

PoS : a Language For Describing the Posing

Atiwong Suchato, Prabhas Chongstitvatana*, Ekachai Leelarasamee**
Department of Electrical Engineering**
Department of Computer Engineering*
Chulalongkorn University, Bangkok 10330, Thailand
prabhas@chula.ac.th

Abstract

This work discusses PoS, a language for describing the posing of a sign language. The design and elements of the language are presented with examples of its use. An animation program that can interpret this language is demonstrated. The discussion on an application of PoS for broadcasting a sign language is presented.

1. Introduction

PoS is a language for describing the posing of a sign language. Sign language is a language of gesture. It is used to communicate between a signer and the audience. A sign language is more efficient than writing and can communicate an emotion of the signer. It is naturally easy to learn by handicaps. Sign language varies from country to country. There are many sign languages such as Thai Sign Language, American Sign Language etc. [1,2,3]

The elements of sign language are : configuration of fingers, position of hands, facial expression and body language, motions and the use of left and right hands. The configuration of fingers is an important element in a sign language and have many forms. The positions of hands are usually at the body level, above the head or in front of the shoulder. Facial expression and body language are used to convey emotions. Motions are also used to display different meaning by varying speed and to emphasize. The use of left and right hands is not fixed but depends on the handedness of the signer. There are dominant hand and passive hand. PoS language is designed to describe all these elements.

An animation system can take a scripting language such as PoS as its input. There are several advantages of using a language to drive animation :

- 1 It is a compact form for describing a message in sign language.
- 2 The description is independent of the figure of the animator. Therefore it is "portable" to many computer systems as far as the animation system is concerned.
- 3 It can be used to describe many sign languages.

2. The language

2.1 General form

To sign a word, PoS describes the configuration of fingers, the position of hands, the orientation of palms and the motions (see Appendix). The language composed of sections which described individual organs such as face, hands and motions. The general form is :

```
<PoS>
<FACE>
  attribute = expression ;
<LHAND>
  ...
<RHAND>
  ...
<MOVE>
  attribute = expression ;
<END>
```

Attributes and expressions are dependent on organs (see Appendix for more details). The following example shows PoS describes the word "animal" :

```
<PoS>
<FACE>
  exp = normal;
<RHAND>
  config = 01001;
  pos = natural;
  palm = down;
<END>
```



Figure 1 The word "animal"

2.2 Position of hands

There are many position of hands, examples are shown in the figure 2.

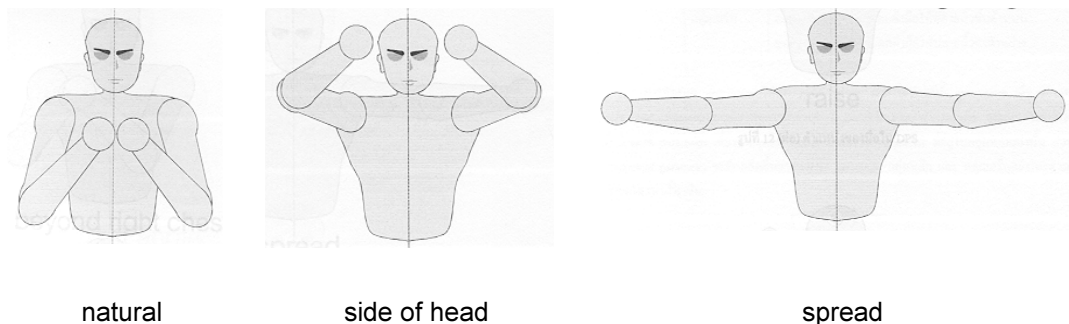


Figure 2 Positions of hands

2.3 Configuration of fingers

Configuration of fingers is described by six digits of symbol. The first five digit correspond to five fingers and the last digit is the modifier which specified spreading fingers apart (see figure 3, 4).

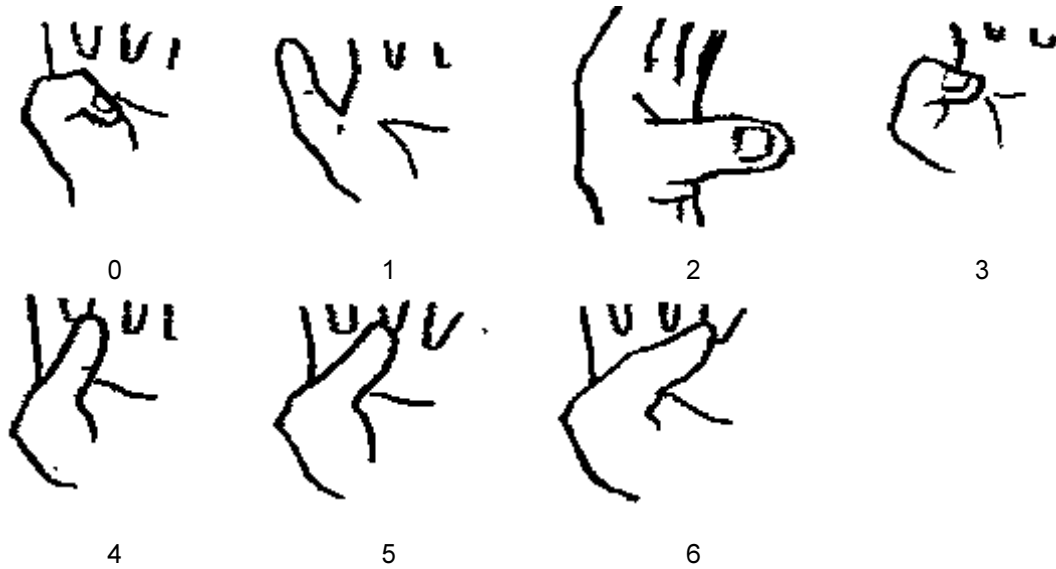


Figure 3 Positions of the thumb

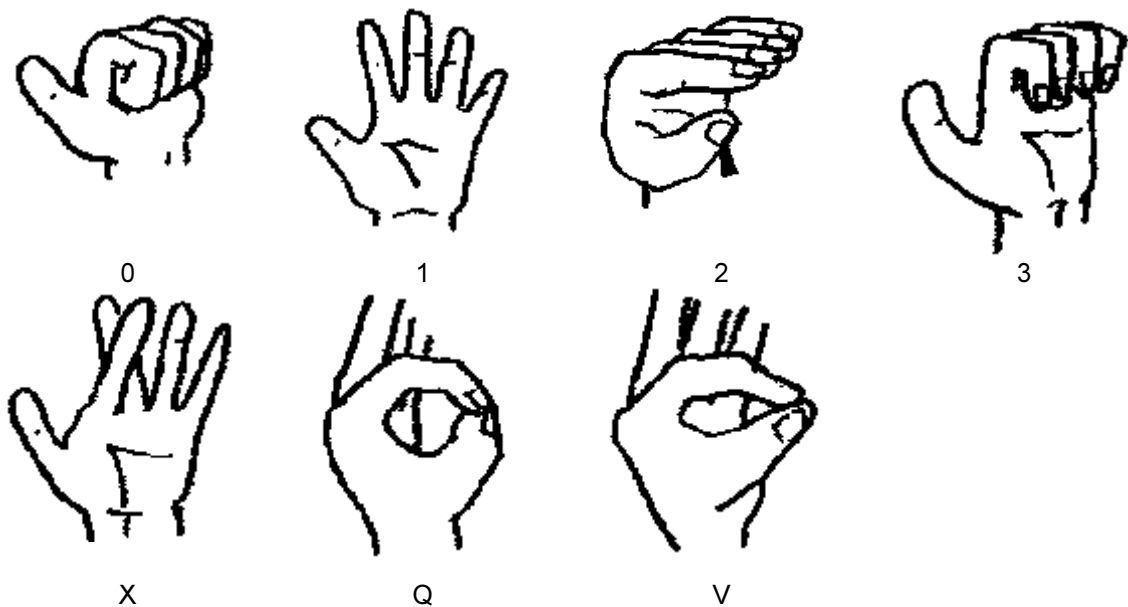


Figure 4 Positions of other fingers

Each hand can be described individually by <LHAND> and <RHAND> sections. When the left and right hand are moving together they can be described by <BOTH>.

2.4 Motions

Motions in PoS are described as sequences of simple motion of each organ. such as

```
<MOVE>
  head = nod;
  arm = wave;
```

Independent motions of each arm can be specified by

```
arm = right: value, left: value;
```

Example arm = right:up and down, left:leftward;

Dependent motions of two arms can be specified by

```
arm = both: value;
```

Example arm = both: away;

Motions of hands can be described in similar manner to motions of arms.

2.5 Temporal relationships of motions

Organs can be moved at the same time or sequentially. The temporal relationships are specified in figure 5. Prefix modifiers can be specified for each motion to change its tempo : * (asterisk) for quick and emphasize, ~ (tilde) for slow and smooth motion.

Example hand = both: *wave;

head	xxxxxxx	xxxxxxx			
right arm		xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
left arm		xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
right hand					xxxxxxx
left hand					xxxxxxx
	step 1	step 2	step 3	...	last

Figure 5 Temporal relationship of motions

3. An animation program

To demonstrate the use of PoS, we have implemented an animation program that can read and interpret PoS language. The program, Signer, has a 3D computer graphic model that display a sign language describing by PoS script. (see figure 6). Figure 7 shows examples of PoS in Thai Sign Language with the Signer.

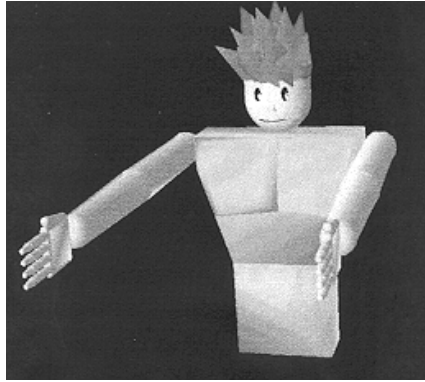


Figure 6 Signer

```

<PoS>
<FACE>
  exp = surprised;
<RHAND>
  pos = beyond chin;
  config = 22222;
  palm = side;
<MOVE>
  head = bend up;
  hand = right: up;
  arm = right: upward;
<END>

```

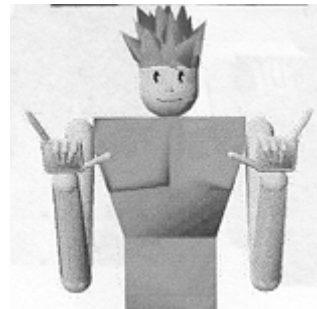


the word “drink”

```

<PoS>
<RHAND>
  pos=beyond right shoulder;
  config= 10001s;
  palm = down;
<LHAND>
  pos=beyond left shoulder;
  config = 10001s;
  palm = down;
<MOVE>
  arm = both:diverge;
<END>

```

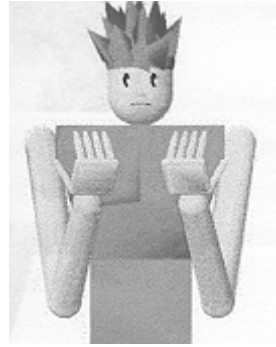


the word “measure”

```

<PoS>
<FACE>
  exp=serious;
<RHAND>
  pos=beyond right chest;
  config=22222;
  palm=up;
<LHAND>
  pos=beyond left chest;
  config=22222;
  palm=up;
<MOVE>
  hand= both: up;
<END>

```



the word “now”

Figure 7 Examples of PoS in Thai Sign Language

4. Related work

The only other work that we are aware of is "Sign Writing language" [4]. This language is used to describe sign languages similar to our work but SignWriting is a visual language, i.e. it is a graphical representation of sign languages. SignWriting has been used successfully to describe many sign languages. It uses spatial relation to describe sequences of motions. In contrast, PoS is a scripting language aims for machine readability.

5. Discussion

A system to broadcast Thai sign language can use PoS. In an encoded form, PoS can be used to drive animation of Thai sign language on a television set using close caption [5,6]. A message is parsed and converted to PoS to be sent through the caption channel. PoS is then interpreted by an animation engine at the receiver end. With the application like this, a sign language can be displayed on a television using scripting rather than video recording of a human signer. As PoS is independent of any specific sign language, the current version of PoS can be extended to be used for other sign languages as well.

References

- [1] Stokoe, D. Casterline, C. Croneberg, "A dictionary of American Sign Language on linguistic principles", Galluadet College Press, 1965.
- [2] Sternberg (ed), "the American Sign Language Dictionary (CD-ROM)", Multicom, n.d.
- [3] O. Wrigley (ed), "Thai Sign language dictionary", The National Association of the Deaf in Thailand, Thai-Watana -Panich Press, 1990.
- [4] www.signwriting.org
- [5] Teerapunya, S. and Leelarasamee, E., "A Thai-English teletext decoder using a novel hardwired code converter", Regional Symp. on Telecommunications Electronics and Systems (RSTEC 96), 1996.

- [6] Atikulawong, K. and Leelarasamee, E., "A processor for Thai-English closed caption system", Conf. of Electrical Engineering (EECON20), 1997, pp.855-859 (in Thai).

Appendix

PoS grammar

Notation :

/sym non terminal symbol
sym terminal symbol
[a,b,c...] list, each item can appear 0 or 1 time.
{a,b,c...} choice, only one of them can appear.
sym* appear 1..n times

```
/script :: <PoS> /pose [/motion] <END>
/pose :: [ <FACE> face-prop, /hand ]
/hand :: { /each-hand, /both-hand }
/each-hand :: [ <RHAND> hand-prop, <LHAND> hand-prop ]
/both-hand :: <BOTH> both-hand-prop
/face-prop :: [ exp = /exp-list [ & /exp-list ] ;
    pos = {decline left, decline right, turn up, turn down} ]
/exp-list :: {normal, surprised, fear, disgusted, angry, happy, sad}
/hand-prop :: [ pos = /pos-list ; , config = /fingers , palm = {up, down, side} [ & {teeter up,
    teeter down} ] ]
/pos-list :: {natural, beyond {stomach, {right, left} {shoulder, chest}, face, chin}, {outer side of,
    inner side of, over, beneath} {right, left} hand, {above, side of} head, beyond
    forehead, neck, raise, forward, spread, low spread, {h, v} right angle, touch
    /touching}
/touching :: {forehead, {right, left} eye, between eyes, {right, left} ear, nose, {right, left}
    cheek, mouth, chin, neck, {right, left} {shoulder, upper arm, elbow, inner arm joint,
    inner wrist, back wrist, palm, back hand}, heart, chest, stomach, hip}
/fingers :: /f1 /f2 /f3 /f4 /f5 [s] ;
/f1 :: {0..6}
/f2..5 :: {0..3,x,q,v}
/both-hand-prop :: [ /hand-prop, touch = /t1 /t2 /t3 /t4 /t5 [ {p,b,s} ] ]
/t1..5 :: {0..9}
/motion :: <MOVE> [ head = /head-move* , arm = /arm-move* , hand = /hand-move* ]
/head-move :: [/tempo] {nod, shake, turn up, turn down, decline left, decline right}
/arm-move :: [ right : [/tempo]/arm-move-list ',' left : [/tempo] /arm-move-list ; ,
    both : [/tempo] /arm-move-list ; ]
/hand-move :: [ right : [/tempo]/hand-move-list ',' left : [/tempo]/hand-move-list ; ,
    both : /hand-move-list ; ]
/tempo :: {*,~}
/arm-move-list :: {not move, {translate, bounce, S, zigzag, curve} /direction, diverge,
    converge, interchange, wave, {clockwise, counter clockwise, forward, backward}
    circular, move to /touching}
/direction :: { upward, downward, up and down, down and up, rightward, leftward, right and
    left, left and right, away, toward, away and toward, toward and away}
/hand-move-list :: {not move, up, down, up and down, down and up, wave, turn over , turn to
    /fingers}
```