

## Sensory Evaluation Method to Create Pictograms Based on Multiplex Sign Languages

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**Abstract**— This paper discusses a method to create pictograms based on multiplex local sign languages with applying the concept of “Context of Use” on dialogue with applying Multivariate Analysis (MVA). Since pictograms are universal communication tools, human centred design (HCD) and context analysis by Persona model are applied. The experiments consist of three steps. The first step is to find out the similarity of a selected word among seven different local sign languages, which are American, British, French Spanish, Japanese, Korean and Chinese by means of MVA. The second step is to create a new common pictogram referring to the first step result by a pictogram designer. The final step is to validate the newly created pictogram by MVA. Under the cycle of HCD, the pictogram designer will perform to summarize the expression of several local sign languages by this method. The acquisition of this experience is to include it as a pictogram design guideline for context of universal communications such as emergency and traveling situations. Through the proposed method, the relationship between selected words and local sign languages are initially explained by sensory evaluation of the subjects. Currently the outcome of pictograms or icons of this experiment are implemented on the modern tablet computers with a touch panel display considering computer-human interactions.

**Keywords**- *Context of Use; Human Centred Design; Pictogram; Universal Communication; Sensory Evaluation.*

### I. INTRODUCTION

This paper discusses a method to create pictograms or icons referring to multiplex local sign languages with the concept of context of use on dialogue and Multivariate Analysis (MVA) [1]. Since pictograms or icons are universal communication tools, Human Centred Design (HCD) [2] and context analysis by Persona model by Alan Cooper [3] are applied in this research. This research was started in order to investigate the context of universal communication through local sign languages.

HCD is based on the context of use which is organized by four factors as user, product, task and environment in use (Figure 1). The research scope covers not only linguistic studies of sign language but also HCD with context of use [4].

The structure of this paper is that at first section the research purpose with deaf people issues in the case of emergency is introduced. Then simple and easy to use pictograms or icons are to be required as an efficient communication tool. In the middle sections to find out such

pictograms or icons applying sensory evaluation method is discussed. The validity of the newly created pictograms or icons is discussed in the final section.

### II. RESEARCH PURPOSE AND ISSUES

The purpose of this research is to figure out a method to create meaningful pictograms or icons referring to several local sign languages [5]. The sign language (SL) is basically a communication method from one person to the other for hearing impaired persons. The main factors of sign language consist of the hand shape, location and movement. There is a dilemma that SL is a language with motion whereas pictograms or icons are still ones. There was quite a discussion among researchers. Then hand shapes and locations are drawn by an animation and movements are done by arrows referring to a snapshot of the related local sign languages.

### III. RESEARCH PROCEDURES

Considering such research purpose and issues, the following three steps with seven phase research procedures are prepared;

Step1:

Phase 1: Determine a concept

Phase 2: Create Persona Model and its Scenario

Phase 3: Key words extraction especially on emergency and travelling situations

Phase 4: Conduct first Sensory Evaluation with seven local sign languages to extract similarities.

Step 2:

Phase 5: Design a summarized pictogram referring to the result above.

Step 3:

Phase 6: Conduct second Sensory Evaluation with seven local sign languages adding a summarized pictogram to validate

Phase 7: Conclude a method

#### A. Phase 1: The Context Determination

Based on the concept described above, two context situations of emergency or travelling have initially been chosen [6]. Alan Cooper proposed the Persona Model [3] related to HCD where several situation representing Personas are imaginably created in order to simulate and find how they will behave under a certain context. This method is highly accepted by the manufacturers in creating new

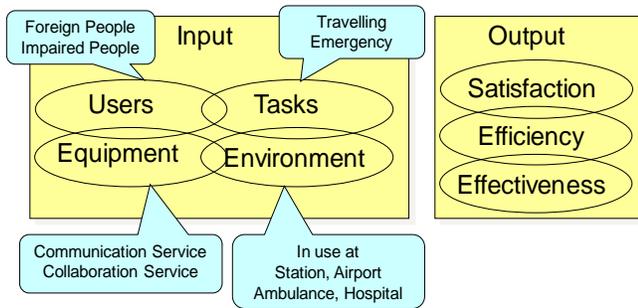


Figure 1. Context of use of Guidance on usability

product plans and has been applied to service science [7].

**B. Phase 2: Persona Model and Scenario Creation**

The first step is to create two Personas with applying the Persona Model under HCD [2]. The first Persona is a deaf person in a situation where he suffers a sudden illness while commuting in the morning, and is carried to the hospital by an ambulance (Figure 2). The second one is an office lady who lives in Hong Kong and has to visit Tokyo on business and then pleasure.

Diary like scenarios underlying Personas are described from discussions with colleagues utilizing the Brain Storming Method. These scenarios mainly pay attention to the dialogues between the Persona and those people surrounding [8]. The first scenario of the deaf person in an emergency consists of about 600 words (equivalent to 3000 Japanese characters) and second with the traveling woman about 1700 words (equivalent to 8500 characters).

**C. Phase 3: Key words extraction on situations**

This research is focused upon dialogues with several participants and referring to observations from the view point of the provider and the receiver under dialogue principle [8].

The next phase is to extract words that are fundamentally essential to the dialogues of the scenarios. 37 words were selected and categorized by discussions with colleagues.

Looking at the dialogues in the scenarios under the selected context, the hardest process is initiating the dialogue to a stranger. In modern times, people are worried about security. They are extremely cautious when approached by an unfamiliar person. Several interjections are included to assist the initiation of dialogues.

**D. Phase 4: First Sensory Evaluation with seven local sign languages**

The research is initially focused upon creating pictograms or icons to make dialogues since the fundamentals of sign language are hand shape, location and movement. This research references to a collection of

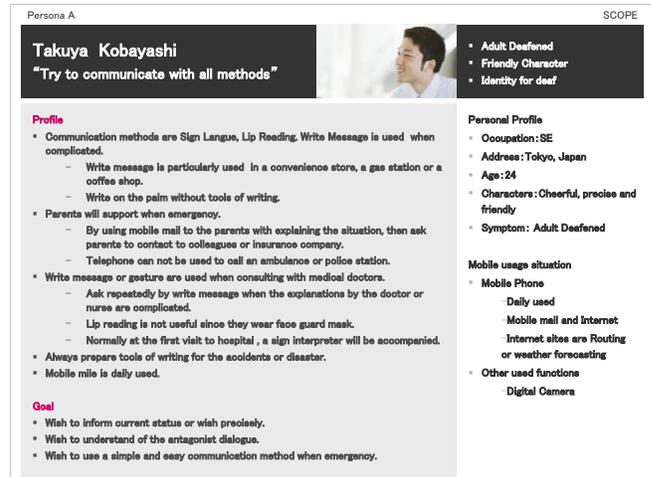
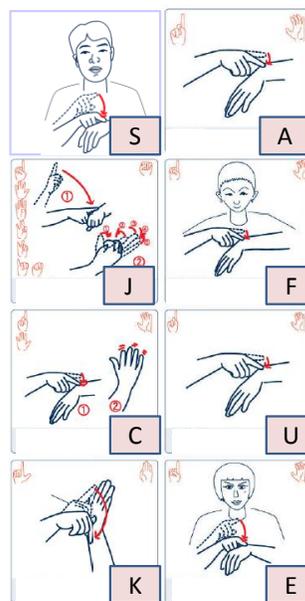


Figure 2. An example of Persona model

animation figures consists of seven local sign languages whose author is a deaf architect, gave overwhelming support to the research by supplying and permitting reference to the database. The seven local sign languages are of American, British, Chinese, French, Korean, Japanese, and Spanish [9].

In the experiment, subjects are first shown an expression with the collection of animation figures consists of seven local sign languages. After then subjects are informed of the sign meaning, they are requested to vote with 19 tokens which of the seven different local sign language expressions (samples) best coincides with the informed image. They are asked to put all 19 tokens on the condition that they are permitted eventually zero voting on some samples.



Abbreviations:

- A: American Sign Language (ASL)
- J: Japanese Sign Language (JSL)
- F: French Sign Language (FSL)
- C: Chinese Sign Language (CSL)
- B: British Sign Language (BSL)
- K: Korean Sign Language (KSL)
- E: Spanish Sign Language (SSL)

Figure 3. A sample of voting sheet of

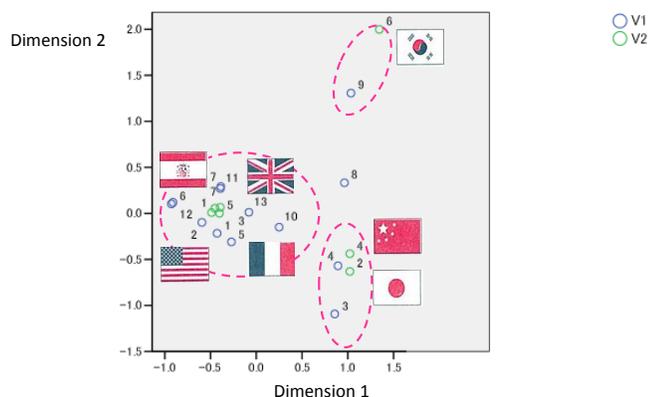


Figure 4. A plot of “When ?” with seven sign languages.

This sensory evaluation method can easily make relative comparisons between the seven expressions of local sign languages and is more applicable than the ordering method or pair comparison method. An example of voting sheet of “When ?” with local sign languages is shown in Figure 3 except the pictogram “S”.

Then the correspondence analysis of Multivariate Analysis (MVA) by statistic software; Statistical Package for Social Science (SPSS) [10, 11] is applied. The outcome is plotted as similar local sign languages are to be plotted closely on a plane. In the characteristics of correspondence analysis, the subjects who have general and standard ideas are positioned in the centre, whereas those who have extreme or specialized ideas are positioned away from the centre. The center crossing point of the first and second Eigenvalues is gravity point or average point.

The first experiment subjects are 13 people in their 20’s including nine science course students, four humanity course students. Some have experience living overseas and sign language interpreting. After voting by the tokens, all the subjects are asked of their confidence level with Semantic Differential (SD) method [12].

Figure 4 is an example of outcome chart where “When ?” is plotted.

*E. Phase 5: Summarized Pictograms Design*

Analyzing a plot chart of “When ?” in Figure 4 with seven sign languages, many subjects feel that French, American, British and Spanish sign languages are representing similarly “When ?” since they are plotted closely on the chart.

Following to the cycle process of HCD, the original designer is asked to summarize and design an animation like

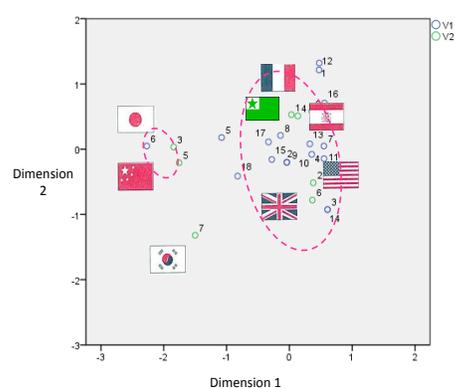


Figure 5. A supplementary treatment plot chart of “When ?” with eight sign languages

pictogram showing exclusively French, American, British and Spanish by referring to the outcome by the sensory evaluation mentioned above. Then the newly designed pictogram, which is “S” in Figure 3, is added to seven local sign languages with American, British, Chinese, French, Korean, Japanese, and Spanish.

*F. Phase 6: Second Sensory Evaluation with seven local sign languages with summarized pictogram*

The next procedure is the same manner as the first experiment of Phase 4. After subjects are informed of the sign meaning, this time they are requested to vote with 23 tokens which of the eight different local sign language expressions including newly designed one which is a pictogram “S” in Figure 3 will be the best coincides with their image. The procedure was the same manner as the first sensory evaluation step of phase 4, and the correspondence analysis of Multivariate Analysis (MVA) by SPSS is once again performed. The outcome including the newly designed pictogram is plotted with other seven local sign languages in order to prove and measure whether the newly created pictogram represents of the cluster.

The second experiment subjects are 20 engineering department students in their 20’s including two female students. Almost all except three are different subjects from the first experience. After voting by the tokens, all the subjects are again asked of their confidence level with Semantic Differential (SD) method.

Figure 5 is an example of outcome chart where “When ?” is plotted. Comparing Figure 4 with Figure 5, Figure 5 is plotted under uncertainty for factor rotation. The newly designed one will represent French, American, British and Spanish sign languages since it is plotted close

to those sign languages. Whereas Japanese, Korean, and Chinese plotted further down.

In order to prove the outcome, Supplementary Treatment of MVA by SPSS is applied with adding newly designed one to the seven sign languages. These deployments of the plots are similar in seven and eight sign languages experiments.

#### G. Phase 7: Conclude the Method

Through the experience of the first Sensory Evaluation with seven local sign languages of 37 words, many sign language expressions are identified by representing the meaning. Among them the most converged seven words of “when?”, “good-by”, “When?”, “thank you”, “where?”, “toilet”, and “expensive” among 37 are selected by means of brain storming.

Comparing two outcomes of Phase 4 (Figure 4) with seven local sign languages and of Phase 6 (Figure 5) with eight local ones, followings are concluded.

- Selected seven newly designed animation pictograms are all positioned in the centre of the related local sign languages cluster.
- Even though almost of the subjects are different at the first and second experiment, the general outcome plot patterns hold similar patterns in space.
- In western sign languages of French, American, British and Spanish tend to be plotted closely together.

#### IV. CONCLUSION AND FUTURE WORK

This paper discusses a method to extract the summarized expression of several local sign languages in order to draw pictograms or icons by applying the sensory evaluation with MVA. The experiments consist of three steps.

The first step is to find out a pictogram is a majority common expression upon a word among seven local sign languages. Looking at the first step, this method looks valid in practice since French and American sign languages are similar by historical background, and in fact they are plotted close to each other. The second step is to prove the characteristics of the pictogram represent the meaning of the word. The final step is to validate the newly created pictogram by MVA. Almost all of the newly designed pictograms positioned in the centre of the cluster then it is representative of the clusters.

In the example of “When?” among seven sign languages, analyzing by the Supplementary Treatment of MVA, the newly designed pictogram will be representing French, American, British and Spanish sign languages since it is plotted close to those sign languages on the plane.

Currently the outcome of pictograms or icons of this experiment are implemented on the modern tablet computers with a touch panel display considering computer-human interactions.

#### V. DISCUSSIONS

Through the proposed method, the relationship between selected words and local sign languages are initially explained by sensory evaluation by the subjects. Under the cycle of HCD, the pictogram designer will perform to summarize the expression of several local sign languages by this method. The acquisition of user experience is to include it as a design guideline for instance of the context of emergency and traveling situations.

The issues are that the quality of the newly designed pictogram depends on the designer’s ability to summarize several ones. The newly designed pictograms are still biased by sign languages in this research in order to become much easier communication tool, and require further improvement to simplify and easily to understand for everybody.

Considering the results of the second experienced phase to prove the outcome design by Supplementary Treatment of SPSS, the proposed method is one of the guidelines to create pictograms by referring to several sign languages.

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