

## Visual-communication representative system

**Chih-Wei Chen.**

*Graduate School of Computational Design, National Yunlin University of Science and Technology,  
Douliou, Taiwan*

*e-mail: [g9634705@yuntech.edu.tw](mailto:g9634705@yuntech.edu.tw)*

**PhD, Teng-Wen Chang**

*Graduate School of Computational Design, National Yunlin University of Science and Technology,  
Douliou, Taiwan*

### Abstract

Visual communication via mobile devices has increasingly become an important factor. Even with 3G/MSN network, the limited computing resources can't compete with a desktop 3D computing system to represent the delicate face impression. Further with the emotional interface design, the face expression has grown more in its intuition as well as intelligent support. Face expression, an important part of visual communication, has become an emotional expression for personalized representation online such as MSN network. By restricting the face expression into a set of shape and pixels, face expression with a built-in grammatical approach can then be analyzed and implemented. A computational design theory called shape grammar has adapted for this purpose. The facial expression for certain emotional express has also analyzed and classified into a set of classes and shapes with transformation rules. Each devices/messengers can apply these rules and present animation during communication.

## **1. Introduction**

### **1.1 Background**

People have communicated behaviour in everyday life. By communicating, everyone can send or receive messages from their friends or family member in any place and any time. Communication becomes convenient and efficiency. People can have various ways to express themselves. For example the message forms could be the text, voice, pictures, and video, etc. People use various message forms to express their thought, idea, feeling, and emotion, and then get reply from other people. They can understand gradually by exchange message or change another communication ways to express clearer. However people still looking for new way to communicate to others, for example to chat through internet or to see each other by web cam. No matter what kinds of device or form used to communicate. The only purpose is help people express message clearly.

### **1.2 Design Problem**

Hardware constrained people express facial emotional during the process of communication. The device conveys that facial expressing without a webcam to capture the facial change. Even though the user can use a webcam to convey the image, but still limited by transit speed. Now many people like using msn or mobile to chat through the internet. The new media help people can express freely and creatively, such as using text to show emotion, recording voice to convey, a sequence of image, and emotional icons. Although the text can convey their meaning directly, people still like using various expressing icon to show more emotional. The expressing icons have various kinds to help user express the emotional, but each icon just can express specific emotional. The user can't use icon express facial emotion as clear as the webcam, and can't dynamic change the facial real time. The study aims to generative facial express change during the process of communication.

## **2. Reviews**

### **2.1 Shape Grammar**

In 1980, Stiny pointed that shape grammar, and using algebra to analyze shape. Shape grammar brought a new way to think of shape.[6] In shape grammar using finite set of shape, symbols, rule, and initial shape to analyze the shape then generate new shape. For example, ice ray. Then more research case about shape grammar applying in architecture as The Palladian grammar, Frank Lloyd Wright's prairie house, Taiwanese traditional vernacular dwellings, and Japanese Tea-room, etc.[2][3][4][5][7][8] In 1990, structure grammar discuss about relationships between parts in configurations.[1] The shape grammar explored the shape can be describe in formal language, and then define the rule to general new shape. However, this study not aware other research discuss shape grammar apply in facial expression.

## **3. Methodology**

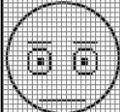
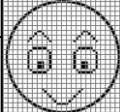
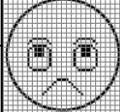
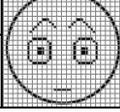
The purpose of this study in order to help people can have more emotion express in limited hardware or device. The study assumes facial express change can be present by shape grammar. When people communicate to other people through internet or mobile phone, they can see the facial express dynamically and automatically reply during chat to each other. The study steps have three steps: analyzing emotional icon, defining rule, and generating facial express. Firstly, we will analyze the msn emotional icon, and then classified the emotional icon into happy, sad, anger, fear, and amaze, then transform the icon to pixel (Table 1). Secondly, define the facial express rule. The rules are describing the pixel general from initial to final shape (Table 2). The relation of the pixel and pixel can be defined as the pixel grammar (Fig 1). The rules is used to constraint automatically reply function. The facial express can be gradually transformed from any emotion facial to another one.

## 4. Implementation

### 4.1 Analysis

Analyzing emotional icons, then classify icons into 5 kinds of emotional expression. The standard facial pixel is used to set the initial shape.

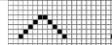
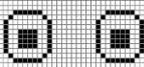
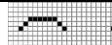
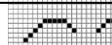
Table 1

| Emotion \ symbol | Icon  | Pixel   | Input               |
|------------------|---|---|---------------------|
| Standard         | None  |    | None                |
| Happy            |    |    | :-) , :)<br>:D , :d |
| Sad              |    |    | :(<br>:'(           |
| Fear             |    |   | 8-)                 |
| Anger            |  |  | 8o                  |
| surprise         |  |  | : <br>^o)           |

### 4.2 Define the shape

Simplified icon to pixel style, and therefore the pixel could be computed and defined the grammar. The set of emotion pixel include four parts face layout, eyebrows, eyes and mouth (Table 2). The rule only applies in eyebrows, eyes and mouth. Face layout will keep the same shape. All emotion pixel graphics are the maximal shape (shows in Table 1), thus to constrained the pixel generative from initial to terminal.

Table 2

| Emotional \ Part | Eyebrows  | Eyes   | Mouth   |
|------------------|---|--|---|
| Initial shape    |  |  |  |
| Happy            |  |  |  |
| Sad              |  |  |  |
| Fear             |  |  |  |

|          |  |  |  |
|----------|--|--|--|
| Anger    |  |  |  |
| Surprise |  |  |  |

### 4.3 Rules

Emotional icon consists of eyebrows, eyes, and mouth. The emotional icon is derived from initial shape by the define pixel grammar (Fig 1). The initial shape starts to derive from the pixel which set a triangle symbol. The rule 4, 6, 7 define the pixel can overlay next pixel; also the pixel can appear again. When the triangle symbol meet the "X", then the grammar will terminal. The pixel can transform, rotate, mirror, and scale. The part of facial that eyebrows, eyes, mouth will change at the same time.

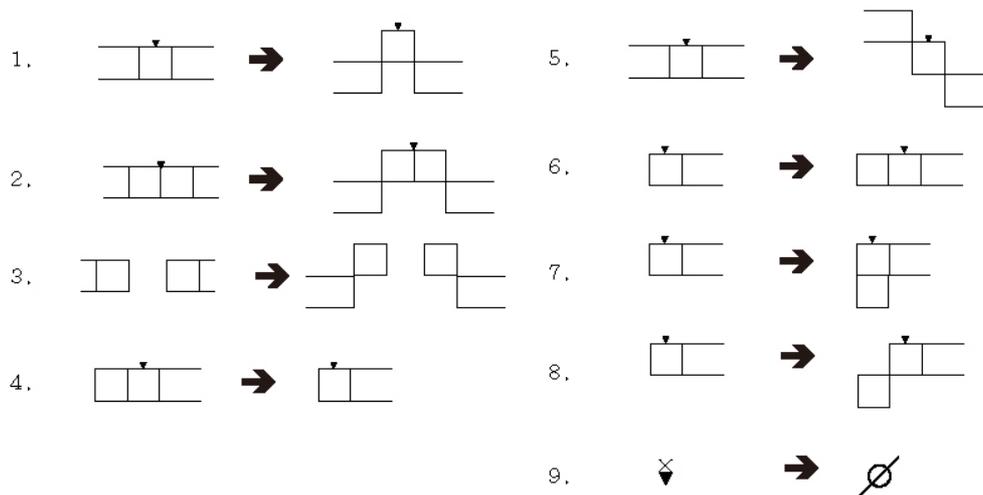


Fig 1 Pixel grammar

## 5. Generative Results

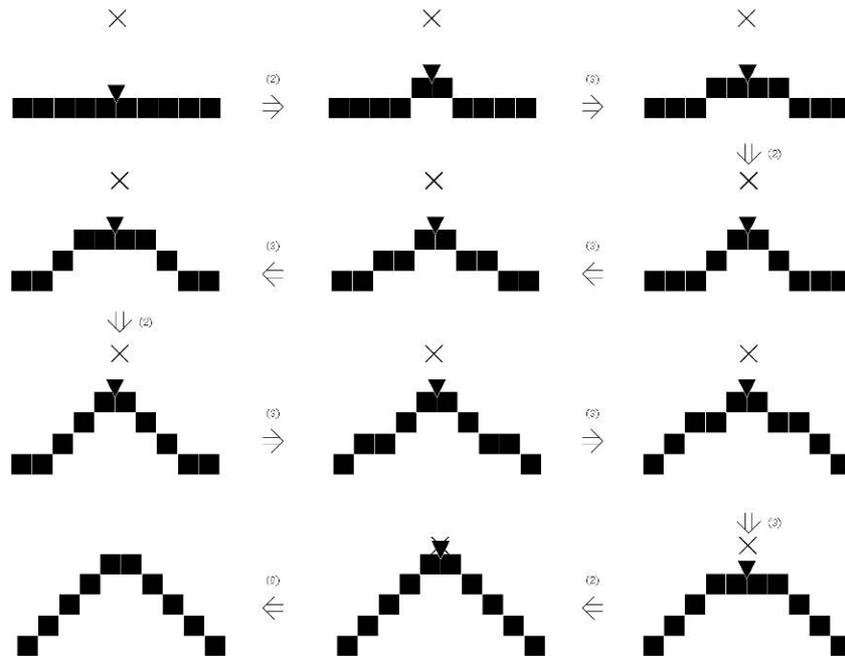


Fig 2. Using pixel grammar to generative eyebrows.

The Fig 2 is to explain how the eyebrows derived from the standard shape to smile shape. The pixel derived from the triangle symbol, and then used rule 3 to upper the pixel. Repeat the steps until to meet the terminal point.

## 6. Conclusion & Future work

This study is aim using pixel grammar derived from the shape that consist pixel to present procedure of facial change. The procedure of generation can present different level of facial emotion and animation. The purpose is to present the dynamic sentiment performance, and automatically change facial emotion. In the future, the pixel grammar aid implement in different messenger and mobile device. It will help people to present facial express during communication.

Reference:

- [1] Carlson, C., Woodbury, R. and McKelvey, R.: 1991, An introduction to structure and structure grammars, *Environment and Planning B: Planning and Design*, 18, 417-426.
- [2] Chiou S-C and R, K.: 1995, The grammar of Taiwanese traditional vernacular dwellings, *Environment and Planning B*, 22(6), 689-720.
- [3] Knight, T. W.: 1981, The forty-one steps, *Environment and Planning B*, 8(1), 87-114.
- [4] Koning H and J, E.: 1981, The language of the prairie: Frank Lloyd Wright's prairie houses, *Environment and Planning B*, 8(3), 295-323.
- [5] Stiny, G.: 1977, Ice-ray: a note on the generation of Chinese lattice designs, *Environment and Planning B: Planning and Design*, 4(1), 89-98.
- [6] Stiny, G.: 1980a, Introduction to shape and shape grammars, *Environment and Planning B: Planning and Design*, 7, 343-351.
- [7] Stiny, G.: 1980b, Kindergarten grammars: designing with Froebel's building gifts, *Environment and Planning B: Planning and Design*, 7, 409-462.
- [8] Stiny, G. and Mitchell, W. J.: 1978, The Palladian grammar, *Environment and Planning B: Planning and Design*, 5, 5-18.