CULTURAL IDENTITY DEVELOPMENT MODEL USING DISCRETE WAVELETS.
A STUDY OF LETTERS IN THE AUTOBIOGRAPHY

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A new objective method for receptivity of cross-cultural values has been developed using discrete wavelets. This method has been applied to 21 letters written by Hart. They were included in her autobiography Once in a Lifetime [1] that recounts her experience before and after the studies in the U.S. The receptivity process of American culture in Yasuko Hart's heart and mind was visualized as a W-curve. The results also suggested common cross-cultural development models. This is the first attempt to analyze the sentences used in the private letters.

INTRODUCTION

The motivation behind this work was to develop an objective method for cultural identity development model using the discrete wavelet transform and to apply this method to 21 letters written during the studies abroad for clarifying the culture shock. A conventional method used to confirm the cultural identity development process including the culture shock is investigated through special psychological tests. The culture shocks hit twice when one lives in other country. Cultural differences in the language and customs easily upset us in the early period. When our own cultural values cannot apply to those of the host country, we might even have a stress with physical and mental symptoms. Generally, this type of stress is called a "culture shock." Then another shock arises caused by the return to own country. After spending some period of time in the foreign country, people learn how to behave and conform to social manners and customs. However, it is necessary to re-acculturate the native culture when coming back. This type of the "second" culture

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shock is called a "U-turn shock." In psychology, major cross-cultural development hypotheses are shown in the W-curve and five-stage development models. These come about in a flow when one becomes more positively attracted by different cultural values, conforms to the foreign culture, then negatively accepts foreign cultural values and has a better opinion of his own culture, and finally acquires an integrated value by developing relative identities. In the present study, the objective model which adopts the hypotheses of the acculturation process is examined on the basis of the letters written by a Japanese student in the U.S.

METHOD OF ANALYSIS

The object of the analysis is 21 letters included into the book *Once in a Lifetime* by Hart [1]. This is an autobiographical description of her four-year studies in the U.S., the original title is written in Japanese. She starts her work on June 4, 1982, just before leaving Japan. She studied at the college during the first year, then returned to Japan for summer vacations, again came back to the U.S. to continue the studies at the university, and decided to settle down in the U.S. with her partner. The examined letters were sent to her parents and friends during these four years.

Evaluation of Sentences

Each of the 21 letters was analyzed by sentences. Each sentence was divided according to the descriptions of the U.S., Japan, and herself, and then evaluated in the form of Table 1 [2]. The percentage of each group was weighed by five grades. Also these data were processed with the wavelets after normalized cross correlations.

Analysis Procedure

The evaluated data is analyzed based on the linear space theory. The methodology presented in this paper has three steps described as follows [3, 4]:

(1) Normalization

In order to use the linear spatial theory, the evaluated data of each item is assumed to be a vector. The letter is not always of the same length as the others. This

Table 1 Evaluation Reference

Evaluations	Meanings	Standards for Classification
1	Strong negative feelings	Negative emotional words with stress modifier
2	Weak negative feelings	Only negative emotional words (no modifier)
3	Neutral sentences	Description (no emotional words)
4	Weak positive feelings	Positive emotional words (no modifier)
5	Strong negative feelings	Positive emotional words with stress modifier

influences the dynamic range of the data. Therefore, it is essential that the evaluated data of each letter be arranged as a percentage.

(2) Orthogonalization

Sentences and words are sometimes related to each other. Namely, each vector representing the evaluated data tends to be subordinate. Such a correlation is reduced by means of the Gram–Schmidt's orthogonalization.

(3) Wavelet Multi-Resolution Analysis

The wavelet multi-resolution analysis is used for extracting the regularity from complex data. Let g_i be a vector representing the orthogonalized data of the ith item, then its wavelet spectrum x_i

$$x_i = W g_i,\tag{1}$$

where W denotes a wavelet transform matrix. Then the wavelet multi-resolution analysis is applied to each letter in order to check the rate of changes precisely

$$W^T x_i = \sum_{j=0}^{m} D_i^{(j)}\tag{2}$$

where $D_i^{(j)}$ represents the jth level of resolution to the ith item.

RESULTS AND DISCUSSION

Each letter was sent at random, although these letters stand on the time axis divided according to understanding of the changes in her receptivity when each letter was written.

Acculturation from Rational Aspects; Study by Five-Stage Development Models

The hypothesis of explaining the acculturation process by stages resulted in the establishment of the five-stage development model. The process beginning with the stage of contacting the foreign culture to that of accepting it is expressed with an emphasis on self-consciousness and behavioral differences. Table 2 lists the mental

Table 2 Reference Culture Level when Accepting Foreign Culture

Stage	Adler (1975)	Atkinson et al. (1998)
1	Own culture	Foreign culture
2	Conflict	Conflict
3	Own culture	Own culture
4	Simultaneous	Conflict
5	Integrate	Integrate

reference groups from the models of Adler [5] and Atkinson *et al.* [6]; these are the typical examples of five-stage development models.

Results of Analysis

Each sentence was divided into the descriptions of the U.S., Japan, and herself. The percentage of each group was weighed by five grades and then analyzed using the multi-resolution analysis of wavelets. Figures 1–8 show the results and extract new five stages of acculturation; these results are listed in Table 3.
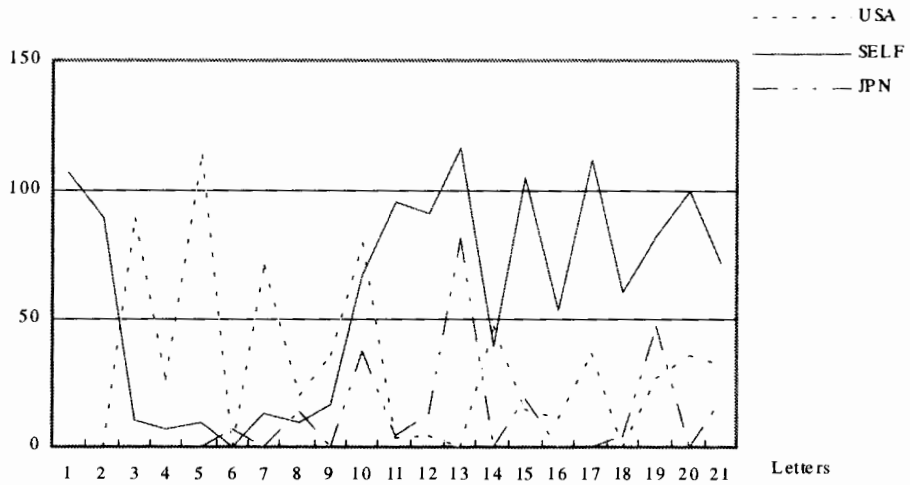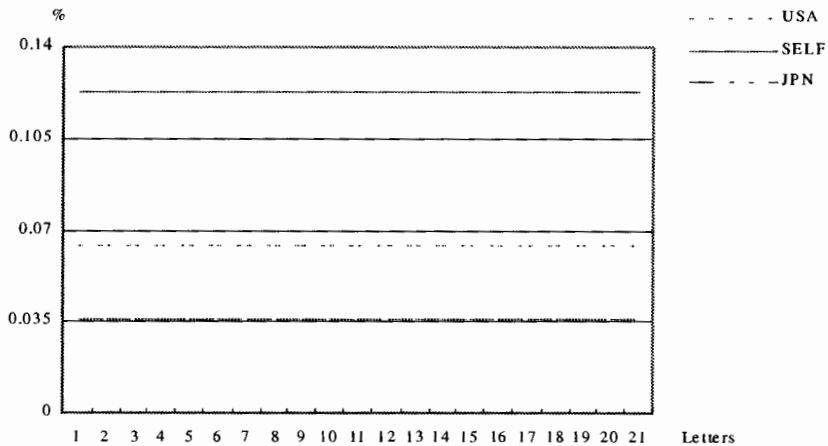
Fig. 1 Original data.

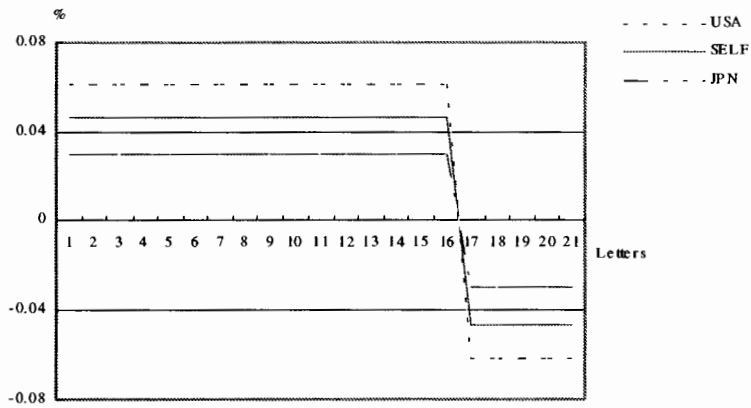**Fig. 2** Level 1 of the wavelet multi-resolution analysis.

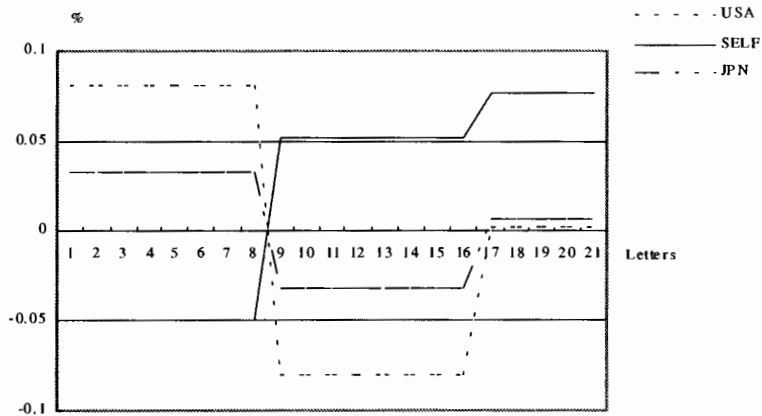**Fig. 3** Level 2 of the wavelet multi-resolution analysis.

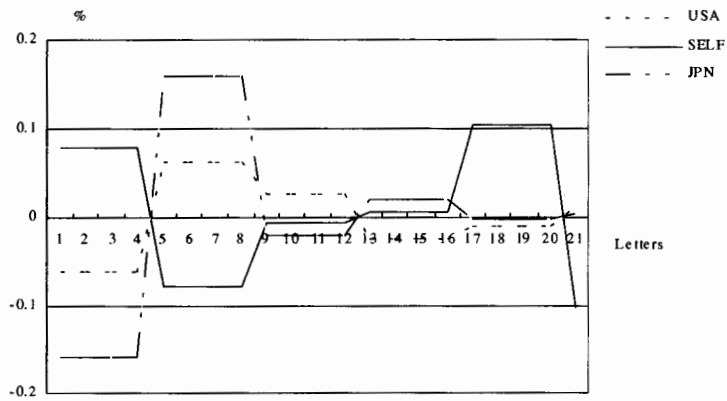**Fig. 4** Level 3 of the wavelet multi-resolution analysis.

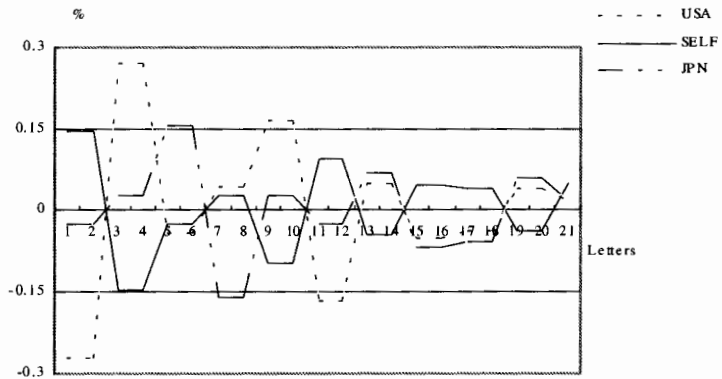**Fig. 5** Level 4 of the wavelet multi-resolution analysis.

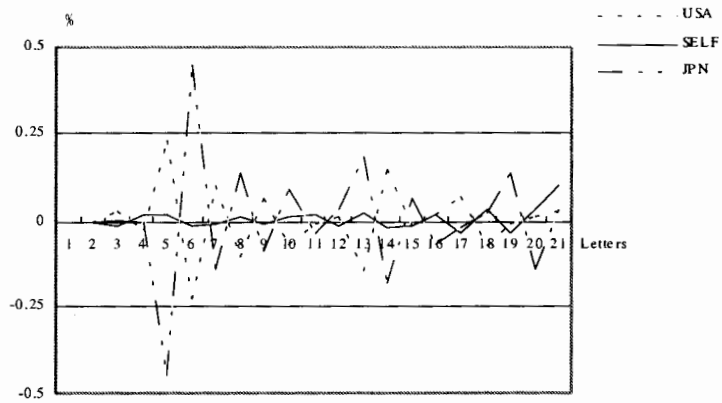**Fig. 6** Level 5 of the wavelet multi-resolution analysis.

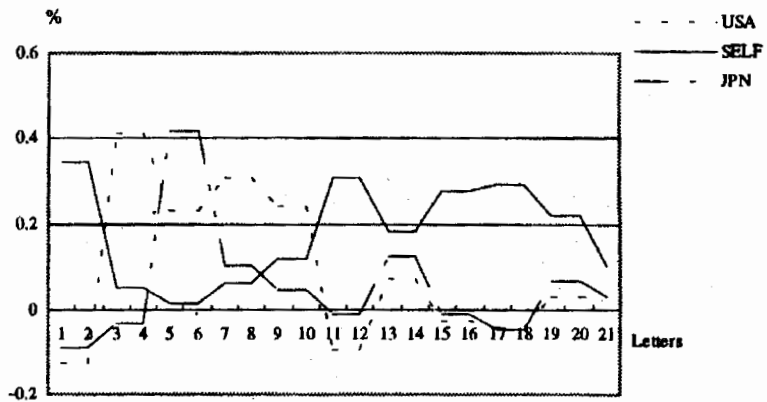**Fig. 7** Level 6 of the wavelet multi-resolution analysis.

Fig. 8 Reappearance without maximum level.

Table 3 Five Stages of Acculturation

Stage	Period	Peculiarity
1	L1–L2	Lower concern for both U.S. and Japan
2	L3–L5	Higher concern for U.S., No concern for Japan
3	L6–L10	Start to concern for Japan and Self
4	L11–L13	Higher concern for Self
5	L14–L2	Composition of U.S.and Japan vs. Self

Acculturation Process

In the past study, the first stage starts by contacting the foreign culture. According to the hypotheses, in this case, the acculturation process was developed as follows:

(1) The person conforms to American culture as a main foreign cultural value.

(2) While spending some period of time accepting many aspects of American culture, the person becomes aware of its negative sides. Then the person becomes aware of the positive sides of his own culture which previously seemed rather negative, switches the reference group from American to Japanese culture.

(3) The person continues to change the reference cultures between those of American and Japanese (this is a period of conflict).

(4) The person develops the identity without being influenced by the other cultural value, regarding both cultures to be on the same level.

In this study, the five-stage development model is extracted from the objective method.

Conflict

This process of acculturation is viewed as "foreign culture," "conflict," "own culture," "conflict," and "integration," respectively. The second stage of "conflict" ranges from letters L3 to L6. This is the "early stage of culture shock" which is to be examined later. Because of this, although it occupies the same period of switching the reference culture from "foreign culture" to that of "own culture," setting the "conflict" stage is the better way to understand the acculturation process.

Acculturation from the Emotional Aspect; Study by the W-Curve Hypothesis

Lysgaard [7] proposed the U-curve hypothesis which explaines the acculturation process including three stages (contact to foreign culture, crisis of accepting,

and a certain integrate), based on the compatibility. The W-curve hypothesis is based on the U-curve hypothesis with addition of the shock on returning to the own culture, proposed by Gullahorn and Gallahorn [8] and Freedman [9].

In these hypotheses, the acculturation processes are divided into two stages. According to Hoshino [10], the first stage has some physical symptoms caused by the mental disbalance like increase of drinking and smoking, sleeplessness, and headache. It occurred during the first few weeks of contacting the foreign culture. He defines this period as the "early stage of culture shock." Furthermore, following this period, there is the "radical stage of culture shock" feeling strong resistance and hostile behavior toward the foreign culture. In this period the deprivation of self-confidence and rejection for other people are exhibited.

Results

In this case, the author of the autobiography experienced returning home twice during her studies abroad and finally decided to settle down in U.S. Studying the W-curve hypothesis, we extracted the letters till her first return to Japan to control the conditions. Furthermore, to understand her psychology after returning we analyzed the letters up to L13 written in U.S. for about four months later. Figure 9 represents the changes in her psychology based on the compatibility of the total evaluation of both Japan and U.S. by each letter. All the data is arranged on the time axis. The average of the compatibility is calculated on the basis of all 21 letters.

Three periods are set by this graph.

(1) First of all, the letters from L3 to L6 indicate the one-month period after reaching America. She wrote letters every ten days. The compatibility changes dramatically up and down in this period, which is considered by Hoshino as an "early stage of culture shock."

(2) The second period is shown by the letters from L7 to L10 and is considered as the "rational stage of culture shock." In this period, after experiencing the early stage of culture shock, which represents a certain rejection of the foreign culture, she started to conform to new culture and she valued American culture more than Japanese one in her letters.

(3) Letter L10 was written in Japan just before returning to America. After this letter, the graph shows a steady decline. This trough means a U-turn shock. She becomes aware of her Americanization upon returning to Japan.

She introspected her identity, because of the shock she couldn't conform to Japanese cultural values. After this period the increase of introspection about self-consciousness is extracted by the multi-resolution analysis of wavelets.

In this study, the acculturation process shown on the W-curve is achieved by the method based on the degree of compatibility.

Table 4 Contents of Letters

| Letter number	Date/Address	Contents
L1	1982.6.4/Parents	(Failure in a university entrance exam. After finishing a secretarial course, she decides to study abroad and attends a private English school for the preparation.) Report the living. Complains troublesomeness of formalities regarding studying abroad and expresses hopes and fears of her own future.
L2	1982.8.15/Parents	(Entrance permission from Dean junior college.) Regret one's selfish attitude, which is caused by anxiety of departure and make a fresh resolve to study in the U.S.
L3	1982.9.7/Parents	Report of her life after arriving in the U.S.
L4	1982.9.18/Parents	Reporting about classes, food, and physical condition. Dissatisfaction about the living.
L5	1982.9.28/Parents	Dissatisfaction about the life in the U.S. and American food. Expresses one's view of Americans through friends.
L6	1982.10.4/Parents	About a parcel sent from Japan. About classes, homework, and friends.
L7	1982.11.7/Parents	How to spend holiday, and about a dormitory and the school.
L8	1983.2.3/Parents	(Fascinated by modern dance and starts to change the school.) Dissatisfaction about friends and change of attitude.
L9	1983.5.9/Parents	(Entrance permission from California State University, but parents was against the idea of transfer. Quit Dean junior college without deciding where to go next.) About next school.
L10	1983.8.31/Parents	Life in Japan during a summer holiday.
L11	1983.8.31/Parents	About going back to the U.S. Expresses the resolution to live in the U.S. another year and asks parents sympathy and understanding.
L12	1983.10.23/ Friend	(Studies in Hampshire University. Drastic change of circumstances causes intense confusion.) Describing one's state of depression about 'mental' independence.
L13	1983.12.16/Friend	Undergoes emotional conflict regarding one's identity as a Japanese and self-denial of Japanese way of viewing life.
L14	1984.1.9/Friend	About one's relationship. About the English and the Japanese as a language.
L15	1984.4.15/Parents	Gratitude for being able to study in the U.S. one more year. The meaning of studying in the U.S.
L16	1984.12.17/Friend	About American individualism and love. About one's future.
L17	1985.1.21/Friend	(Starts to share a flat with four men.) About one's new life and recent change of oneself)
L18	1985.2.21/Friend	Change of way of thinking about dance.
L19	1985.6/Friend	(Return to Japan after two years.) A clash of opinions with one's family.
L20	1985.10.11/Friend	Observations on oneself who is no longer the one once used to be. Differences between America and Japan.
L21	1986.4.3/Friend	(Co-habits with the present partner.) About a work for one's graduation. The relationship with the partner. About a graduation project and life after graduation.
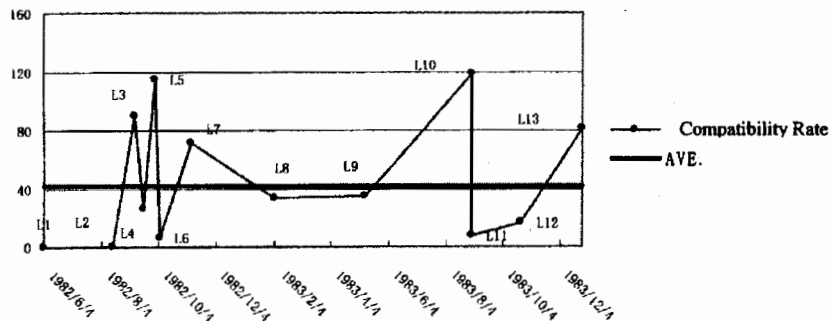
Fig. 9 Verification of the W-curve.

Culture Shock

In conclusion, in the results presented above we can see two troughs (one of them is the "culture shock" and the other is the "U-turn shock") on the W-curve. Furthermore, the "culture shock" in an "early stage of culture shock" is related to physical symptoms such as sleeplessness, diarrhea, and headache. Table 4 examines the contents of each letter.

COCLUSIONS

(1) In this study, the acculturation process is extracted from the person's letters that are not only the psychological tests but also the ordinary information about the individual.

(2) The "early stage of culture shock," "rational culture shock," and "U-turn shock" are the principal conflicts in acculturation.

(3) From the study by the five-stage development model, we extracted the processes of "foreign culture," "conflict," "own culture," "conflict," and "integration" and this result supports the Atkinson hypothesis.

(4) Level 3 of the wavelet multi-resolution analysis shows the process, which includes: first, the conformation to the foreign culture, then the re-evaluation of own culture, and finally, the achievement of the identity without being influenced by a particular culture.

As is well known, employing of the wavelet transform is essentially required the power of 2 data length. This means that the wavelet multi-resolution analysis depends on the data length. In other words, it is impossible for analysis to decompose into arbitrary resolution. The future study is to develop the methodology independent of the data length.

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