estimator.

Table 15 Maximum likelihood estimate

k	a	b	c	d	e	f
$\hat{\lambda}_k$	1.303	2.138	0.907	0.407	1.811	0.979

Table 16 Confidence interval by 80% confidence coefficient

k	a	b	c	d	e	f
L. C. L.	0.844	1.494	0.504	0.048	1.249	0.568
U. C. L.	1.763	2.782	1.308	0.767	2.373	1.390

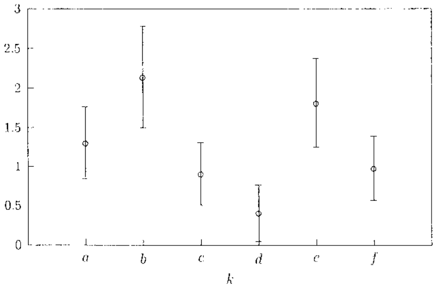


Figure 20 Estimate and confidence interval for λ_k

$$\hat{\lambda}_k = A_2^{-1}(\bar{r}_k)$$

A confidence interval with a percent equal to confidence coefficient $100\times(1-\alpha)$%, derived approximately from this λ_k, serves as the confidence interval.

$$(\hat{\lambda}_k - z_{\alpha/2}/\sqrt{I_n(\hat{\lambda}_k)},\ \hat{\lambda}_k + z_{\alpha/2}/\sqrt{I_n(\hat{\lambda}_k)})$$

Here, $z_{\alpha/2}$ indicates $100\times\alpha$ percentile in the Gauss distribution, and $I_n(\hat{\lambda}_k)$ denotes approximation of λ_k-relate Fisher information $I_n(\lambda_k)$ by $\hat{\lambda}_k$.

Calculation was initiated with the maximum likelihood estimate $\hat{\lambda}_k$ of concentration λ_k for each individual $k=a, \cdots, f$. The results of this calculation are shown in Table 15. This was followed by interval estimation of λ_k. In this estimation, the confidence coefficient was set at 80%, in view of the length of the confidence interval. The thus estimated confidence interval for λ_k is given in Table 16. In this table, L. C. L. stands for low confidence limit, and U. C. L. indicates upper confidence limit. Figure 20 plots the confidence intervals against the concentration estimates in individual subjects. The lower and upper ends of the vertical bars in this figure mean the lower confidence limit and the upper confidence limit, respectively. The central circle indicates the estimate.

4. 4. Analysis of Harmonic Balance

The question of harmonic balance is statistically equivalent to a testing of uniformity, i.e., testing of the hypothesis that the population distribution is a uniform distribution on S^1 when n pieces of circle data $\theta_1, \cdots, \theta_n$ are given. In the above-mentioned parts of this paper, statistical inference was based on the assumption that the population distribution is equal to the von Mises distribution. The uniform distribution on S^1 is a degenerated von Mises distribution, i.e., a von Mises distribution with concentration $\lambda=0$. This distribution is a member of the family of von Mises distributions. Therefore the testing of hypothesis in this section does not contradict the analyses before this section.

Before testing the distribution, some preliminary discussions are made. The distribution of

PDD in individuals can be assessed to some extent on the basis of circle plots and descriptive statistics referred to in Section 3–2. Here, Figures 21 through 26, graphically representing the empirical distribution function of PPD in each individual are used for analysis. These figures represent a modification of what is usually called "uniform probability plot." On this plot, the graph of empirical distribution function of each individual's PPD approaches the 45-degree line as harmonic balance is preserved better. In Subjects *b* and *e* who had large mean result lengths, the graph of the empirical distribution function of PPD is markedly off the 45-degree line. Even in subjects *c* and *d* who have relatively small mean result lengths, the graph is off the 45-degree line. Thus, in all subjects, harmonic balance was poorly preserved.

Now, the uniformity of PPD for each individual is tested. For this purpose, Kuiper's V_n test is used. The results of this test are given in Table 17. V_n^* was the test static of the hypothesis about

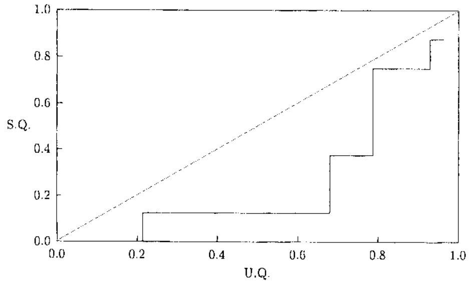


Figure 21 Uniform probability plot, *a*

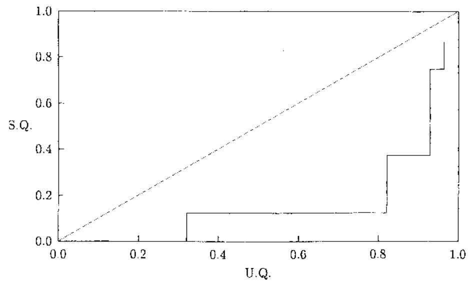


Figure 22 Uniform probability plot, *b*

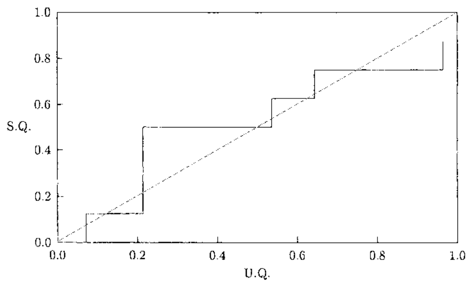


Figure 23 Uniform probability plot, *c*

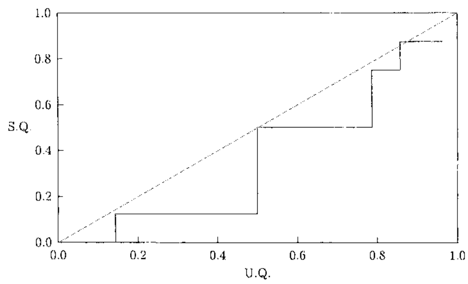


Figure 24 Uniform probability plot, *d*

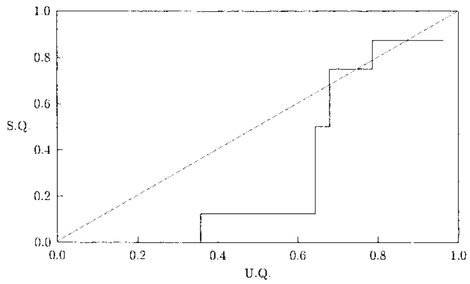


Figure 25 Uniform probability plot, *e*

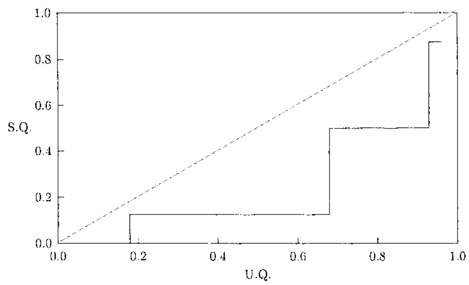


Figure 26 Uniform probability plot, *f*

uniformity, and the critical point was 1.747 for the testing at a significance level of 5%. Therefore, if $V_n^* > 1.747$, the hypothesis of uniformity is rejected, allowing us to conclude that the individual concerned is not in harmonic balance.

Table 17 Result of testing uniformity

k	*a*	*b*	*c*	*d*	*e*	*f*
Vn	0.542	0.690	0.528	0.380	0.602	0.542
*Vn**	2.923	3.723	2.848	2.051	3.250	2.923
Result	dismiss	dismiss	dismiss	dismiss	dismiss	dismiss

The following conclusions can be drawn from the results of PPD analyses conducted above.

1. We attempted to resolve the question of ecological health by ranking the 6 subjects according to the relative level of ecological health rated on the basis of given data and by estimating the concentration of the von Mises distribution. Tables 15 and 16 and Figure 20, shown in Section 4–3, allow the six subjects to be ranked in the following order in terms of closeness to ecological health (Subject *d* is closest).

d, c, f, a, e, b

2. We attempted to resolve the question of harmonic balance, described in Section 4–2, by testing the hypothesis about uniformity conducted in Section 4–3. The test revealed that none of the six subjects had preserved harmonic balance.

These results indicate that the concept EVOV is useful in analyzing the environmental value possessed as standards of environmental cognition by individuals. EVOV allowed us to replace the concept “ecological health” with a more precisely defined concept “harmomic balance.” This means that the presence of harmonic balance affirms ecological balance definitely, and that if ecological health has been affirmed, harmonic balance is preserved by environmental value. A question which can arise most naturally from EVOV is the necessity of comparing the direction and norm of EVOV among different individuals. To deal with this question statistically, the von Mises distribution is indispensable for technical reasons. This distribution is a continuous unimodal distribution. Putting aside the question about data discreteness, the circle plot used in Section 3–2 suggests it plausible to consider that this distribution originates from a bimodal distribution. When testing the hypothesis, the popular distribution was assumed to follow the von Mises distribution. This assumption was rational and significant. The environmental value which has developed in Kuranda, Northern Queensland, following historical courses in this region was successfully expressed by a coherent system of value orientation composed of X axis (ranging from natural factors to cultural factors) and Y axis (ranging from ecological systems to man-made systems). Here, PPD was set over a positive dynamic range of each value, allowing two-dimensional application of EVOV. An open issue for the future to expand the scope of application of EVOV is to conduct three-dimensional analyses involving regions with specific resource development processes and the axis of time.

5. Conclusion

The overall conclusions yielded from analyses in Sections through 4 are listed below.

1. A feature common for PPM (reflecting the environmental value orientation of individuals) and interviews (used to evaluate environmental cognition of individuals) is that the object to be selected varies depending on the situation faced by the individual.
2. For selection of the object, a sensor or tool, involving illusion, is needed (Hidaka 2003: 159–185).
3. Adequate insight into the object is needed to obtain deep cognition. In some cases, deeper cognition may be achieved by residents who view the community from inside than by visitors. In other cases, more accurate cognition may be achieved by visitors who view the community from outside than residents.
4. Residents do not oppose visitors, but the environmental value surrounding the residents is opposed to that surrounding the visitors. The environmental value range from positive to negative in individual residents and visitors.

Not only the interview method but also PPM was indispensable for us to reach the conclusions shown above. In Section 2, we interviewed residents and visitors in/going to Kuranda about their environmental cognition. We cannot say definitely that the questions were appropriate or that we were able to hear their real intentions in this survey. There is a fundamental problem, i.e., discrepancy between cognition and object. It is a problem unrelated to the place of residence. This discrepancy becomes greater as the information is transferred from a human brain to another human brain mediated by language and character. Photography can exactly copy the contents of objects. Photographs are valuable as evidence. In the 1990s, PPM was considered to be valuable since it allowed a kind of "dialogue in a locked room" between one analyzer and one subject mediated by the contents projected onto the photographs. We applied PPM to the community study in Kuranda in 1997. Now, ten years later, we have succeeded in finding a new approach which involves mathematical statistics.

In the Introduction section, we referred to experimental perception which could be achieved by photography. Our method of PPM, used in this study, involved no such instruction as "Take photos intentionally" or "Take photos unconsciously." In practice, no subject was able to remember the contents of the photographs they had taken a few hours before. It seems therefore rational to say that the brain (consciousness), which manipulates knowledge or concept, is involved in the interview during which the subjects remember the speeches they have made, while the body (unconsciousness) is involved in photography in which the subjects tend to forget the contents of the objects they photograph before long. When the focuses selected by residents and visitors while taking a total of 81 photographs were analyzed by PPM, it was found that residents tended to take photographs of relatively near objects (within 3 m of the subject; 49 photographs or 60%), while visitors tended to take photographs of distant objects (30 m or more distant; 63 photographs or 78%). This means that photography tends to make residents focus on near objects unconsciously and to let visitors focus on distant objects. Because residents are interchangeable with visitors, as discussed in Section 2, both residents and visitors have compound eyes that can recognize both "the concrete" located in the vicinity and "the abstract" located distant.

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Appendix 1
Questionnair about Environmental Value of Kuranda

Date: / /2002	Interviewer:	Location:

①Name:		④Living Environment: □Is. □Town □Bush □Beach □City State: □QLD □NSW □NT □Others
②Sex: F or M	⑤Age:	⑤Place of Residence □Kuranda □Cairns □Others ( )
③Job:		
⑥Father's Descent:		⑦Mother's Descent:

⑧How many years have you been staying here: Years

⑨Please arrange in your order of priority of Environmental Values of Kuranda before and after constructing "Skyrail".

After "Skyrail"		Before "Skyrail"
□	Wilderness Value	□
□	Biophysical Value	□
□	Natural Conservation Value	□
□	Pastoral Value	□
□	Hortocultural Cropping Value	□
□	Key Timber Species Value	□
□	Mining Resource Value	□
□	Tourism Resource Value	□
□	Art and Craft Resource Value	□
□	Real Estate Value	□

⑩How do you think about construction of "Skyrail"?
□approve □opposition □both of Yes & No □neutrality

⑪How do you think about "Sustainable Development" of Kuranda?
□Possible □Easy □Difficult □Impossible

⑫Which aspect do you emphasize in "Sustainability"?
□Ecology □Economy □Generation □Ethinicity □Others

⑬How do you think how to use "National Park" here?
□Conservation □Biodiversity □Green Way □Landsacpe □Tourism Item □Revitalization of Community

⑭Please write the meaning of "Land" for you.
☞..

....

....

....

⑮Which type of "Land" do you need now in Kuranda?
□Private Property □Regional Commons □Native Title

⑯Who have to plan "Land Use" of Kuranda?
□Land Owner □Community People □Land Council □State

⑰Which aspect do you emphasize at "Landscape" with Land Use of Kuranda?
□Natural Landscape □Practical Use than Landscape
□Cultural Landscape □Ecology than Landscape