Educational Activities Using of Picture Books for Blind Children: A Case Study

KANEKO Takeshi

(**Department of Policy & Planning**)

Abstract: Picture books for blind children include pictures made with tactile materials to enhance understanding, but occasionally these books have pictures that can not be understood tactually by blind children. The purpose of this study is to make relevant and interesting picture books for blind children using pictures that can be understood tactually and, using these books, to enhance the development of blind children and their learning. Examples of this inclnde improvements in tactile perception, tactile imagery and the use of imagination when presented with pictures and stories, and the learning of Braille. These aspects were investigated in a case study using picture books with a blind girl between the ages of 3 and 6. It was found that, 1) tactile perception generally improved and "searching" and "tracing" tactile perception improved, 2) the child expressed the stories using gestures and by manipulating 3-D models of the characters in the picture books. Consequently, her tactile images and imagination were enhanced, and 3) she developed an interest in the Braille used in picture books and this became a basis for her learning of Braille.

Key Words: Picture books for blind children, Tactile perception, Imagery, Imagination, Braille

I. Introduction

Picture books for blind children are designed for visually impaired children. They are made from tactile materials or pictures manufactured through stereo copying or embossing. Using these books, it is possible for visually impaired children to understand the picture by touching it. However, visually impaired children are sometimes unable to enjoy tactile picture books because the pictures in them are difficult to understand through touching. Consequently, we tried to produce enjoyable picture books with pictures that blind children can easily understand through touch, and we examined their appropriateness by introducing them to visually impaired preschoolers. As a result, if such books are manufactured in accordance coith some of the guidelines developed in this research, we feel that enjoyable picture books containing pictures that are easy to comprehend through touch can be produced.[3)]

Furthermore, although the picture books themselves are regarded as being enjoyable materials for children, which is considered most important, the utilization of picture books may contribute to some areas of development and learning in children. In general, these areas include the ongoing exchange between children and persons reading the picture books (such as mothers or nursing individuals), enhancing children's images and cultivating their imagination, and stimulating an interest in letters and their learning.[1) 4) 5)] Such contributions are also relevant for visually impaired preschoolers. Furthermore, when visually impaired preschoolers touch pictures in picture books, it is a good opportunity to improve their methods of tactile perception. With regards to improvements in tactile perception, we have already developed two guidelines that are regarded as being effective for such improvement.[3)]

In this study, we will discuss the case of one visually impaired preschooler for whom progress was observed in some areas through activities utilizing picture books for blind children developed by us. This study covers three areas: improvement in tactile perception, enhancing images and cultivating imagination, and stimulating an interest in letters (Braille) and their learning.

II. Prerequisites for the Activities

As described above, in this study, we examine three areas in which we observed the progress of one visually impaired preschooler through activities utilizing picture books for blind children. As a prerequisite for these activities, the special features and types of picture books used in this study and the order of their introduction will be mentioned.

1. Characteristics of Picture Books for Blind Children in this study

As stated earlier, the most important aspect of a picture book is that it is enjoyable. Therefore, the pictures should be easily understood by children, which is only natural for a picture book. In the case of picture books for blind children, the pictures should be easily understood by visually impaired children through touching. In other

words, objects represented by pictures should be adequately understood. What does the picture describe? (Is it a human being, monkey, turtle, balloon, soap, kitchen sink or slide?) This should be understood easily. The events represented by the picture (the monkey is climbing a tree, the balloon is gradually becoming bigger, the turtle has been overturned, the soap is falling from a kitchen sink) should also be easily recognizable.

On this precondition, the picture book should be enjoyable for children through its pictures and its story.

In this study, picture books for blind children that were regarded as satisfing the above-mentioned points was considered a prerequisite. As for the picture books themselves, at the beginning of the treatment, as mentioned earlier, they were based on guidelines developed by us, and then new picture books based on new policies were utilized. In addition, we used some picture books based on guidelines for improving tactile perception.

Further details of these guidelines and picture books produced will be covered later in the explanation of the progress of the treatment.

2. Types of Picture Books for Blind Children and Order of Introduction in this Study

The types of picture books for blind children include those composed of pictures by pasting tactile materials on the pages, and those composed of raised pictures through stereo copying or embossing. In the case of stereo copying, original images are copied on special stereo copying paper and then processed using a stereo copier, so the black areas of the images are raised. The original images can be drawn on a computer. Embossed pictures are composed of dotted lines and dotted patterns, and formed on Braille paper. When utilizing computer software such as EDEL (created by Mr. Norihiro Fujino) *(Note), a drawing can be made on a computer and printed out on Braille paper using a Braille printer.

For picture books with tactile materials, depending on the type of tactile materials pasted, information on their feel (smooth, rough, wooden or furry, etc.) can be transmitted to the children, which is not true for other forms. Even younger visually impaired children (preschoolers) are able to extract information from the feel. Therefore, pasted tactile materials are regarded to be most effective in the initial stage of activities using picture books.

On the other hand, in the case of making an original image for stereo copying or a embossed picture by computer drawings, a picture can be drawn more accurately and easily. In other words, the structural elements of a picture can be arranged more accurately. Furthermore, more complicated features such as an outline or lines can be more accurately and easily drawn. In addition, after entering school, when studying a curriculum, figures, graphs, diagrams, and maps produced by stereo copying or embossing may be utilized.

In due consideration of the above, for the introduction of picture books to blind children, the sequential order is considered to be first picture books utilizing pasted tactile materials. After this, picture books for blind children made by stereo copying or embossing can be introduced.

In the case of the visually impaired child (preschooler) examined in this study, at the age of 3 years and 0 months, a picture book for blind children utilizing pasted tactile materials was introduced for the first time. Subsequently, a picture book utilizing stereo copying was introduced at the age of 4 years and 5 months.

By dividing this study into two periods based on the above, we describe the results of each period.

III. a Case Study: Introduction

The child, M, is a girl born in May 1995. She was a 23-week-old fetus and 696g at birth, and her vision was only at the level of light sensation due to premature retinopathy. From age 2, she started to attend support classes for visually impaired preschoolers in an institute for the visually handicapped, once a week. Since the resource room is visited by researchers, M was involved in research from the time that she started to attend the institute.

She was involved in treatment through picture books for blind children produced from this study between the ages of 3 years and 0 months and 6 years and 2 months (as of July 2001). When picture books were introduced, she had no problems in vocalizing her comprehension through spoken language. In addition, she was able to turn the pages of the books herself.

IV. Progress of Treatment

1. Introducing Picture Books for Blind Children Utilizing Tactile Materials

The picture books that were introduced to M for the first time utilized tactile materials pasted onto the pages, as mentioned above.

These picture books were based on guidelines developed by researchers to satisfy the prerequisites of being enjoyable and easy to comprehend by blind children (Kaneko, et al. 1999)[3]. Furthermore, to stimulate improvements in tactile perception, picture books were based on the two guidelines (from the same study).

Note*: For further details on EDEL, please refer to the author's homepage (http: homepage2.nifty.com/EDEL-plus/).

Hereinafter, the guidelines on the production of picture books for blind children and their contents will first be discussed. Next, the results of the introduction of picture books to M by describing her improvement in tactile perception and the stimulation of her interest in letters (Braille) and their learning will be covered.

(1) Guidelines on Production

(i) Basic Guidelines on Production

In the case of producing picture books for blind children, to produce tactually appropriate pictures without relying on intuition or experience and tracing ordinary visual pictures, the following basic guidelines were considered (Kaneko et al. 1999)[3].

Picture books for blind children should be produced by utilizing various attributes (such as tactile materials, size, number, shape, present position, direction and inclination) in a self-conscious and appropriate manner. (For instance, in the case of the picture of a balloon, the tactical material are rubber; 7cm in diameter; there is one balloon; it is round; it is located in the lower central part of the page.)

In addition, these basic guidelines were also adopted for picture books for blind children utilizing stereo copying.

(ii) Guidelines on Producing Easy-to-Comprehend and Fun-to-Touch Picture Books

Guidelines on producing easy-to-comprehend and fun-to-touch picture books for blind children (Kaneko, et al. 1999) are described briefly as follows.

(i) Each picture in a picture book should be manufactured by different tactile materials. Moreover, tactile materials similar to the feel of the actual object should be selected as much as possible. This enables a child to easily and clearly understand the picture by simply placing her hand (or fingers) on it. (For example, rubber materials for a balloon picture, fur materials for a cat, and paper that feels like stainless steel for a kitchen sink.)
(ii) The shape, regarded to be one of the attributes of a picture, should be simple. It should be a simple shape such as a straight line, circle or square whenever possible, or it should be composed of these elements. (For example, a circle for a balloon and a square for a kitchen sink.)
(iii) As a method for producing enjoyable picture books, even if the shape is simple, attributes other than the shape such as the size, number, position, direction and inclination should be inventive. In particular, to make picture books simpler and more enjoyable, only one attribute in the same picture (for instance, only size or only position) should be changed on each page. (For example, only the size of a balloon picture is changed or the position of a cat is changed in consecutive pages.)
(iv) To put the above-mentioned guidelines (I).-(III) into practice, we create original stories and pictures to produce tactile picture books. Then, applying the lessons learned through this process, other tactile picture books are produced on the basis of existing picture books for sighted children.

(iii) Guidelines on Improving Tactile Perception

The guidelines on improving tactile perception are as follows.

(i) To encourage "searching" with hands or fingers, the position of specific pictures or structural elements in picture books should be changed on each page.
(ii) To create movement by "tracing" with hands or fingers, pictures using straight lines, rectangles or circles (or structural elements), which are considered to stimulate a child to trace should be included in picture books.

(2) Contents of Picture Books Created for Blind Children

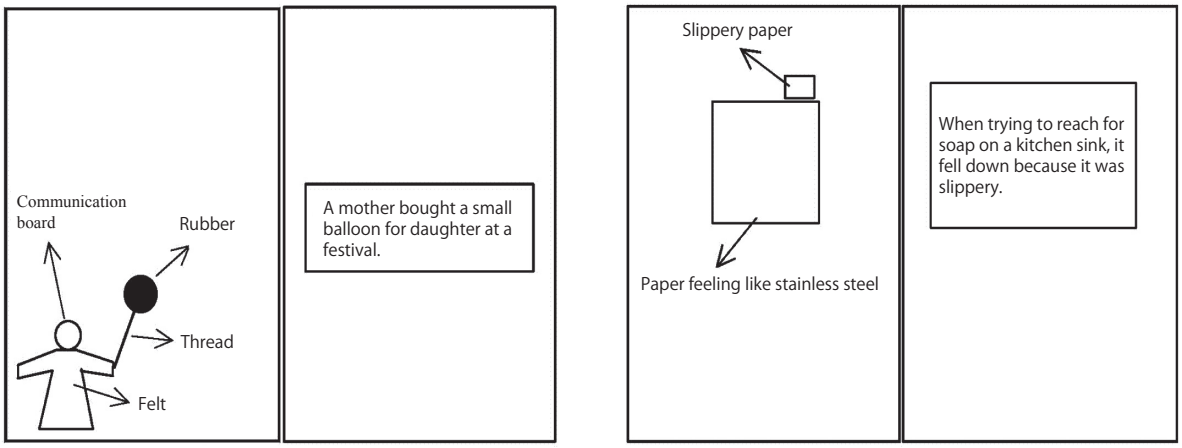
On the basis of the above-mentioned "basic guidelines" and "guidelines for easy-to-comprehend and fun-to-touch picture books", 8 picture books were created by pasting tactile materials on pages.

The pictures were created by pasting tactile materials on the left page of double pages with the story written beneath or on the right page. The text was initially not in Braille but comprised normal letters, and an intervener read the text out loud. The right side of the picture book was bound so that a child turned pages from left to right.

For further details on these picture books, please refer to Table 1 and Kaneko, et al. (1999)[3]. In Table 1, among the 8 picture books, four picture books made in an earlier study and mentioned in this study and one after the earlier study are listed.

Figure 1 shows the examples of pages from picture books.

Furthermore, of the 8 picture books, the above-mentioned guideline (i) in "guidelines on improving tactile perception" was incorporated into 3 picture books "Balloon", "Soap" and "Cat". In the picture books "Soap" and "Nuts", guideline (ii) was incorporated.



(a) First page of the picture book "Balloon". **(b) First page of the picture book "Soap".**

Figure 1: Examples of picture books for blind children utilizing pasted tactile materials (the picture materials are also indicated).

Table 1: Picture books for blind children utilizing tactile materials (Roman numerals figures in the table correspond to each page).

1. Picture book "Balloon" [Pasteboard is B5 and lengthwise]

<Story> A balloon held in a girl's hand gradually became bigger and lifted her up into the air. It was then pecked by a crow and burst and scattered, which turned out to be a dream.

<Pictures>

(i) In this picture, the girl [6.5cm high, felt clothing, her face is a circle made of communication board (Note 1)] (Note 2) is holding a balloon (circle of rubber material) (2cm in diameter). (The balloon is in the center of the pasteboard and the girl is to its lower left side.) (The balloon and the girl's hand are joined by a thread.)
(ii) In this picture, the balloon is a little larger (4cm in diameter). (The girl is not in the picture.)
(iii) In this picture, the balloon is even larger (6 cm in diameter). (Same as above.)
(iv) In this picture, the balloon is bigger still (8 cm in diameter). (Same as above.)
(v) In this picture, the balloon is in a higher position.
(vi) In this picture, a crow (furry material, its bill is made of hard paper) pecks at the balloon.
(vii) In this picture, the balloon bursts and scatters (it is divided into an 8 in a fan shape, 5mm between each piece). (Same as above.)
(viii) In this picture, the balloon returns to its original shape and size and the girl is holding it again [as in picture (i)].

<Text>

(i) A mother bought a balloon for her daughter at a festival.
(ii) She hoped that the balloon would become larger. Suddenly, like magic, it got bigger and bigger.
(iii) It got bigger and bigger.
(iv) It got even bigger still.
(v) To her surprise, the girl started to float up into the air, so she held on tight.
(vi) Suddenly, a crow appeared, and wondering what it was, he started to peck at the balloon.
(vii) The balloon burst and the girl began to fall.
(viii) The girl woke up startled. It was just a dream. She was still holding the balloon tightly in her hand.

2. Picture book "Soap" [Pasteboard is B5 and lengthwise]

<Story> Soap on a kitchen sink falls down and a cat, carrying it in its mouth, goes to a park to put it on a slide. Then, the soap falls down the slide, into a pond and dissolves.

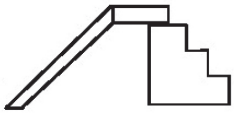
<Pictures>

(i) In this picture, soap (small rectangle, 1.5cm x 2cm, slippery paper pasted on a base of thick paper) is on the top-right corner of a kitchen sink (large square 7cm long, paper feeling like stainless steel is pasted on a base of thick paper).
(ii) In this picture, the soap is on the bottom right-corner of the kitchen sink.
(iii) In this picture, a cat (facing left with its mouth open, 5.5cm x 12cm, made of furry material) takes the soap in its mouth.
(iv) In this picture, there is a slide and the soap is on the top of it. (see Picture below). (Steps are made using three rectangles, the slope is drawn with oblique lines of 7mm in width and 7.5cm in length, wood board material).
(v) In this picture, the soap is at the bottom of the slope (oblique line).
(vi) In this picture, there is a pond (circle, 7cm in diameter and 7mm wide, plastic material) and the soap is in it.
(vii) In this picture, we see only the pond without the soap.

<Text>

(i) When a girl tried to grab some soap off a kitchen sink, the soap slipped and fell down.
(ii) The soap fell onto the floor with a bang.
(iii) The cat took the soap in her mouth and ran away.
(iv) The cat took it to the top of a slide.
(v) When she reached for the soap, it started to slip down the slide.
(vi) The soap slipped down the slope faster and faster then fell into a pond.
(vii) The soap started to bubble and then it disappeared.

<Picture>



3. Picture book "Nut" [Pasteboard is B5 and lengthwise]

<Story> A girl tried to take nuts from a high tree, but she couldn't reach them. She couldn't reach them even using a stand. An elephant came to try and take the nuts but couldn't reach them. Then a giraffe came to try to take them, but without success. Finally, a monkey came, climbed up the tree and then took the nuts. The monkey shared the nuts with the girl.

<Pictures>

(i) In this picture, there is a tree full of nuts on the right side of the pasteboard (wooden board 7mm in width and 15cm in length represents the tree trunk; plastic circle-shaped board 1.5cm in diameter represents round nuts attached to the top of the tree; four artificial leaves are arranged around it) and the girl is reaching out toward the nuts on a tree from the left side (5.5cm in height, distance between girl's hand and nuts is quite far).
(ii) In this picture, the tree does not change its position and the girl on the left side is on a stand (3cm in length, made with wood).
(iii) In a similar manner, in this picture the tree does not change position and an elephant is facing toward the right (his nose is reaching for the nuts, 12cm in height).
(iv) In a similar manner, in this picture a giraffe is facing toward the right (her neck is reaching for nuts, 13.5cm in height).
(v) In this picture, a monkey (4.5cm in height) facing toward the right is on the bottom-left reaching out to touch the tree.
(vi) In this picture, the monkey is on the center-left side of the tree reaching out to touch it.
(vii) In this picture, the monkey is on the top-left and reaching for the nuts.
(viii) In this picture, the girl and the monkey face each other on the left side of the tree and reach out to touch the nuts in the center (there are no nuts on the tree).
(The elephant, giraffe and monkey are made with different types of furry as elsewhere materials).

<Text>
(i) A girl went to a forest to search for nuts. There were some nuts on the top of a tree, but they were so high that she couldn't reach them.
(ii) The girl tried using a stand, but she still couldn't reach them.
(iii) Then, an elephant came. The elephant also wanted to get the nuts and tried extending his long nose, but he couldn't reach the nuts because they were too high.
(iv) Next, a giraffe came. The giraffe also wanted to get the nuts and tried to extend her long neck. She could reach the leaves, but she couldn't reach the nuts.
(v) Finally, a monkey appeared. The monkey also tried to get the nuts. "I will climb up this tree!" he said.
(vi) The monkey easily climbed up the tree.
(vii) When he reached the top of the tree, he could get the nuts easily.
(viii) The monkey shared the nuts with the girl. "They were so delicious!" she said.

4. Picture book "Cat" [Pasteboard is B5 paper lengthwise]

<Story> A cat who loves to go for walks went for a walk along a wall, took a nap on the roof of a house, woke up and then came down. She then encountered a disgusting dog. She ran home in confusion to find her favorite fish had been prepared for supper.

<Picture>
(i) In this picture, the cat is on the bottom of the page (made with furry material, 6cm high) facing toward the left side.
(ii) The cat is in the center of the page and there is a wall (rectangle) underneath. (The lower end of the wall is where the cat was before in (i).)
(iii) The cat is at the top of the page and the roof of a house is below (other parts of the house are below). (Same as above.)
(iv) The cat is at the bottom-right of the page and a dog is on the left side (different fur materials for the dog and cat, 7cm large). Both animals face each other.
(v) The cat is in the same position as above and the fish is on the left (rough plastic material, 5cm in length).

<Text>
(i) There was a cat. She loved to go for walks. "It's such a nice day, so I think I'll go for a walk!" she said. She went out.
(ii) She walked along a wall.
(iii) She climbed up onto the roof of her neighbor's house and took a nap.
(iv) After she woke, she climbed down only to encounter a disgusting dog. She ran home in confusion.
(v) When she returned home, her supper was ready. To her surprise, it was her favorite fish. She ate a lot of fish until she was full.

5. Picture book "The Wind and the Tree" [Pasteboard is A4 and horizontal]

<Story> A tree was blown by the north wind and about to fall down, but it recovered thanks to the south wind. However, since the south wind continued to blow, this time it leaned toward the opposite side and was about to fall down. Luckily, the north wind blew again and returned the tree to its original position.

<Pictures>
(i) In this picture, the tree is in the center of the page. (Wooden board 7mm in width and 15cm in length represents the tree trunk, 4 sheets for artificial leaves are arranged around the top.) For the tree, the trunk is drawn vertically from the bottom of the page.
(ii) In this picture, the tree is inclined 45 degrees toward the right side of the page.
(iii) Same as (i), picture of the vertical tree.
(iv) In this picture, the tree is inclined 45 degrees toward the left side.
(v) Same as (i) and (iii), picture of the vertical tree.

<Text>
(i) A tall tree stood in the center of a field.

(ii) One day, a big wind blew from the north, the tree bent and was about to fall down. The tree was worried, and it thought, “Oh no! What can I do?”
(iii) Then, from the opposite side, a wind blew from the south and helped the tree to recover. The tree felt relieved, and thought, “That’s better.”
(iv) But, the south wind didn’t stop blowing, so the tree bent toward the opposite side this time. The tree was worried, and thought, “This is not good.”
(v) To his surprise, the north wind blew again and helped the tree recover. “Thank Heaven, I’m safe!” he said.

(Note 1) Kent paper is pasted on both sides of styrene foam. Because of the sandwiching of the styrene foam, the feel is different from pasteboard, even though the same Kent paper is used.
(Note 2) Hereinafter, the modeling of people in other picture books is based on this description. In addition, some legs or hands are made with the same communication board as used for the faces.

(3) Results of Using the Picture Books

(i) Improvement in Tactile Perception

(a) Change in Touching and Picture Comprehension

Before the introduction of these picture books when M was 2 years and 0 months old, she was often observed scratching with her pointing finger and its nail as a way of touching and manipulating objects that researchers had introduced.

This behavior had almost completely disappeared by the age of 2 years and 11 months (April 1998).

One month later, at the age of 3 years and 0 months (May 1998), the above-mentioned picture books were introduced for the first time. At that time, she would use the bulb of the pointing finger of either hand to touch any place on the picture. The tip of her finger did not move when she left her finger on the picture. From the scratching movement mentioned earlier, although she did not scratch the pictures, we feel that her way of touching with the tips of her finger remained.

Even by touching with the tips of her fingers, she could understand the contents of a picture because the tactile materials were different in each picture.

For example, in the picture book “Balloon”, she could comprehend the balloon through the rubber tactile material and the crow from the fur. However, by touching in this way, she could not understand the size or shape of a picture. For example, in “Balloon”, the size of the circular balloon grows in diameter from 2cm to 8cm as the pages progress. Perceiving the changes in size was an important part of this picture book; however, M did not notice the change in balloon size through her touching style.

Consequently, a member in the institute would guide the tips of her fingers from the left end of the balloon’s surface (or the right end) to the right end (left end).

After repeating this, M spontaneously began doing this for the balloon pictures. However, her direction of movement was from top to bottom instead of left (right) to right (left). By touching in this way, she could grasp the size of the balloon.

Two months later (two months after the introduction of the picture books), after tracing the picture of a balloon from top to bottom, she would tap the picture with the palm of her hand.

Six months after the introduction of the picture books, at the age of 3 years and 6 months (November 1998), instead of just pointing she began to feel the pictures with her fingers other than pointing finger or the palm of her hand. For the balloon pictures, we discovered that she used 5 fingers and the palm of her hand. Through this way of touching, she was able to easily grasp the change in size of the balloon.

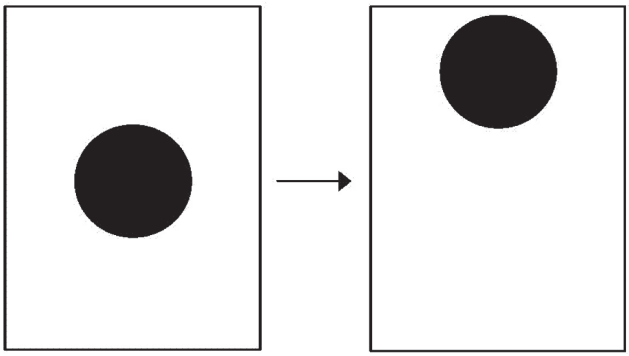
(b) The “Searching” Motion

Picture books for blind children based on guideline (i) in “guidelines on improving tactile perception” were introduced to M. As a result, with respect to the change in the position of the balloon in the picture book “Balloon”, the soap in the picture book “Soap” and the cat in the picture book “Cat”, in the early stages of introduction when she was between 3 years and 0 months and 3 years 1 month old, we observed the searching motion of her hand or fingers for these pictures. When she turned the pages, the searching motion of her hand or fingers occurred when pictures were positioned differently from the previous page. (see Figure 2)

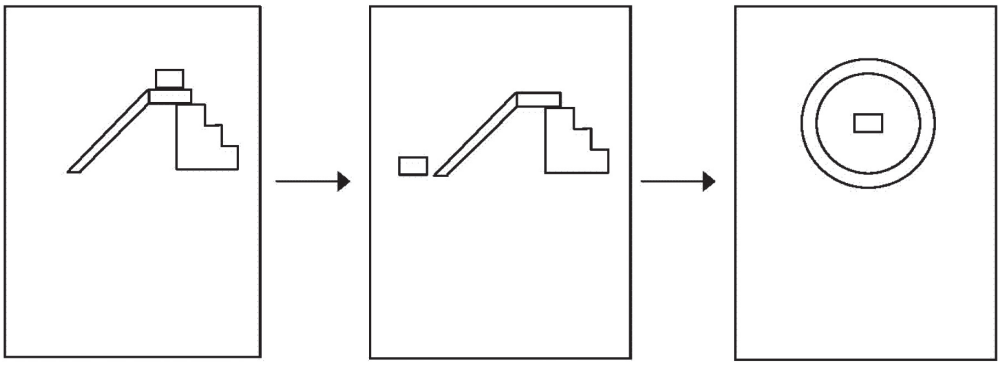
We sometimes mentioned that they (the balloon, the soap, and the cat) reached the top or the bottom of the page and then asked “Where did it go?”, but would rarely guide her hand.

(c) The “Tracing” Motion

The picture books “Soap” and “Nuts” based on guideline



(a) Change in position of the balloon in the picture book "Balloon" (pages 4 to 5).



(b) Exemples of change in position of the soap in the picture book "Soap" (pages 4 to 6).

Figure 2: Change in position of pictures that stimulated the "searching" motion.

(ii) in "guidelines on improving tactile perception" were introduced to M. As a result, a "tracing" motion for the picture of the slope of the slide (oblique line of 7.5cm) in the picture book "Soap" and the tree trunk (straight line of 15cm in length) in the picture book "Nuts" arose 6 months after the introduction (at 3 years and 6 months). (see Figure 3.)

After their introduction, we did not provide any hand assistance.

As mentioned in Kaneko, et al. (1999), for another child with visual impairments, the tracing motion appeared 4 months (at 3 years and 2 months) after the introduction of "Soap" to a child at age 2 years and 10 months.

On the other hand, as mentioned earlier, M's searching motion was observed when the picture books were first introduced. The other visually impaired child was also observed to search in a similar manner. However, this visually impaired child was different from M, because we sometimes guided her hand through the tracing motions. But, she did not move her hand spontaneously following such assistance.

As mentioned above, the tracing motion appears to be more difficult than the searching motion. However on the basis of these two cases, if blind children can regularly touch picture books that include straight or oblique lines, we think the tracing motion before long arises. On the other hand, even if we guide their hands, one could say that it is difficult to initiate a spontaneous tracing motion.

The reason for this, as mentioned in Kaneko, et al. (1999), may be that the searching motion arises regularly in daily life, whereas the tracing movement may arise less frequently. In addition, in our daily lives objects can be distinguished or identified in a tactile manner by simply holding or gripping them, which makes tracing their outlines unnecessary.

(ii) Stimulating an Interest in Letters (Braille) and Their Learning

For the words of the story and the title of the cover page in the picture books produced in the study, when M was age 3 years and 8 months (January 1999), in addition to ordinary letters, Braille in transparent tag paper was attached, because we expected that M might touch them.

As a result, M touched Braille letters when reading (feeling) a picture book at age 4 years and 0 months (May 1999), which developed into an interest in Braille. When M touched Braille, she sometimes asked the assistant what the part she touched said. Furthermore, during the same period M even began to show an interest in Braille in places

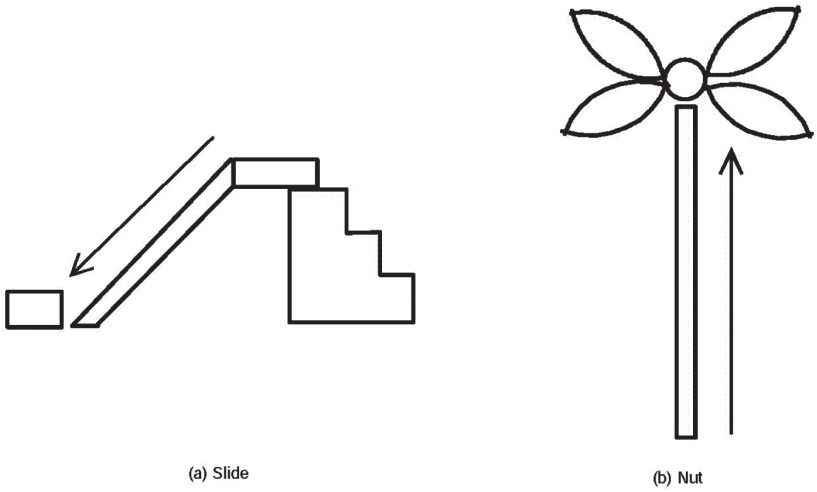


Figure 3: Tracing motion in the picture books "Soap" and "Nuts" (the arrows show the direction of motion).

other than picture books (such as Braille room names on handrails within the facilities).

2. After Introducing Picture Books for Blind Children in the Form of Stereo Copying

At age 4 years and 5 months (October 1999), in addition to picture books for blind children using the above-mentioned tactile materials, picture books for blind children that utilized stereo copying were produced and introduced to M. In these books, original drawings for stereo copying were created on a computer.

Hereinafter, the guidelines for producing picture books for blind children utilizing stereo copying and the contents of picture books based on this will first be described. After these picture books were introduced to M, there was an improvement in her tactile perception, enhancement in her imagery and imagination, and a greater interest in learning letters (Braille). This will then be discussed.

(1) Guidelines on Production

(i) Guidelines on Easy-to-Comprehend and Fun-to-Touch Picture Books

When producing picture books through stereo copying, it is impossible to discriminate between pictures through differences in tactile materials in the same manner as those with pasted tactile materials. Guideline (i) in the "easy-to-comprehend and fun-to-touch pecture books guidelines" for picture books for blind children using pasted tactile materials cannot be utilized.

However, if attributes other than tactile materials such as size, number, shape, position, direction or inclination were used inventively, we thought that each book would become easy to understand and fun. Furthermore, for the structural elements of a picture, to distinguish the major elements from other elements, we decided to incorporate differences in paintings and drawings (outlines). The guidelines are summarized below.

(i) Attributes other than tactile materials such as size, number, shape, position, direction or inclination should be used inventively.
(ii) The major structural elements on each page should be expressed through painting, while other elements should be expressed through drawings (outlines) for easy identification.

(ii) Guidelines on Improving Tactile Perception

Compared with pasting tactile materials, the advantage in the case of creating original drawings on a computer for stereocopying is that a picture (and its structural elements) can be arranged accurately and easily. It is also possible to draw more complicated lines such as bending lines, curved lines and spiral lines. Of these, the former is superior when producing pictures to stimulate the more advanced searching motion to improve tactile perception. The latter is advantageous in the case of stimulating the more advanced tracing motion by producing more complex lines in picture books.

With due consideration of the above, the following guidelines on stimulating improvement in tactile perception were followed.

(i) To establish more advanced searching motion, placing the one hand on base points and searching with the other hand, two related pictures (on two related structural elements) should be arranged relative to vertical, horizontal or oblique positions.

(ii) For the development of more advanced tracing movement, more complicated lines such as oblique lines, bending lines, curved lines and spiral or longer lines should be arranged in picture books as a picture (or its structural element).

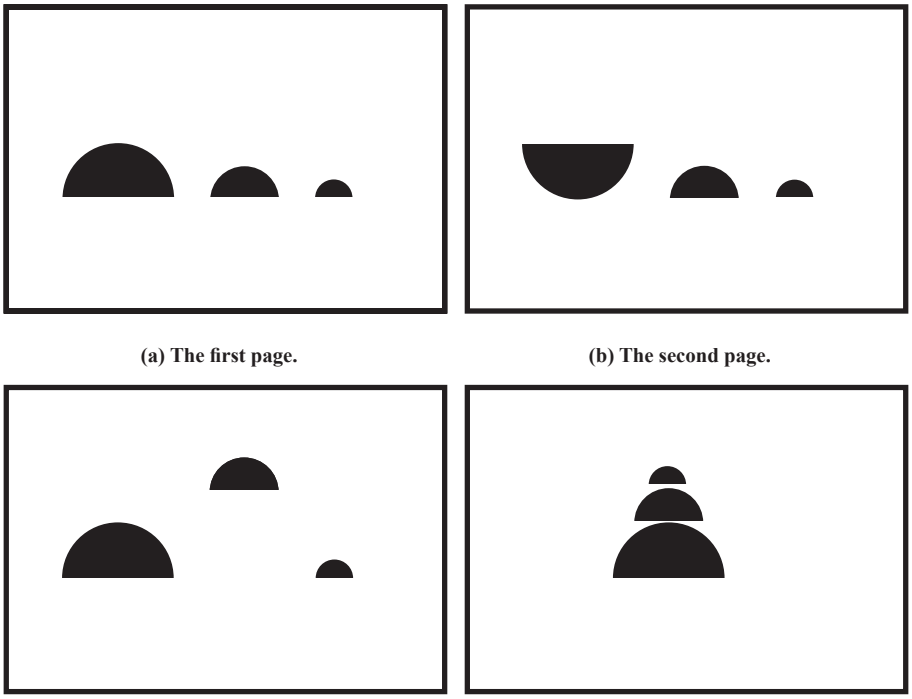
(2) Contents of Picture Books for Blind Children

The form of production is the same as for the above-mentioned pasting of tactile materials, other than raised pictures, which are made by stereo copying.

All the pictures and stories were produced by us. Furthermore, all of the original drawings were drawn on a computer for greater accuracy and easy modification.

Five picture books for blind children were produced on the basis of the above-mentioned guidelines. For further details, please refer to Table 2. In addition, examples of pictures are shown in Figure 4.

Of the five above-mentioned picture books, one picture book "Butterfly" was produced by incorporating guideline (i) in "guidelines on improving tactile perception". Two picture books "Norimaki: Vinegar Rice Rolled in Laver" and "Adventure of the Grass Bead" were produced by incorporating guideline (ii) of the same guidelines.



(a) The first page. **(b) The second page.**

(c) The third page. **(d) The sixth page.**

Figure 4: Examples of a picture book for blind children utilizing stereo copying (based on the picture book "The Turtle Picnic", only pictures are shown).

Table 2: Picture books for blind children utilizing stereo copying (the roman numerals in the table correspond to each page)

1. Picture book "The Turtle Picnic" [Paper is A4 and horizontal] < stereo copying>

<Story> A family of turtles, father, mother and baby go on a picnic in the forest. The family travels in the order of father, mother and baby. On the way, father turtle is overturned, mother turtle becomes frightened and jumps, and baby turtle loses his way. They eventually arrive safely in the forest, play happily and eat lunch. On the way home, mother turtle rides on father, and baby turtle rides on mother. They return home.

<Pictures>

(i) A picture of father, mother and baby turtle in a row from left to right. In the center of the page, semicircles of 7cm, 4cm and 2cm in diameter are shown with the diameter sides down. (The inside of each semicircle is painted). The space between each turtle is 3cm.
(ii) A picture of father turtle overturned. Father turtle is represented by placing the diameter-side up.
(iii) A picture of mother turtle frightened and jumping. Mother turtle is represented by placing the semicircle 6cm higher.
(iv) A picture of baby turtle losing his way. This is represented by the disappearance of the baby turtle.
(v) A picture of the family eating lunch together. The turtles are in the center of the page in the order of father, baby and mother from left to right, with a spacing of 1.5cm.
(vi) A picture of mother turtle riding on the back of father turtle, and baby turtle riding on her back. This is represented by arranging the turtles in the order of father, mother and baby turtle from the bottom in the center of the page. Each space is 5mm.

<Text>

(i) A turtle family went on a picnic in the forest. Mother turtle walked behind father turtle, and baby turtle walked behind mother turtle.
(ii) On their way, father turtle stumbled over a stone and was overturned.
(iii) Mother turtle was very frightened by a snake and jumped.
(iv) Baby turtle lost his way.
(v) However all of them played happily and ate lunch together in the forest.
(vi) On the way back, mother turtle rode on father turtle's back, and baby turtle rode on mother's back. They quietly went home.

2. Picture Book "*Norimaki*" Vinegar Rice Rolled in Laver [Paper is A4 horizontal] <stereo copying>

<Story> A girl makes *Norimaki* (vinegar rice rolled in laver) together with her mother. At first, she makes a round *Norimaki* by rolling once, twice and three times. Next, a square *Norimaki* is made in a similar manner by rolling once, twice and three times.

<Pictures>

(i) A picture of a round *Norimaki* being rolled once. This is represented by spiral lines with an inside diameter of 4cm, the diameter of the outside circle is 6cm (line thickness is 1mm).
(ii) A picture of a round *Norimaki* being rolled twice. This is a double spiral line. By drawing a circle once through the end of the outside line of (i), the picture is connected (diameter of outside circle is 10cm).
(iii) A picture of a round *Norimaki* being rolled three times. In a similar manner as (ii), this is a triple spiral line created by adding one more line (diameter of outside circle is 14cm).
(iv) A picture of a square *Norimaki* being rolled once. This is a square spiral line of 4cm on the inside and 6cm on the outside (line thickness is 1mm).
(v) A picture of a square *Norimaki* being rolled twice. In a similar manner as the round *Norimaki*, this is a double square line created by connecting the lines (length of outside square is 10cm).
(vi) A picture of a square *Norimaki* being rolled three times. In a similar manner as the round *Norimaki*, this is triple square line created by connecting the lines (length of outside square is 14cm).

<Text>

(i) A girl made *Norimaki* together with her mother. She rolled out a round *Norimaki* once.
(ii) She rolled it twice.
(iii) She rolled it three times and it was ready to serve.
(iv) Then, she rolled a square *Norimaki* once.
(v) She rolled it twice.
(vi) She rolled it three times and it was ready to serve.

3. Picture Book "Adventure of Marble Boy" [Paper is A4 horizontal] <stereo copying>

<Story> A marble boy went out to play outside his house on a hill. On the way, he passed various types of hills, a beetle pushed him up a hill and he fell down into a hole. A mole then helped him to get out from the hole.

<Pictures>

(i) The road is represented by a line 1mm in width. A horizontal line of 4cm is at the top left of the page. An oblique line runs 40 degrees downward for 11cm from the right end of this line, and a horizontal line runs 4cm from the right end of the line. The marble boy is represented by painting a circle 1.5cm in diameter. The marble boy is located on the horizontal line in the top left of the road (distance between the horizontal line and the marble boy is 3mm).
(ii) The road is the same as (i). The marble boy is on the horizontal line at the bottom right.
(iii) The road is a horizontal line running 24.5cm along the bottom of the page. The marble boy is in the center on the horizontal line.
(iv) For the road, horizontal lines of 4cm are drawn on the top left and top right of the page. Two lines of length 10.5cm are in the center, bending downwards (angle of slope is approximately 40°) and connected. The marble boy is on the horizontal line at the top left.
(v) The road is the same as (iv). The marble boy is on the horizontal line at the top right.
(vi) For the road, through each horizontal line of 3cm on the botton left and bottom right of the page, an oblique line of 10cm at 40 degrees from bottom left to top right, a horizontal line of 3cm and an oblique line of 10cm at 40 degrees toward the bottom right are connected. The marble boy is on the horizontal line at the bottom left of the page.
(vii) The road is the same as (vi). The marble boy is on the horizontal line in the center of the top part. On the left side, a beetle is on the oblique line. The beetle is made by drawing lines, as shown in picture (a), and has a 3cm body length and a 1.5cm for the long horn.
(viii) The road is the same as (vi). The marble boy is on the horizontal line at the bottom right of the page.
(ix) The road (under the ground) is expressed by lines as shown in picture (b). The position of the marble boy is shown in picture.
(x) The road (under the ground) is the same as (ix). The marble boy is on the horizontal line at the top right.
(xi) The hole is represented by connecting two 10.5cm horizontal lines from top left and top right, two vertical 7cm lines downward from the center, and the 4cm horizontal line. The marble boy is on the horizontal line at the top left of the page.
(xii) The road (including the hole) is the same as (xi). The marble boy is on the horizontal line in the hole.
(xiii) The road (including the hole) is the same as (xi) except that there are no horizontal lines under the hole. In the hole, a mole is 1.5cm from the top line. The mole is made by a line drawing, as shown in Picture (c). Its size is 7cm x 3.5cm. The marble boy is on the horizontal line at the top right of the page.

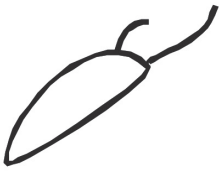
<Text>

(i) A marble boy went out to play outside his house on a hill.
(ii) He went rolling down the hill.
(iii) He kept going.
(iv) He was fine going on such a hill.
(v) He could go to the top of the hill.
(vi) But, he could not go up such a hill.
(vii) When he was considering what to do, his friend the beetle came. "I can push you up to the top of the hill" he said. The beetle pushed him up to the top. "Thank you. I am alright now," the marble boy said. The marble boy thanked the beetle.

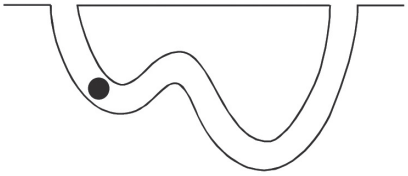
(viii) Then he rolled down the hill.
(ix) "Ah!" It looks like he fell into a hole.
(x) But, the hole spiraled up. "Ah!" He came out of another hole.
(xi) He went rolling again, but there was another hole. "Ah! There's another hole. The previous time I was OK, so this time I will be OK, too." he said, Just as he thought that, he fell down into the hole.
(xii) But, this time the hole was a dead end.
(xiii) "What shall I do?" he asked himself. As he was thinking about it, a mole, surprised that something had fallen into the hole, poked his head out of the hole. So, the mole pushed the marble boy so he could escape the hole. He then became friends with the mole.

<Pictures>

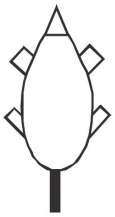
a.



b.



c.



4. Picture Book "Butterfly" [Paper is A4 horizontal] <stereo copying>

<Story> There was once a family of butterflies. The baby practiced flying by following his father. He flew vertically, horizontally and diagonally around some flowers. On the way, they took a rest on some flowers. Finally, they sat on a flower and ate some honey.

<Pictures>

(i) The butterfly is shown in Picture (a); father butterfly is 6cm x 7cm and baby butterfly is 2.5cm x 3cm. In this picture, father butterfly is on the left side of the page and baby butterfly is on the right side. They are 5cm apart.
(ii) Father butterfly is in the top center of the page and baby butterfly is 6cm below.
(iii) By turning the picture of the butterfly shown in Picture (a) 90 degrees, father butterfly moves to the left of the page and baby butterfly is 6cm to the right.
(iv) Father butterfly is at the top left of the page at 45 degrees to picture (a) and baby butterfly is 10cm away and at 45 degrees, toward the bottom right.
(v) The flower shown in Picture (b) is situated on the left side of the page, and the length of the stem is 9cm. Next, another flower, with a 5cm stem is drawn, 6cm to the right. Father butterfly is on the left flower and baby butterfly is on the right flower. The direction of the butterflies is shown in Picture (a). The space between the flowers and the butterflies is 5mm.
(vi) A flower shown in Picture (c) [made by removing the stem and leaves from Picture (b)] is located in the center of the page. The size of the flower is 4cm x 4cm. Father butterfly is facing in the direction shown in Picture (a) and is 2cm left of the flower. Baby butterfly is 2cm right of the flower and by turning 180 degrees in direction to father, is on the right.
(vii) The flower and its position are the same as (vi). Father butterfly, by turning 45 degrees clockwise, is in the top left to the flower, and baby butterfly, in the same way, is in the bottom right to the flower. The distance between the flower and the butterflies is the same as in (vi).
(viii) The flower is the same as (vi). By turning 45 degrees clockwise (90 degrees cloclcwise from the picture shown in Picture (a)), father butterfly is on the upper side of the flower, and by turning 45 degrees clockwise, baby butterfly is on the bottom of the flower.
(ix) Flowers with stems are arranged in a similar manner as (v). Baby butterfly is on the left flower and father butterfly is on the right flower. The distance between the butterflies and the flowers is 5mm.

<Text>

(i) There was a family of butterflies. The baby butterfly could not fly well yet, so he practiced flying by watching his father.

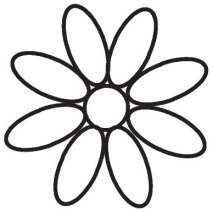
(ii) They flew vertically in a straight line.
(iii) They flew horizontally in a straight line.
(iv) They flew diagonally.
(v) When they were tired, they stopped to rest on some flowers. Father butterfly rested on a tall flower. Baby butterfly rested on a short flower.
(vi) They flew around the flowers. At first, father butterfly faced upwards and baby butterfly faced downwards.
(vii) After a while, they flew around; father butterfly faced diagonally upwards. Baby butterfly faced diagonally downwards.
(viii) Then, they flew around some more. Father butterfly faced right and baby butterfly faced left.
(ix) When they got tired of flying, they stopped again to rest on some flowers. But this time, baby butterfly took a rest on a tall flower, and father butterfly took a rest on a short flower. Then they had a delicious snack of honey.

<Pictures>

a.

b.

c.



5. Picture book "The Sea Bathing Turtles" [Paper is A4 horizontal] <stereo copying>

<Story> A family of turtles went sea bathing. The family marched in the order of father, mother and baby. On the way, father turtle sank into the ground, mother turtle fell into a hole, and baby turtle had difficulty climbing up a hill. However, they arrived at the sea safely and began sea bathing. The family swam on top of the waves and under the waves.

<Pictures>

(i) A Father, mother and baby turtle are lined up from the left. In the center of the page, the turtles are represented by semicircles 7cm, 4cm and 2cm in diameter, respectively (inside of semicircle is painted). 3mm beneath them, a road is represented by a horizontal line of 23cm (1mm in width). The distance between each turtle is 3cm.
(ii) A picture showing the position of father turtle who has moved 1.2cm down. The others are in the same position as in (i).
(iii) As (i), but there is a hole under father turtle. The hole is 5cm wide (for this, the horizontal line of the road is deleted) and 4.6cm deep.
(iv) As (i), a hole similar to that in (iii) is made under mother turtle. Then, mother turtle is placed in the hole below the horizontal line.
(v) From the center left of the page, a road is represented by an oblique line 23cm at 20 degrees to the horizontal and a 3cm horizontal line is drawn towards the right. In the order of father, mother and baby, they are lined up on the center of the slope 2.5cm apart. The bottoms of the semicircles are parallel to the road.
(vi) The angle of a road in (v) is changed to 36 degrees. The bottom of the turtle family is parallel to the road; only the distance of baby turtle from mother turtle is changed to 6cm.
(vii) By transposing the left and right of the road in (vi), it changes to a downward slope toward the right with a 3cm horizontal line on the left. The bottom of the turtle family is parallel to the slope, father turtle is located near the horizontal line, mother and baby turtles are situated 5mm apart on the slope in order.
(viii) The line shown in the Picture is used to represent waves. Three waves are arranged vertically on the left side of the page. The size of a wave is 3.5cm x 13cm. On the right side of each wave, father, mother and baby turtles are arranged. The distance between the waves is 2.5cm. The distance between each wave and the center of the turtle on the right is 5cm.
(ix) The wave shown in the Picture is drawn 6cm x 22cm in size; only one wave appears in the center of the page. Father turtle is on the left peak, mother turtle is at the bottom of the wave, and baby turtle is on the right peak.
(x) On the road in (i), father turtle is in the center, mother and baby turtle are arranged on him. The turtles are 3mm above each other.

<Text>

(i) A family of turtles went sea bathing. Mother turtle walked behind father turtle, and baby turtle walked behind mother turtle.
(ii) On the way, father turtle sank into the soft ground.
(iii) When father turtle finally got out, there was a hole in the ground. Father turtle could not fall down into the hole.
(iv) However, mother turtle fell into the hole. Father and baby turtle helped to pull mother out of the hole.
(v) They went on for a little while and they came across a hill. The hill didn't pose much of a problem.
(vi) But, baby turtle had difficulty climbing the next hill. Baby turtle got left behind. But he kept on trying to climb the hill.
(vii) Soon, they were going downhill, so mother turtle almost bumped into father turtle, and baby turtle almost bumped into mother turtle.
(viii) Eventually they made it down the hill and came to the sea.
(ix) All of them swam together. The waves were so high that father and baby were on top of the waves and mother turtle was under the waves.
(x) They really enjoyed that. As they were going home, mother turtle rode on father's back and baby turtle rode on mother's back. Finally they arrived home happily.

<Picture>

(3) Results of Using the Picture Books

(i) Improvement in Tactile Perception

(a) Change in Touching and Picture Comprehension

Of the five picture books for blind children that utilize the above-mentioned stereo copying, the picture book "The Turtle Picnic" was introduced to M for the first time at age 4 years and 5 months (October 1999).

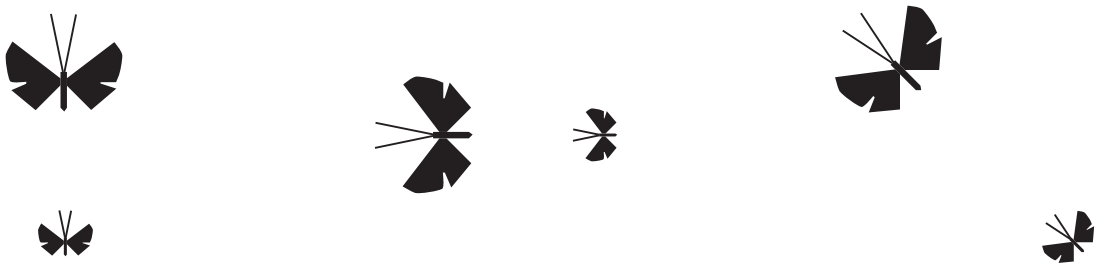
In this picture book, the three turtles, the father, mother and baby, were represented by large, medium and small semicircles (painted). When father turtle was overturned after stumbling over a stone, he is turned 180 degree, when mother was frightened and jumped, her position is moved upwards, and when baby turtle lost his way, this is represented by his removal from the picture. In the story, the family of turtles went on a picnic in the forest incorporating the above-mentioned episodes.

When we introduced this picture book to M, although she could not discriminate and identify pictures based on the difference in tactile materials, by introducing the various attributes of the above-mentioned pictures, she could fully discriminate between and identify each picture and understand what each picture represented.

As mentioned earlier, M had touched the pictures with not only with her pointing finger but with all five fingers and the palm of her hand. In doing this, she was able to grasp such attributes as the size and direction of a picture and understand the picture. If she had only touched the pictures with the bulb of her finger, it would have been difficult to understand the pictures in such picture books utilizing stereo copying, where information from tactile materials can not have been obtained.

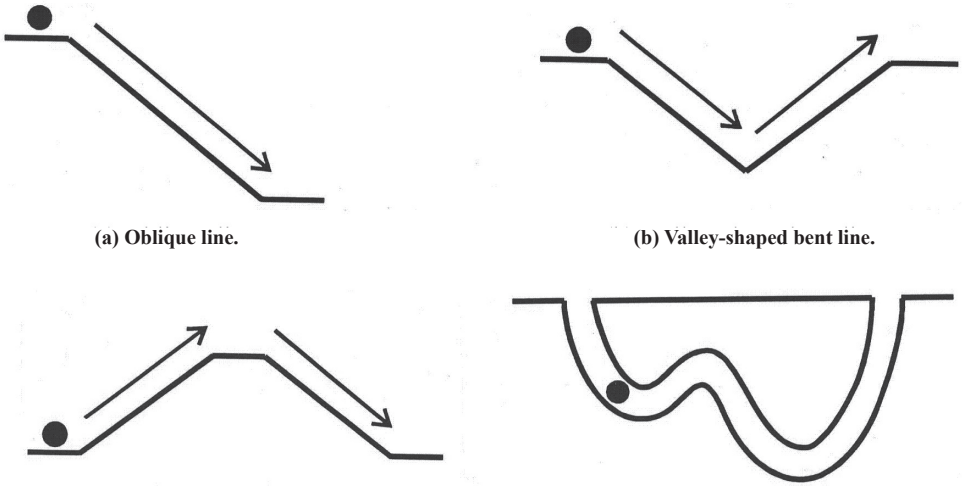
On the other hand, at age 5 years and 1 month (June 2000), by touching with the bulb of her pointing finger, she began to show that she could obtain information on more detailed parts of the picture. For example, in the picture book "Nuts" (utilizing pasted tactile materials), by touching in this way, it was observed that she touched part of a leaf on a tree, and in the monkey picture, she touched the hand and tail of the monkey. (For a picture of the tree, please refer to Figure 3 (b).). When she was first introduced to the book, instead of not moving her finger on the picture, she moved her finger on the picture (tranced it) while pressing the picture. She traced the leaf from the center to the end, and whereas in the case of the monkey picture, she traced the thin hands and the tail of the monkey (5mm wide, 2cm long). Furthermore, it was also observed that she traced the profile of the picture, for example, the radius of a piece (fan shape 4cm in radius with an angle of 45 degrees) of the broken balloon. Even in the picture books that utilized stereo copying, for example, the picture book "Butterfly", introduced at age 5 years and 8 months (January 2000),

it was observed that she could discriminate between and identify the antenna and other parts of a butterfly by touching them with her fingers in this way. Moreover, in this picture book, by touching the antenna of a butterfly, she could understand the butterfly's direction. (For the picture of a butterfly, please refer to Figure 5.)



(a) Vertical arrangement. (b) Horizontal arrangement. (c) Oblique arrangement.

Figure 5: Searching motion with one element as a base in the picture book "Butterfly" (after touching one butterfly, she touched the other)



(a) Oblique line. (b) Valley-shaped bent line.

(c) Mountain-shaped bent line. (d) Valley-mountain-valley.

Figure 6; Tracing a road in the picture book "Adventure of Marble Boy" (the divections of motion are expressed by arrows).

Therefore, to obtain information on the detailed parts of the pictures, her way of touching—by placing the bulb of her finger on a picture and tracing—was effective.

(b) Searching Motion

When she was introduced to the picture book "Butterfly" based on guideline (i) in "guidelines on improving tactile perception", at age 5 years and 8 months (January 2001), by using one hand as a base, she began to search with her other hand.

In this picture book, the parent and child butterflies are arranged on a page in vertical, horizontal, oblique and symmetrical positions. She was able to touch one butterfly with one hand and search for and touch the other butterfly with the other. (Please refer to Figure 5.)

With respect to this movement, when M touched the parent or child butterfly, even though an assistant would sometimes ask her where the other butterfly was, the assistant did not guide her hand to it.

In such a manner, if the number of elements was limited to two, one hand was able to touch one of the elements while the other hand could search and touch the other element.

However, for this to arise, a child can relate two elements and has intention to touch both elements at the same time. If not, other means such as wording to encourage this could be taken.

(c) Tracing Motion

The picture book "*Norimaki*" based on guideline (ii) in "guidelines on improving tactile perception" was introduced to M at age 4 years and 5 months (October 1999). This picture book contains one-fold, two-fold and three-fold spirals and square shapes (lines 1mm in width) to represent *Norimaki*. A single fold spiral shape is represented by a circle with an inside diameter of 4cm and an outside diameter of 6cm. The double shape is represented by adding a 10cm circle, and the triple shape is represented by adding a circle 14cm in diameter.

In this picture book, when we encouraged her to trace, although she could trace part of a shape, we did not observe her trace from the beginning to the end, even in the case of the single shape.

After that, the picture book "Adventure of Marble Boy" based on guideline (ii) was introduced to her at age 5 years and 4 months (September 2000). In this picture book, the structural elements of each picture are arranged through continuous oblique lines expressing a road, valley-shaped bent lines, mountain-shaped bent lines and valley-mountain-valley-shaped curved lines. The width of each line is 1mm and the length is 11cm (oblique line), there are 2 oblique lines 10.5cm in length (mountain-shaped bent line), 2 oblique lines 10cm in length and a horizontal line 3cm in the center (mountain-shape bent line); the distance of the straight line is 16.5cm (valley-mountain-valley-shaped curved line). (Please refer to Figure 6.)

The circle-shaped "marble boy" went along on a road in the story.

Four months after being introduced to this picture book, at the age of 5 years and 8 months (January 2001) M could trace the three above-mentioned oblique lines, the valley-shaped line and the mountain-shaped lines well.

To trace all the valley-mountain-valley-shaped curved line, someone had to intervene and provide partial guidance by taking M's hand. At that time, the intervener read the movement of M's hand in a tactile manner. If the motion stopped, the intervener guided her hand, encouraging her to move her hand. If she moved her hand forward, the intervener trusted her to continue moving her hand and used no force, which was effective. Through this method, although partial guidance of the intervener was necessary, spontaneous movement was possible.

(ii) Enhancing Child's Use of Images and Cultivating Imagination

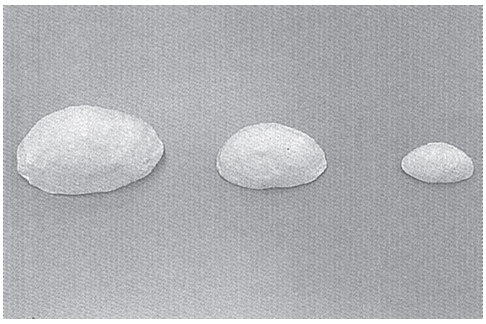
(a) Tactile Perception of Pictures, Body Actions, and Using Models

At age 4 years and 5 months, in the picture book "Turtle Picnic", M's actions began to correspond with the pictures and story.

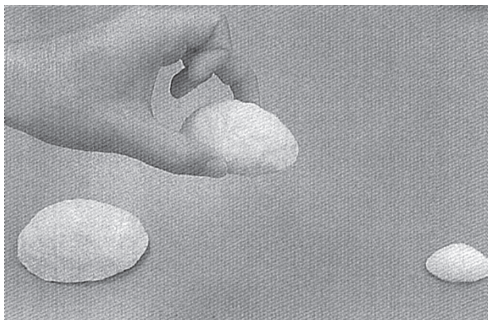
As mentioned earlier, this picture book is about a family of turtles—a father, mother and baby who go on a picnic in the forest—represented by large, medium and small semicircles.

After reading this picture book, she displayed actions such as lying on her back, jumping up and searching for the baby turtle who had lost his way, then pretending to pick the turtle up from the floor when she found out from the picture book that "father turtle had been overturned", "mother turtle was frightened and jumped" and "baby turtle lost his way and disappeared", respectively. After that, with other picture books, we observed her rolling over on the slope when the marble boy rolled over on a hill in the picture book "Adventure of Marble Boy", and she bumped her head on the body of the observer when the baby turtle was about to bump into mother turtle in the picture book "The Sea Bathing Turtles".

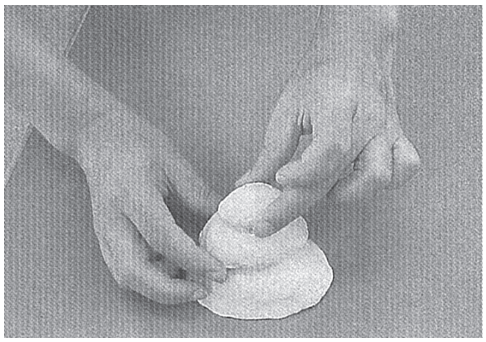
Next, in the case of the picture book "Turtle Picnic", 2 months after the above-mentioned actions (at age 4 years and 7 months) we created three-dimensional models of the turtles (large-sized father, medium-sized mother and small-sized baby turtles, the lengths of the bases were 10cm, 6 cm



(a) Models of turtles.



(b) Causing mother turtle to jump.



(c) Making mother turtle ride on father's back, and baby turtle ride on mother's back.

Figure 7: Models of turtles and manipulation of models.

and 3cm, respectively) similar to the pictures in the picture book. By manipulating these, we tried to get M to act out the story. (Please refer to Figure 7.)

As a result, it was quite simple for M to assign the large, medium and small models as father, mother and baby turtles. In addition, when the mother turtle was frightened and jumped, she held the mother turtle up with her hands. Moreover, when mother turtle rode on the back of father turtle, and when baby turtle rode on mother turtle, M manipulated the models in such a manner. She continued to manipulate the models as she was recounting each scene of the story.

As observed above, the body actions or the manipulation of models appeared to be effective for creating a deeper understanding of the picture books for blind children. This behavior made it possible for her to understand the story as being associated with the images through specific actions.

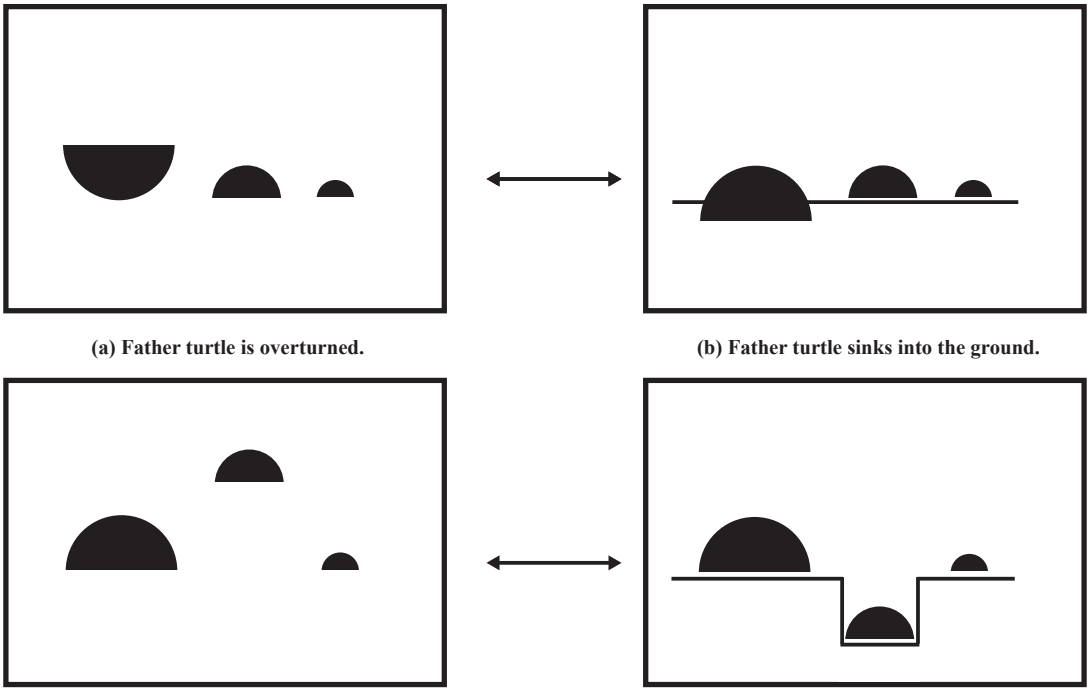
Next, when reviewing the pictures in the picture books for blind children, it seemed that touching the pictures made it possible for children to understand the story associated with the images through specific tactile actions. For example, in the picture book “Turtle Picnic”, when mother turtle was frightened and jumped, the picture of mother turtle, which was previously the same height as father and baby turtles, moved to the top of the page. When M turned the page and touched the same place as father and baby turtles, there was nothing there. In the story when mother turtle was frightened and jumped, if M moved her hand up, she could find mother turtle.

In other picture books, she traced the slope of the slide or the trunk of the tree, or she confirmed by touching the pictures that the balloon had become bigger every time she turned the page. Consequently, in the various scenes, specific tactile movements arose. In this manner, one might say that touching the pictures also made it possible for her to understand the story associated with each image through specific tactile actions. In addition, in the case of picture books for blind children utilizing pasted tactile materials, information obtained through feeling various materials may also instill specific images.

Even totally blind children are able to understand stories associated with specific images through nonvisual pathways such as the tactile perception of pictures, bodily action and the manipulation of models.

Picture books are believed to cultivate children’s imagination by inviting them into a story world different from daily life. This is the same for stories provided through picture books for blind children.

To further cultivate this imagination, we feel that it is very important to awaken and enhance images through the tactile perception of pictures, body actions and the manipulation of models that can also be used by visually



(a) Father turtle is overturned.

(b) Father turtle sinks into the ground.

(c) Mother turtle jumps.

(d) Mother turtle falls into a hole.

Figure 8: Comparison of two types of picture books for blind children [comparison made by touching (a) and (b), and (c) and (d)].

impaired children.

(b) Comparison of Two Picture Books for Blind Children

After introducing the picture book "Turtle Picnic" at the age of 4 years and 5 months (October 1999), the picture book "Sea Bathing Turtles" was introduced at the age of 6 years and 2 months (July 2001). In these two picture books, the father, mother and baby turtles appeared in the same manner. Furthermore, although the stories were different, father turtle being overturned, mother turtle being frightened and jumping, and baby turtle losing his way corresponded with father turtle sinking into the ground, mother turtle falling into a hole, and baby turtle haing difficulty climbing a hill, respectively. They were designed so that M could make a comparison of the two sets of pictures and stories.

As a result, When the picture book "Sea Bathing Turtles" was introduced, after reading (touching) the book, M wanted to reread the picture book "Turtle Picnic". From this, we observed her touching the pictures alternately to compare the two stories.

There fore, if the characters appearing in both books are the same and there are corresponding parts in both stories, one could presume that a comparison between two stories and pictures will be made.

On the basis of this comparison, it is possible that the two picture books deepened her understanding of these stories and enhanced the images.

Although this process might occur in ordinary picture books, if the books belong to a series, this may be effective in promoting the enhancement of images in picture books for the blind, too. This could be carried out by producing books oneself or by adapting a series of ordinary picture books.

(iii) Stimulating an Interest in Letters (Braille) and their Learning

As described earlier, at age 4 years and 0 months (May 1999), M began to develop an interest in Braille sentences and the Braille title on the cover pages on the picture books for blind children. After 9 months had elapsed, at age 4 years and 9 months (February 2000), while tracing Braille letters, she could recite part of the story by memory. After that, at age 4 years and 11 months, she could type some braille letters (*a, wa, tsu, i* and *o* in Japanese characters) using a Braille typewriter (Perkins Brailler) and then touch what she had typed.

Later, at age 5 years and 0 months (May 2000), she began to study Braille seriously and learned each Braille letter through Braille models at the school for the blind where she attended. At the same time, in the picture books for blind children she was able to distinguish each Braille letter and started to show an interest in what each letter represents.

After that, at age 6 years and 1 month (June 2000), without depending on the context of a passage, she began to understand the Braille letters of "*a*", "*ka*" and "*me*". Then, she started to read these Braille letters, in the picture books for blind children.

While reading ordinary picture books, sighted children begin to show an interest and learn the letters in the books. In a similar manner, in the case of visually impaired children, under natural circumstances such as reading (touching) picture books, they also appear to develop an interest in letters (Braille), which becomes the basis for Braille learning.

Furthermore, in the case of M, before the start of involvement through picture books for blind children, her mother would read books to M. In other words, there was a period when M just listened to stories with only her ears.

According to this case study, one way visually impaired children can smoothly acquire letters (Braille) is to first be read stories, in other words, listening to stories only with the ears. The next step is to listen to stories while touching the pictures in picture books for blind children. The final phase is to read the Braille included in the picture book.

V. Conclusion and Considerations

1. Improvement in Tactile Perception

In this study, through treatment using picture books for blind children, M's method of touching changed from touching pictures only with the bulb of her pointing finger to touching with five fingers and the palm of her hand. In addition, we later observed her touch more effectively. She used tactile motions to obtain general information, such as the size or direction of a picture, using five fingers and the palm of her hand, and to obtain more detailed information about a picture, she used the bulb of her pointing finger.

Furthermore, by incorporating settings through picture books for blind children to stimulate improvement in tactile perception, we could see progress in the searching and tracing motions of her hands and fingers. When carrying out the searching motion, she searched for the same picture in a different position as each new page was revealed. Next, when there were two related elements in the same page, one element became the base point and she then searched for the other element. When tracing, she could initially trace a short diagonal line and a vertical line for approximately 10cm, after which we could observe progress, for example, her tracing of a valley shape or a mountain shape 20cm in total length.

However, she was unable to trace a spiral or all of a valley-mountain-valley-shaped curved line on her own. In addition, a picture containing a spiral was introduced after she was observed tracing the above-mentioned short lines. This turned out to be difficult for M, and therefore appeared to be a too big step for her.

From this case, it seems that pictures should be presented at an appropriate time for each child to stimulate the tracing motion. For example, pictures should progress from short to long lines, straight to curved lines, curved lines to circles, and then circles to spirals.

2. Enhancing Children's Use of Images and Cultivating the Imagination

Through the treatment using picture books for blind children, M was able to express part of the story by bodily actions, such as lying on her back on the floor, and rolling over on the slope.

In the picture book "Turtle Picnic", after we had observed her expressing part of the story with her body, we presented models of the turtle family that appeared in the book, after which she began to express part of the story by manipulating these models.

Body action, manipulation of models and tactile perception based on picture books for blind children may make it possible to understand a story associated with the images of each specific tactile action. Even if visual images cannot be utilized, tactile images may be utilized. In the case of visually impaired children, it is important to stimulate and enhance such use of tactile images. Moreover, this may lead to the enhancment of the imagination.

Furthermore, to build on the success of the manipulation of models based on the picture books, an assistant intervened with the intention of developing pretend play. For example, immediately after the period of manipulation of models in the picture books, when a miniature piano and a doll were introduced, M took the doll and manipulated the doll to hit the keyboard of the piano (pretend action). Later, during a more recent period (May 2001 at age 6 years and 0 months), when we introduced *Anpan-man* (Bean-Jam Bun Boy) dolls, characters that M often watched on TV or videos, we started to observe her acting out (pretend action) the defeat of the doll *Baikin-man* (Germ Boy) using *Anpan-man*, or acting out (pretend action) *Jam-ojisan* (Uncle Jam) healing the broken face of *Anpan-man*.

Such characters may also stimulate pretend play and enhance the imagination through images of tactile actions.

Furthermore, in the case of sighted children, it appears easy to search for an appropriate object for them to manipulate on their own and effectively utilize this in pretend play. However, visually impaired children seem to have difficulty searching for appropriate objects on their own during an activity.

In addition to the above-mentioned tactile perception of pictures through picture books for blind children or the manipulation of models, even in the case of pretend play, an

object feasible for touching and manipulation by visually impaired children is effective. Consequently, appropriate introduction of tactile objects to blind children and its timing appears to be important.

3. Stimulating an Interest in Letters (Braille) and their Learning

At the present time in Japan, most sighted children are able to read *hiragana* (simple phonetic characters) before they enter school[2]. Depending on the child, it is possible to encourage blind children, even before entering school, to learn Braille, which is regarded as being necessary for smooth progress after entering school.

However, most sighted children are blessed with an environment of abundant letters and can obtain such information visually. Such an environment means that picture books or fairy tales can be read by a parent, newspapers can be read by the whole family, and books and textbooks by their brothers and sisters. Letters are projected on TV, printed on bags of snacks, store signboards and on advertisements. This environment becomes the basis for learning letters. On the other hand, in the case of blind children, none of this information can be utilized.

Therefore, for the purpose of providing an appropriate environment for blind children as a basis for learning letters (Braille), a course for learning Braille, as observed for M, may be a good reference. This course begins with being read stories or listening to stories with only the ears, followed by listening to stories while touching tactile pictures, then developing an interest in and touching the Braille in the story or title. This becomes a basis for learning Braille and leads naturally to its learning. Therefore, this course is considered to be effective.

Acknowledgments: I would like to express my appreciation to M and her family for allowing me to study through picture books for blind children. I would also like to thank Mr. Tomohide So (Kanagawa Light Center), Ms. Mariko Wakamatsu (same as above) and Ms. Nahomi Yagi (same as above) and other staff.

Additional Note: A portion of this study was subsidized through a grant from the Ministry of Education, Culture, Sports, Science and Technology for (A) “Study on the Production, Effective Use and Diffusion of Picture Books for Visually Impaired Children” (Subject No.12710162)

References

1) Fujizaki, H. (1997) Learning via Media. Compiled by Miyake, K., Uchida, N. Child Psychology, Society for the Promotion of the University of the Air, 115-123.
2) Imai, H. (1987) Children’s Reading of Letters. Compiled by Fukuzawa, S. Speech Psychology-2, Children’s Language, Dainippon-tosho, 57-93.
3) Kaneko, K., & Sugai, H. (1999) Study on Production and Effective Utilization of Picture Books for Blind Children – Examination through Trial in 2 Study Cases. *Bulletin of the National Institute of Special Education*, 26, 37-50.
4) Muto, T. (1994) Children in the Modern Society. Compiled by Ogiwara, M., Takahashi, K. Revised Child Education, Society for the Promotion of the University of the Air, 109-120.
5) Sasaki, H. (1984) Compiled by the Utsunomiya Picture Book Library, Children’s Psychological Development and Picture Books. Reimei-shobo.

—Recieved June 5, 2003; Accepted April 27, 2004—