

# [Practical Paper] Development of a Communication System with Pictograph Translation for Parent and Child

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**Abstract**—Children in day care facilities can experience anxiety and a sense of isolation. Equally, working parents have on-going concerns about their children's state of mind. A system to enable mail communication between children and parents has been developed. By using QR code cards and a touch screen with pictographs, pre-school age students are able to create and transmit mail messages. The message is translated into text, which is transmitted to the parent. The parent's response is then converted to pictographs. Field trials and evaluations have indicated that the system is useable and has good potential. Nevertheless further improvements are possible.

**Keywords:** Communication, Parent and Child, Translation System, Pictograph, Mobile Phone

## 1 INTRODUCTION

The number of working mothers has been increasing over recent years [1]. This often results in pre-school age children being placed in day care facilities or nursery schools. Pressure of work may lead to parents asking the facility to keep their child for longer hours and/or parents arriving late to collect their children. This causes stress for both parent and child. The child can feel anxious or isolated and, through a combination of worry and guilt, the working parent finds it hard to concentrate on their job.

Therefore there is a need for mechanisms to facilitate communication between parents and young children. We selected an asynchronous communication mode to maximize convenience, especially for parents who may not be able to communicate in real time from their place of work but who can readily use a mail function.

Three to five year old children recognize pictures and animation more easily than characters. Therefore, we selected pictographs as the mechanism for exchange emails. Pictographs are already used in mail communications instead of sentences, but the pictographs used on mobile phones are not easy for children. Therefore we invented an original pictograph lexicon based on a survey.

Using our system, a child can create mail using pictographs and a parent can write mail using sentences. The system translates between the pictographs and sentences. We have further developed and improved the system based on opinions from a company that was developing products for preschools. We tested the system in preschools. Both parents and children involved in evaluation found it useful.

## 2 BACKGROUND

Many kinds of information equipment for children such as child-friendly mobile phones are now available on the market. However such equipment requires the user to be able to read. In addition, there are products available so that parent can see his or her child from a distance by using a camera. Mimarmorikun [2] is one such system. However, its use is limited because a parent cannot access the image via a mobile phone and it does not offer interactive communication. Alternatively, there are communication systems using pictographs [3,4], but these systems are not practical for use in communication between parent and child.

We sought to develop a system with the merit of enabling communication at any time, by using a mail function. Since the primary criterion was that any system must be useable by young children, we chose to use pictures and animation rather than conventional text. Prior to creating a working system, we collected questionnaire responses from 56 parents and 29 caregivers and teachers at three preschools. Our purpose was to determine the perceived value of the system and to collect information on the likely content of parent child communications.

The survey elicited the following responses. On the plus side respondents believed that parents could resolve feelings of unease about their children and children themselves might be less anxious.

On the downside, there was concern expressed about the increased burden the system may place on caregivers and pre-school teachers. The questionnaire responses found more positives than negatives in using the system so the basic approach was seen as valuable.

Nevertheless, the perceived weakness would have to be resolved. So, it was clear that the interface would have to be very child friendly to enable children to use it unassisted.

Three to five year olds are better at understanding pictures and animation than recognizing characters or reading/writing sentences. Therefore, the child interface uses animation. In addition, the pictures and animation are activated by touch panel rather than keyboard and mouse.

We used responses from questionnaires from 67 parents and their child to identify the most useful range of pictographs for communication between parent and child. This resulted in a set of 70 keywords, each with an associated pictograph [5,6].

### 3 SYSTEM CHARACTERISTICS

The communication system has a translation function between pictograph and text message. The system translates both the child's pictograph message to text message, and parent's text message into a pictograph message. A parent can use either a mobile terminal or a personal computer, while the child uses a special terminal located in their preschool or nursery school.

Figure 1 shows the catalogue of pictographs and the screen for creating pictograph sentences. Pictographs can be selected by touching this screen, and this builds a pictograph sentence on the upper left-hand side of the screen. In this case, the pictographs are "Sad", "Meet me", "Soon", so it means "I am sad. Please meet me soon."

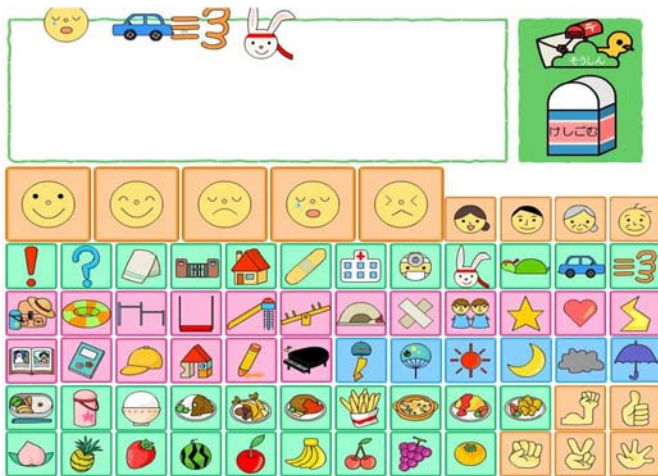


Figure 1: Screen for creating mail using pictographs.

Since the system can be used with either a personal computer or a mobile phone, a parent can access it regardless of time and place. The pictograph message is translated into text and sent to the parent's mobile phone or personal computer. Conversely, the parent's text response is translated into pictographs and transmitted to a special terminal in the preschool.

### 4 SUMMARY OF SYSTEM STRUCTURE

Figure 2 shows the system structure. Children can use a terminal in their preschool. They operate it by using the touch panel of a 19 inch liquid crystal display. They can log on to this terminal easily using the QR code reader. The children's terminal has 70 different pictographs arranged in the pattern shown in Figure 1. The server manages necessary information such as parent's address and child's name using an address list. The translation block translates between pictograph messages and text messages. The parent utilizes either a mobile phone or a personal computer. In addition, the parent can review the picture diary described in the next section using Internet [7].

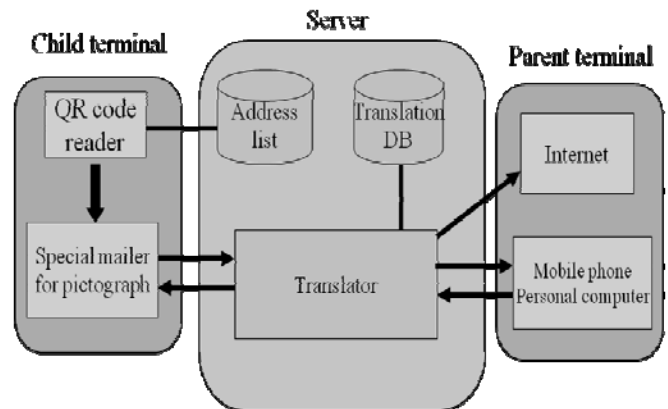


Figure 2: System structure.

### 5 SYSTEM FUNCTIONS

#### 5.1 Log on function using QR code



Figure 3: Nameplate with QR code.

The preschooler logs on using a name card with a QR code shown. These are personalized for easy recognition (Figure 3). The log in screen uses animation (Figure 4) to make the process easier for small children. The QR code automatically identifies the child and the parent's mail address. Once logged on, the child can then proceed to create and send messages.



Figure 4: Log on screen.

## 5.2 Operation using the touch panel

The child's terminal in preschool can be operated by finger touch on the panel. No mouse or keyboard is required so a child requires little if any assistance from the staff.

## 5.3 Pictograph translation function

A pictograph translation function in the server (Figure 2) converts pictographs to sentences and vice versa. A survey of 56 parents and 29 caregivers and teachers enabled us to identify the key elements of conversation and led to the choice of 70 pictographs.

## 5.4 Picture diary function

Children's messages are stored on the server in both pictograph and sentence form. This diary is accessible via the Internet. Figure 5 shows a view of the picture diary. This function enables parents and their children to review the communications later and discuss them together. We believe that this is a positive resource for parent and child communication. It also enables parents to keep a record of the messages and see patterns in the type of messages their child has sent.

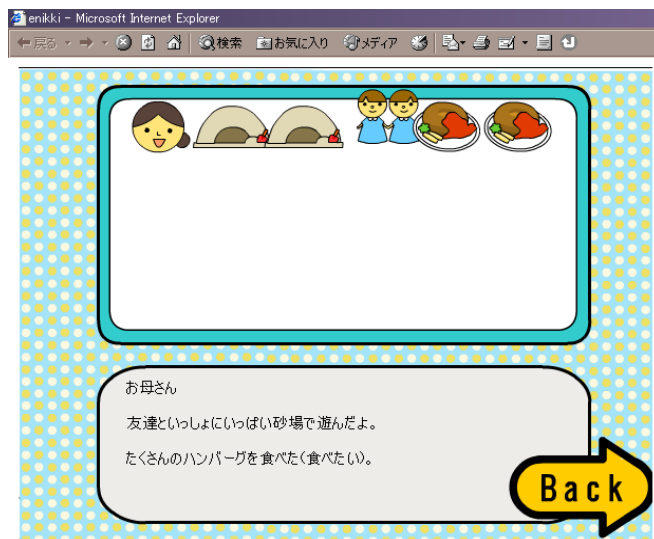
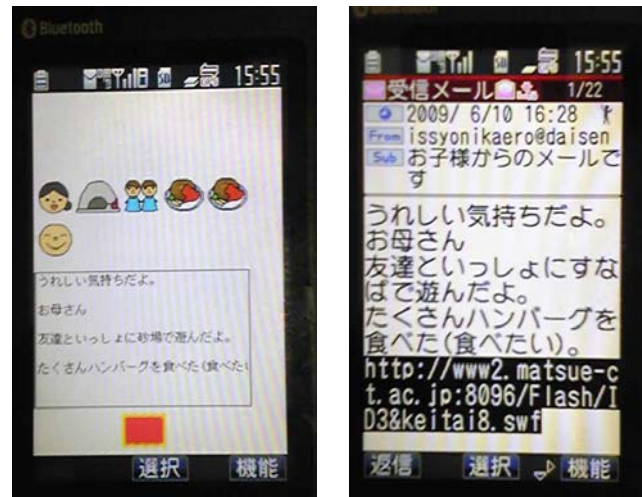


Figure 5: Picture diary.

## 5.5 Function for pictograph browsing using mobile phone

Parent can read transferred text message via mobile phone or personal computer. The pictographs selected by the child can also be viewed. Sample screens are shown in Figures 6 (A) and (B).



(A) Transferred mail

(B) After connection to URL

Figure 6: Sample screens of browsing pictographs and translations on mobile phone.

# 6 IMPLEMENTATION

## 6.1 Language

We developed the special mailer program using FLASH. Thus, we could make dynamic content including animation, and could develop a system a child would find interesting. The program for text processing, translation and mail processing was developed using PERL.

## 6.2 Translation Algorithm

The pictographs are divided into five categories; "feelings", "person", "adjective or adverb", "verb and noun", and "other". The translation program translates the pictograms in each category sequentially.

Order of translation: feeling → person →

adjective or adverb → verb and noun → other



Translation result:

"Mother, I am sad. I played seesaw with my friend. I want to eat (ate) much curry rice."

Figure 7: Example of pictograph translation.

The translation algorithm is shown in Figure 7. First, the words of "feeling" and subject must be translated because the child primarily wants to explain his or her feelings to the recipient. For example Figure 7 shows that the algorithm translates the pictographs of "sad" and "mother" to "I am sad, mother" and conveys his or her feelings first. Next, the algorithm converts what the child did or wants to do by

combining “adjective or adverb” and “verb and noun”. As shown, if there are pictographs of “with friends” and “seesaw”, the translator interprets this as “I played seesaw with my friends”. This is because, to a child, “seesaw” means the activity such as “I played seesaw”. On the other hand, plural pictographs are translated as “much”. In this example, curry is translated “I want to eat (ate) much curry.” Janken such as “Goo” or “Choki” are assigned to the “other” category and are translated last in the text message.

## 7 METHODOLOGY AND OUTCOMES

We evaluated this system twice in preschools in Matsue city. We re-evaluated the child-terminal, because at the time of the first trial we had developed only a PC screen. We could evaluate with mobile phone, on the second trial because we have now developed the parent’s terminal. On the first occasion, five year olds operated the system offline. The second time, parents and children used mobile phones and the special terminal online. Figure 8(A) is a picture from the first evaluation and Figure 8(B) shows the second trial. The evaluations were based on two items. First, “Could a child use the system unassisted? (Observations of 30 adults.)” Second “Did translation result agree to the child’s intention?” (Responses from seven children.)



(A) Children using the special terminal



(B) Parents and children using the system

Figure 8: System in Use.

We explained the operation method to groups of three children at a time. Then, they each had a chance to try it out. All the children tried twice.

The children were then asked to send a message to their mothers. After sending the message, the children were interviewed regarding the content and intent of their messages.

The outcomes were positive. The child participants had no difficulty understanding how to log on using a nameplate with a QR code or how to send mail. They could also use the eraser function and understand its purpose.

Six of seven children said the translation result agreed with their original message. The exception was a child who selected too many pictographs and this obscured the text translation.

The reaction of the children during field trials and evaluations was very positive. They were very enthusiastic and wanted to try it by themselves. We believe that this was in part due to the appeal of the animation and pictographs, which the children understood easily. All the children could use the system immediately, confirming that the system has potential as a communication medium.

In the second experiment, eleven pairs of parent and child used and evaluated this system. We showed standard sentences to parents, and they then created and sent messages. Each child responded to the parent’s message and the parent then sent a response. After the field trial, parents answered a questionnaire. The questions were divided into evaluation of the mobile terminal functions and evaluation of the system as an effective means of communication.

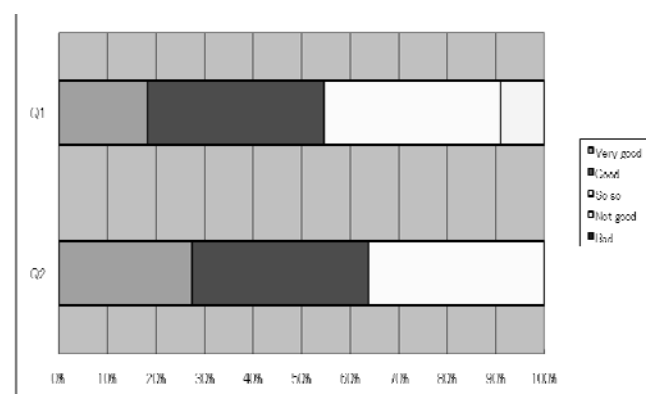


Figure 9: Evaluation of the function of mobile terminal.

The questions and results are as shown below.

- (a) Function of pictograph view screen of mobile phone
  - Q1 How useable did you find it?
  - Q2 Could you see the screen and pictographs easily?
- (b) The system as a whole
  - Q1 Were you satisfied with the translation function?
  - Q2 Did you feel this system would be effective for relieving your child’s sense of isolation?
  - Q3 Did you think this system would be useful as a tool to communicate with your child?

As shown in Figure 9 the evaluation of usability of the mobile terminal was good. Prior to the trial, an earlier questionnaire had indicated that about 50% of parents were concerned about the additional burden the system would place

on the nursery school staff. However, after the field trial, 80 % of parents agreed that this system was useful for communication (Q3 of Figure 10). Parents commented that this system was interesting and they were happy to receive mail from their children while at work. They commented that this system would be useful.

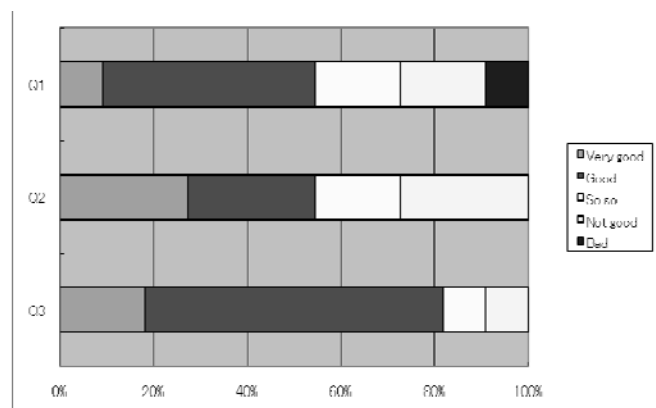


Figure 10: Evaluation of the system.

Although the questionnaire results, comments and our observations were generally positive, there are still some problems to be resolved.

We could observe as each child-parent pair communicated through mail exchange. Most children could not respond adequately to their parents, because the children had only pictograph translations of the sentences and so could not always understand their parent's intention. For instance, a sentence "I will be late to go to the preschool, because I am busy now." could not translate to pictographs adequately. Whereas parents could see both pictographs and sentences. To resolve this problem, we are considering ways to also show sentences to those children who can read, and for the system to read the sentence by speech synthesizer for those who cannot.



Figure 11: Example of improved screen for pictograph mail.

Another problem is that the pictographs cannot distinguish between past and future. For instance even if the child's intention was to convey "I ate", the translation result is "I ate or I will eat", so the message to the parent is ambiguous.

There was a problem with the pictograph table as children took a long time to select from the many pictographs to make a message. We have therefore modified the screen. Figure 11 with the new arrangement of the pictograph table can be compared with Figure 1. The expressions and foods are now ordered as shown. In addition, some pictographs that were not used by the children have been deleted. Main changes are as shown below.

- (1) First line includes pictographs of family and emotions because these are most important to the child.
- (2) Next lines include pictographs of foods and play activities.
- (3) Other pictographs follow. Unused pictographs such as "Uchiwa", "Fuurin" and "Goo" were deleted from the table.

Future evaluations will include comparison of the original and new pictograph tables.

Japanese is written using two syllabaria, hiragana and katakana plus kanji. Conventionally, children learn hiragana first followed by katakana, then finally kanji are introduced. Many children learn to read words, if not sentences, in hiragana and katakana before they enter elementary school. Therefore, storybooks for younger learners are presented in a mixture of hiragana and katakana. Parents with slightly older children, five years old and above, commented that it would be convenient to enhance the pictograph message with hiragana and katakana. If the child can read a little, he or she could then communicate more smoothly. To accommodate the wider age group we are planning to offer a choice of pictographs and characters.

## 8 CONCLUSIONS

We developed the communication system to offer asynchronous communication between parent and child. The system relies on a QR code log-on card that identifies the child and the target recipient. Children create messages by selecting pictographs that are translated into text and transmitted to the parents' mobile phone or personal computer. The reverse process enables parents to send messages back.

We improved the system after receiving comments from a company that is developing some products for preschools and receiving questionnaire responses from pre-school institution staff and parents. After trials that demonstrated that system use was within the capability of preschoolers, we ran evaluations and sought further feedback from parents and pre-school staff. This has led to further improvements such as modifying the pictograph catalogue. Additional modifications will include including an option for older children such as six years old to select Japanese characters and refinements of the pictographs to include verb tenses. Enabling the child to select a recipient from father, mother or grandparent will also make it more useful. This system received the Grand Prix Award at the Chugoku Campus Venture Grand Prix in 2009.

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