

Methods of Pictograph Design Based on the Formative Methods of Dongba Pictographs and Tangut Script

トンパ文字及び西夏文字の構成法に基づくピクトグラフデザイン方法

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● Keywords: pictograph design method, Dongba pictographs, Tangut script

Abstract:

In this paper, we present our research developing new pictograph design methods based on the formative methods of Dongba pictographs and Tangut script, for the purpose of developing understandable, systematic and interesting pictographs.

First, we studied and analyzed the formative methods of Dongba pictographs and Tangut script. Based on this research, we extracted a set of new pictograph design methods, briefly: pictographic representation, abstract representation and combining meaning-presented components. We also discussed characteristic strategies such as taking advantage of combination methods and systematic representation. To test the feasibility of the proposed pictograph design methods, we designed some pictographs for Traditional Chinese Medicine through each method.

We then administered a questionnaire to test the readability of the pictographs we designed. Based on the results of the questionnaire, we conclude that pictographs designed based on Dongba pictographs and Tangut script are effective in communicating their content. Pictographic representation and systematic representation methods were also proven to be effective in creating readable pictograms. The results of the questionnaire suggest that it is difficult to represent abstract meaning using abstract forms. However, the method of adding abstract symbols to concrete shapes and systematic representation may result in more readable designs.

要約

本論文では、意味伝達性が高く、興味をそそるピクトグラフを作成することを目的として、トンパ文字及び西夏文字の構成法に基づく新しいピクトグラフデザイン方法について述べる。トンパ文字と西夏文字の構成法の分析を行ってデザイン方法を抽出した。それらは象形表現、抽象的表現そして会意表現である。そして、組合せ表現、組織的表現を加えて新しいデザイン方法として提案する。提案したデザイン方法に基づいて中国漢方薬のピクトグラフを作成し、アンケート調査を行ったところ、このデザイン方法の有効性が確認された。

1. Introduction

Communication through pictographs becomes an essential tool in today's world, which is becoming a 'global village'. Ever since 1964, when art director Masaru Katsumie used pictographs for signs and events in the Tokyo Olympic Games, the effectiveness of pictographs has been evaluated highly, and pictographs have been used at every venue where people gather from around the world¹⁾. Today, many kinds of pictographs have become indispensable in modern life.

However, after investigating some pictograph designs appearing in our surroundings, we find that several unsatisfying issues still remained unsolved. ① Many pictograph designs lack logicity and systematicity. ② Complicated meanings are difficult to convey through pictographs. ③ Existing pictograph design styles are monotonous and generally use inflexible images.

In order to solve the above problems in pictograph design, we focus on ancient Asian characters, especially the Dongba pictographs and Tangut (Xixia) script.

Ancient script began with pictographs, which communicated through drawing the forms of the concepts they represented¹⁾. The hieroglyphs of ancient Egypt and the oracle bone script of ancient China and Dongba pictographs were similar in this respect. We believe that the formative methods of these hieroglyphs would be beneficial resources for modern pictograph design. (The results of our previous research on the formative methods of Chinese writing are summarized in "Methods of mark design based on the Six Principles of Chinese writing"²⁾).

In comparison with the hieroglyphs of ancient Egypt, Dongba pictographs maintain the high level of characteristic and abundant expressive force in conveying complicated meaning typical of hieroglyphs. As the only unique pictographs still in use today, their vivid appearance has drawn growing attention in the modern work. Many works of the famous Japanese designer Katsumi Asaba apply Dongba pictographs in graphic design. However, Mr. Asaba

focuses mainly on the aesthetic perception of Dongba pictographs, without addressing the formative methods of the characters.

The formative methods of Tangut script are very logical and systemic characteristics. We believe a combination of these characteristics with those of Dongba pictographs will result in a set of design methods with potential applications for pictograph design and sign design.



In this paper, we present our research developing new pictograph design methods based on the formative methods of Dongba pictographs and Tangut script. The feasibility of these pictograph design methods was tested through application to Traditional Chinese Medicine (TCM). TCM pictographs were made to represent an apparatus, a position of the body or symptom, or a person's action. The Dongba pictographs' abundant representations of shape and action, combined with the Tangut script's systematic representation, will be beneficial for pictograph communication in this domain.

2. Formative methods of Dongba pictographs and Tangut Script



2.1. Formative methods of Dongba pictographs

The Dongba pictographs were developed by the Naxi ethnic group in southwest China 3,000 years ago. It is considered the only unique pictograph language extant in the world today. The formative methods of Dongba pictographs can be summarized as follows^{3,4)}.


2.1.1. Hieroglyph

The Dongba characters were developed through the drawing of plants, animals and other objects found in nature, using hieroglyphs as a base. Simplified strokes were used to represent ordinary objects, such as  (cloth) and  (vehicle).

2.1.2. Transformation



Transformation is a method of producing new characters by transforming the shape of old ones. The old and new characters are then related in terms of meaning and pronunciation. For instance,  (broken tree) is produced by breaking the shape of  (tree).

2.1.3. Simple Indicatives


Characters of this sort use geometric forms to illustrate abstract concepts such as quantity, state or action. For example,  (separate) shows its meaning by illustrating two circles divided by two curves.

2.1.4. Adding abstract symbols to hieroglyphs




Characters in this category are composed by adding abstract symbols, such as dots and lines, to existing

characters. For instance,  (dread) shows its meaning by adding several trembling lines to the character  (shock).

2.1.5. Compound Indicatives

In Compound Indicative pictographs, several characters are combined to indicate a new meaning. For instance,  (sleep) is represented by depicting a man lying on a bed, with a trembling line near his mouth to indicate snoring.

2.1.6. Phono-semantic Compounds

A phono-semantic Compound creates a new character by linking together a character with a related meaning (the semantic element) and another character (the phonetic element) to indicate its pronunciation. For example, the character  (village, pronounced *be*) is formed by combining  (room), which indicates meaning, and  (pronounced *be*), which indicates pronunciation.

2.2. Formative methods of Tangut Script

The Tangut script is an obsolete logographic writing system, used for writing the also obsolete Tangut language during the XiXia Dynasty. The entire character system was created by the high-ranking official Yeli Renrong according to several logical rules. The formative methods of the Tangut Script can be summed up as follows^{5,6)}.

Tangut characters can be divided into two classes according to their structure: simple and composite. The latter are more numerous. None of the Tangut characters are pictographic.

2.2.1 Simple characters

Simple characters commonly have fewer strokes, and can denote meaning or pronunciation separately. There are about 350 simple characters, which are the basic building blocks of other characters. They are partially modeled after the Chinese characters, with diagonal brush strokes prevailing. The simple characters can be either semantic or phonetic.

2.2.2. Composite characters

Composite characters are combinations of the simple characters. They are divided into three types.

1) Associative compounds

Associative compounds combine two or more components. A component can be a simple character, or part of a composite character. The composite characters include semantic-semantic combinations, such as combining "not" and "moving" to create "fixed"; or combining "mouth", "no" and "water" to create "thirsty". Other composite characters are semantic-phonetic, combining a character with a related meaning and another character to indicate its pronunciation.

2) Interconverting characters

There are a number of pairs of special composite

characters worth noting. The members of such a pair have the same components, but differ in the location of the components within them (e.g. AB vs. BA, ABC vs. ACB). The members of such a pair have very similar meanings. For instance, 𠄎(finger) and 𠄏(toe) form a pair of mirror images.

3) Symmetrical characters

Symmetrical characters illustrate another characteristic formative method of Tangut script. Some of these characters have the same components on the left and right side, always with meanings related to "both" or "double", such as 𠄎(both, a pair) and 𠄏(lips). Some have a vertical stroke between the two parts, always with meanings related to "middle" or "through", such as 𠄐(balance) and 𠄑(between).

3. New pictograph design methods based on the formative methods of Dongba pictographs and Tangut script

3.1. Pictographic representation

Pictographic representation is the basis of hieroglyphic writing. The Dongba pictographs have a strong picturesque character, and most of them depict physical objects. In addition, though Dongba pictographs were progressively simplified and stylized over the course of their development, the picturesque characteristic was not weakened greatly, as is the case for the Chinese characters. Because of their visual characteristics, the Dongba pictographs are perspicuous and easy to understand. Moreover, the vivid appearance of the Dongba pictographs has aroused the interest of modern people who are tired of mechanical forms surrounding them.

Realistic and direct style is commonly used in pictograph design. Thus, the Dongba pictographs are a valuable source to study.

3.1.1. Depicting the image of an object directly

Depicting the figures of the objects using concise lines is the most common method in pictograph design. The Dongba pictographs are typical in this respect, depicting many objects through their outlines, such as 𠄒(tree) and 𠄓(leaf).

Some Dongba characters can be retained without change for their graphical nature and fairly realistic style. We designed a pictograph of "Man" (Fig. 1) by depicting the image of a person with concise lines based on the Dongba pictograph 𠄔(man). In order to create an artistic and interesting form, we drew the draft with Chinese brush.



Fig. 1 Man

3.1.2. Transforming from the existing images

Transforming is a characteristic method often used in the formation of Dongba characters. By transforming the shapes of existing pictographs, many new characters were produced. Furthermore, since the new characters are related in meaning to the original ones, they are easily interpreted. The methods of transforming often used in Dongba pictographs are listed below.

- 1) Extending: 𠄕 (I) represents a man pointing towards himself. It is formed by extending the arm of 𠄔 (man).
- 2) Distorting: 𠄖 (whirlwind) is represented by distorting the shape of 𠄗 (wind).
- 3) Direction-changing: the meaning of 𠄘 is "food"; turning it upside-down makes 𠄙 (lack of food).
- 4) Cutting and simplifying: 𠄚 (eclipse) is a new character produced by cutting some part of 𠄛 (sun).
- 5) Part-enlarging: 𠄜 (body) is transformed from 𠄔 (man) by enlarging the body part of the character in particular. 𠄝 (fat) emphasizes the body much more.

These methods can easily be used in modern pictograph design. For instance, we designed pictographs for "Aversion to Cold" (Fig. 2) and "General Weakness" (Fig. 3) by transforming the pictograph of "Man" (Fig. 1).



Fig. 2 Aversion to Cold



Fig. 3 General Weakness

3.1.3. Representing an object with the help of correlative objects

Some objects are difficult to depict or easily confused when represented alone. Thus, when creating pictographs for these objects, related objects such as surroundings, attachments and contents should be represented together. Hence, the Dongba character 𠄞(brow) is represented with the help of 𠄟(eye).

This method is also helpful in modern pictograph design, as illustrated in our pictograph for "Corn" (Fig. 4). Since the shape of the corn could easily be confusing when represented alone, we presented it with the help of a foot.











Fig. 4 Corn

3.2. Abstract representation

It is obvious that the opportunity for concrete representation is limited. For example, bodiless substances and abstract concepts are difficult to depict using concrete graphics. Thus, ancient people attempted to use abstract symbols to form new characters.

3.2.1. Using abstract symbols

Some concepts in Dongba pictographs are represented by

geometric forms such as points, lines, and shapes. They are used to represent formless objects such as  (air) and  (wind); to represent abstract concepts such as  (center) and  (middle); to represent activity such as  (hang) and  (cover); and to represent states such as  (high) and  (straight).

In modern times, pictographs composed of geometric forms have gradually been added. They have wider applicability and potential and are more compatible with concepts related to modern life.

Using this method, we designed a series of pictographs concerning "pain". "Pain" is an abstract concept, and there are many types of pain. After designing a basic symbol indicating "pain", we can combine this "pain" symbol with concrete or abstract



Fig. 5 Pain



Fig. 6 Throbbing Pain



Fig. 7 Stabbing Pain











Fig. 8 Intermittent Pain



components to express various types of pain. Thus, we created a symbol with a zigzag line to symbolize the unpleasant sensation of pain, and then developed several pictographs to represent different kinds of pain based on the "pain" symbol. Figs. 5-8 show the series of "Pain", "Throbbing Pain", "Stabbing Pain", and "Intermittent Pain".






3.2.2. Adding abstract symbols to pictographs

This is another effective method widely used in Dongba pictographs to produce new forms. It extends the capacity for expression by adding abstract graphics to concrete shapes. Several types of abstract symbols are frequently used in Dongba pictographs³⁾:

1) Dots: to represent a large quantity:  (crowd); to represent powder or granular substances:  (sand); to represent liquid:  (alcohol).

2) Trembling line : to represent shaking or vibration:  (shock); to represent a ray or smoke:  (rainbow),  (hot); to represent a sound from animals or nature:  (tweet).

3) Interacting (crossed) lines: to represent talking over or a dispute:  (quarrel); to represent attachment or correlation:  (companion, spouse) symbolizes a man and a woman hand in hand.

4) Block: blocks like , ,  represent almost all things that need not be said clearly; in other words, the abstract concept of "something". For instance,  (nip) is to nip something with a  (pinchers).

As this method combines the advantage of both concrete

and abstract graphics, it largely expands the options available for expression.

To put this method into practice, we designed pictographs for "Frequent Urination" (Fig. 9) and "Difficult Urination" (Fig. 10) by adding lines or dots, to symbolize the large or small quality of the urination, to the figure of a person with an emphasized penis.






Fig. 9 Frequent Urination



Fig. 10 Difficult Urination

3.3. Combining meaning-bearing components

3.3.1 Graphical aggregate

Most of the Dongba pictographs with several components belong to this category. The meaning of the new character always equals the simple combination of the components' meanings. An example is the character , which is composed of the pictographs for  (sit) and  (stone). Its meaning, "to lean against a stone", is the combination of the meanings of the two component characters.

Using this method, we designed a pictogram for "Bruise" (Fig. 11). The main element is a falling person, with abstract symbols attached to strengthen the dynamic state. The line which symbolizes steps below the person also helps to express the meaning clearer.









Fig. 11 Bruise

3.3.2 Logical aggregate

The creation of logical aggregates is the most important method for forming Tangut characters. The logical characteristic of the Tangut script allow characters to be easily understood.

1) Adding new component to the basic character

New characters can easily be formed by adding new components to basic characters. Moreover, the meaning of the new character is then related to the meanings of all the components. For instance, the basic character  (thin) plus the radical  (tree) makes  (thorn);  (thin) plus radical  (metal) makes  (needle)⁷⁾.

With this method, we designed pictographs for "Swollen Abdomen" (Fig. 13), "Pregnancy" (Fig. 14), and "Abdominal Angina" (Fig. 15) by adding different components to the pictograph for "Empty-stomach" (Fig. 12).



Fig. 12 Empty-stomach



Fig. 13 Swollen Abdomen



Fig. 14 Pregnancy



Fig. 15 Abdominal Angina

2) Replacing some components

Another logical combination method replaces some

components of a character with other components. For instance, the Tangut character 𐰇 (forget) is formed by replacing the left part of 𐰇 (heart) with the right part of 𐰇 (non-existence). Readers can easily deduct the new character's meaning through knowledge of the meanings of the components.

With this method, we designed a pictograph for "Car Sickness" (Fig. 17) by replacing the glass in the pictogram for "Intoxicated" (Fig. 16) with a car.



Fig. 16
Intoxicated



Fig. 17
Car Sickness

3.3 Combining several components to represent complicated meanings

A picture always conveys much more information than a word. Many Dongba pictographs can represent complicated meaning as if they are sentences, as in 𐰇 (slaves escaped together). By combining several concrete and abstract components, it is possible to visualize movements, changes, operations and complicated concepts such as including situations.

We designed pictographs for "Constipation" (Fig. 18), "Insect Bite" (Fig. 19) and "Stab Wound" (Fig. 20) by combining multiple components to represent complicated meaning. The pictograph for "Constipation" represents the complicated

concept of "difficult evacuation of dry, hardened feces from the



Fig. 18
Constipation



Fig. 19
Insect Bite



Fig. 20
Stab Wound

bowels". The pictograph for "Insect Bite" represents the situation of "swelling after being bitten by an insect".

4. Characteristic design methods derived from the formative methods of Dongba pictographs and Tangut script

4.1 Using combination methods to express meanings

Combining existing components is not a new method in pictograph design. However, the idea that the combination methods themselves may also convey meaning is novel. The orientation, size, and relative position of components may also become important means of conveying information. The multiformity and freedom of layout allow for rich combination methods to express meanings.

4.1.1. Exploiting orientation

The meaning of 𐰇 (bump) is expressed clearly by changing the orientation of the component 𐰇 (cow).

Sometimes, because of differences in orientation, characters that make use of the same components may have different meanings. For instance, 𐰇 (kick) is represented by two people who are lifting up their feet in opposite directions, while 𐰇 (follow) is represented by two people who are walking in the same direction.

With this method, we designed pictographs for "Bad Appetite" (Fig. 21) and "Good Appetite" (Fig. 22). We visualized the abstract concept "appetite" by combining concrete objects that indicate food and the figure of a person. Here, the combination method



Fig. 21
Bad Appetite



Fig. 22
Good appetite

plays an important role in expressing the meaning clearly. By changing the orientation of the person, two pictographs making use of the same components convey different attitudes toward food.

4.1.2. Exploiting size

For instance, the Dongba character 𐰇 (father and son) is composed of 𐰇 (father) and 𐰇 (people, son), and the sizing of these components plays the main role in expressing meaning. 𐰇 is drawn smaller in size to indicate his lower status.

4.1.3. Exploiting relative position

In Dongba pictographs, 𐰇 (hold in the arm) depicts a woman with a baby in her arms; 𐰇 (give birth to) depicts a baby underneath a woman. In these characters, both the relative position and the size take part in showing the meaning clearly.

Though Tangut characters are not pictographs, we can also find several Tangut examples exploiting relative position. For instance, 𐰇 (ride) is represented by placing part of 𐰇 (person) above and 𐰇 (horse) below.

With this method, pictographs for "Dry in the Sun", "Dry in the Shade" and "Photophobia" were designed (See Section 5 for a discussion of these pictographs for "Dry in the Sun" and "Dry in the Shade").



Fig. 23
Photophobia

4.2 Systematic representation

4.2.1 Meaning group

1) Similar meaning with similar forms

In Tangut script, characters with related meanings are formed from similar shapes. For instance, the radicals 𐰇 (people), 𐰇 (beast), 𐰇 (insect), 𐰇 (hand), and 𐰇 (finger) are made from similar forms⁵⁾.

Creating similar forms for pictographs with similar meanings is a logical method that makes pictographs more

understandable. This effect on understanding is clear in the results of our questionnaire.

The pictographs we designed for "Man" (Fig. 1), "Woman" (Fig. 24) and "Child" (Fig. 25) using similar forms were reported



Fig. 24 Woman Fig. 25 Child

by all participants to be represented clearly.

2) Common components

The Tangut characters can be divided into many categories according to their "radicals". For example, characters with the radical 钅 (metal) have meanings related to metal, as in 钹 (pan), 锯 (saw), 刀 (knife) and 锡 (tin).

To make pictographs in the same domain contain the same



components is also a systematic method in the development of meaning groups. Meanings of the pictographs in the same group can thus be easily interpreted and memorized. To put this method into practice, we designed several pictographs related to diseases in the ear by changing the elements within the ear symbol (Figs. 26-28).

4.2.2 Semantic network

To build a semantic network, we first design several basic meaning components, and then combine them together. This method is the equivalent of composing innumerable words using several letters. It is often used in the formation of Tangut characters, as in characters with the components 口 (mouth) and 水 (water). 涇 (mouth) is formed by combining the radicals 口 (mouth) and 人 (human). Putting two mouth radicals together makes 囗 (lips). Changing the human radical into the water radical makes 汙 (spittle); by inserting the water radical into 囗, 涎 (saliva) is created⁵⁾.



Fig. 29 Cannot See Clearly Fig. 30 Eye Mucus Fig. 31 Eye Swelling Fig. 32 Tearing

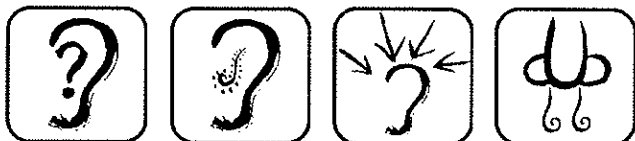


Fig. 33 Cannot Hear Clearly Fig. 34 Ear Mucus Fig. 35 Pressure in Ear Fig. 36 Runny Nose

With this method of systematic representation, we designed a series of pictographs about diseases in the eye, ear and nose, using the symbols for eye, ear, nose, liquid, mucus, pressure, etc (Figs. 29-36).

5. Questionnaire and analysis

5.1. Practice of the questionnaire

From February 22nd to 25th, 2008, we carried out an evaluation of the readability of the pictographs we designed for TCM. A total of 20 effective replies were received.

5.2. Contents of the Questionnaire

The questionnaire included three sections, and respondents were asked to fill in the questionnaire papers in proper order.

Questionnaire I (open-ended): We selected 22 pictographs made using the design methods described above, and divided them into 15 groups. The respondents were asked to write down the meaning the pictographs based solely on the symbols. This was the main means of evaluating the readability of the pictographs for TCM, as it provided the respondents' free opinions.

Questionnaire II (close-ended): The respondents were asked to indicate whether the design concepts had been properly represented, for the same target pictographs as in Questionnaire I. The results were considered supplemental to Questionnaire I, for the purpose of clarifying the evaluation.

Questionnaire III (close-ended): Identical concepts were represented by several different designs. The respondents were asked to select the design that best expressed the meaning. A total of 4 groups (12 pictograms) were presented.

5.3. Respondent demographics

A total of 20 Chinese participants completed this survey, including 6 males (30%) and 14 females (70%). 7 (35%) were age 10-29, 11 (55%) were age 30-59, and 2 (10%) were over 60. 5 (25%) respondents majored in medical science, and 2 (10%) majored in graphic design.

5.4. Results and analysis

5.4.1. Results and analysis of questionnaires I and II

Similar results for readability of the pictographs were obtained from questionnaires I and II. In brief, the pictographs were considered readable by most of the respondents (In questionnaire I, an average of 69.7% of the respondents gave the correct answers. In questionnaire II, an average of 71% of the respondents thought the meanings of the target pictographs were represented clearly).

The results of analysis were as follows.

Table1 Results of questionnaire I in the order of the correct rate

Item	Correct rate
Man; Woman; Child (Fig. 1, 24, 25)	100%
Pregnancy (Fig. 14)	100%
Bad Appetite; Good Appetite (Fig. 21, 22)	100%
Lumbago (Fig. 37)	85%
High Fever!	85%
Bruise (Fig. 11)	80%
Tinnitus (Fig. 26)	80%
Runny Nose/ Tearing (Fig.36, 32)	75%
Corn (Fig. 4)	70%
Photophobia (Fig. 23)	65%
Medicine for Nose; Medicine for Eyc; Medicine for Ear	65%
Intoxicated (Fig. 16)	55%
Insect Bite (Fig. 19)	50%
General Weakness (Fig. 3)	35%
Pain; Throbbing Pain (Fig. 5,6)	0%
Average	69.7%

Table2 Results of the questionnaire II in the order of the correct rate

Item	Represented clearly	Can not say which	Do not represented clearly
Man; Woman; Child (Fig. 1, 24, 25)	100%	0%	0%
Pregnancy (Fig. 14)	100%	0%	0%
Bad Appetite; Good Appetite (Fig. 21, 22)	100%	0%	0%
Lumbago (Fig. 37)	85%	10%	5%
High Fever!	85%	15%	0%
Bruise (Fig. 11)	80%	5%	15%
Tinnitus (Fig. 26)	80%	15%	5%
Runny Nose/ Tearing (Fig.36, 32)	80%	20%	0%
Corn (Fig. 4)	75%	20%	5%
Photophobia (Fig. 23)	65%	15%	20%
Medicine for Nose; Medicine for Eyc; Medicine for Ear	60%	20%	20%
Intoxicated (Fig. 16)	50%	30%	20%
Insect Bite (Fig. 19)	50%	25%	25%
General Weakness (Fig. 3)	45%	35%	20%
Pain; Throbbing Pain (Fig. 5,6)	10%	40%	50%
Average	71%	16.7%	12.3 %

1) Most readable pictograph designs: For the pictographs for “Man, Woman, Child” (Fig. 1, Fig. 24, Fig. 25), “Pregnancy” (Fig. 14) and “Bad Appetite, Good Appetite” (Fig. 21, Fig. 22), all respondents gave the correct answers (100%) and thought the meanings had been represented clearly (100%).

All of these three groups were represented using pictographic elements. Pictographs for “Man, Woman, Child” used independent pictographs, while “Pregnancy” and “Bad Appetite, Good Appetite” were represented by combining several pictographic elements.

Moreover, among these three groups, two groups were created through series design. The systematic representation

method of these designs contributed to straightforward understanding meanings.

2) Most unreadable pictograph design: For the pictographs for “Pain, Throbbing Pain” (Fig. 5, Fig. 6), none of the respondents gave the correct answers (0%), and only 10% of the respondents thought the meaning of the pictographs had been represented clearly. In questionnaire I, the respondents’ answers for the meaning of these pictographs were as follows: unreadable: 60%; electric shock/ repeated electric shock (of varied intensity): 15%; pain/ violent pain: 5%; chilliness/ serious chilliness: 5%; tremble: 5%.

The results of the questionnaire showed that the pictograph for “Pain” was thought to be unreadable by most of the respondents. However, when the “Pain” symbol was combined with concrete shapes, its meaning became clearer. For example, in the pictograph for “Lumbago” (Fig. 37), we expressed the meaning of “Pain in the Waist” by adding the pain symbol to the waist of a stooping person. For this pictograph, the rate of correct answers reached 80% in questionnaire I and 85% in questionnaire II.



Fig. 37 Lumbago

From these results, we learned that the most difficult task is to represent abstract meaning through individual abstract forms. However, the method of adding abstract symbols to concrete shapes may result in more readable designs.

On the other hand, although the pictograms for “Pain” and “Throbbing Pain” were thought to be unreadable, several respondents grasped the relationship between the two pictograms and described the latter to represent “repeatedly” or “repeatedly with varying intensity”. This result also proved that systematic representation is an effective method in conveying meaning correctly.

3) Pictograph designs with intermediate results: For the pictograph for “Bruise” (Fig. 11), 80% of the respondents gave the correct answers and thought the meaning had been represented clearly. In questionnaire I, respondents’ answers for the meaning of this pictogram were as follows: bruise or fall: 80%; slippery steps or be careful of steps: 15%; injury or fracture: 5%.

The pictograph for “Bruise” was designed using the graphical aggregate method. It is a fairly realistic representation made by combining concrete shapes. However, it is also notable that 15% of the respondents thought this pictograph stood for “slippery steps/be careful of steps”. In our opinion, the misreading was mainly due to the steps drawn under the person. Thus, when choosing

elements to form a pictogram, it is important to confirm that they will not lead to misunderstanding.

5.4.2. Result and analysis of questionnaire III

Table3 Results of questionnaire III

Item	A	B	C	D	Others
Diarrhea	0% (Fig.43)	45% (Fig.44)	45% (Fig.45)		10%
Dizziness	25%	65%			10%
Carsickness	10%	5%	60%		25%
Dry in the Shade	15% (Fig.38)	50% (Fig.39)	10% (Fig.40)	20% (Fig.41)	5%

(Note: some respondents chose multiple designs for one item.)

Two different types of results were obtained from questionnaire III. In three of the four groups, one design received a preponderance of votes (“Dizziness”, “Car Sickness” and “Dry in the Shade”); in the remaining group, two designs received equal votes (“Diarrhea”).

For example, to express the meaning of “Dry in the Shade”, we provided four designs with the same layout (Figs 38-41). Among them, the design with a cloud to indicate “shade” (Fig. 39) received a majority of 10 votes (50%).



Fig. 38 304A



Fig. 39 304B

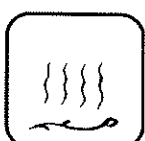


Fig. 40 304C



Fig. 41 304D

We designed the pictograph “Dry in the Shade” using the same method as for “Dry in the Sun” (Fig.42). All of these pictographs had the same components: a pictographic symbol for herb and several vertical curves that symbolize “steam, evaporation”. We provided four alternatives to express the concept of dry in the shade. The pictograph with the cloud received the largest number of votes. In our opinion, the main reason is that the cloud is a typical symbol to indicate shade in Chinese culture. Choosing the most conventional symbol is thus very important in designing pictographs to be understood by the majority of readers.

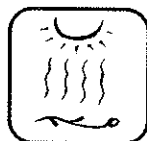


Fig. 42 Dry in the Sun

On the other hand, among the three designs for “Diarrhea” (Figs 43-45), two (Fig. 44, Fig. 45) gained the same



Fig. 43 301A



Fig. 44 301B



Fig. 45 301C

number of votes (9 votes, 45%). All of the three pictographs were designed using the combination method based on a sitting person. 301B combines the person and abstract symbols: straight lines and dots to symbolize something

sputting out rapidly. In 301C, a tap is added as a metaphor. Both of two designs were accepted by the respondents. From this result, we learned that the same meaning can be represented in several different ways. There is no one standard answer to satisfy all. Many factors influence people’s imagination of the same concept, including their gender, age, education, thinking pattern, culture difference, etc. This is an interesting issue for study in our future research.

5.5. Conclusion

The result of the questionnaire about the readability of the pictographs we designed for Traditional Chinese Medicine show that the new design methods based on Dongba pictographs and Tangut script are effective for pictograph design. Several other conclusions will also be beneficial to our future research:

1. The methods of pictographic representation were proven to be effective in creating readable pictograms.
2. The most difficult task is to represent abstract meaning using purely abstract forms. However, the method of adding abstract symbols to concrete shapes and systematic representation may result in more readable designs. This is an area for study in our future research.
3. The method of systematic representation is effective in developing easily understandable pictogram systems.
4. The same meaning can be represented by different pictogram designs. We should explore suitable design according to the target subjects and circumstance.

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