

# Composing Facial Expressions with Signing Avatars

**Guillaume Olivrin**  
Meraka Institute, CSIR, Pretoria  
South Africa  
golivrin@meraka.org.za

## INTRODUCTION

Facial expressions are an integral part of sign languages. Communicating in sign language without facial expressions would be worse than speaking in a monotonic voice: more boring, less expressive and totally ambiguous. In sign languages, facial expressions also have linguistic roles in addition to their attentive and affective functions.

The objective of the signing avatar input system is to provide a framework for composing sign languages' facial expressions. A logical embodied model for animated facial expressions makes it possible to study the role of facial cues in forming a facial expression. The resulting facial expressions are only as important as the various cues they carry. To understand the meaning of these facial cues, we establish a linguistically constraint system of agreements and relations between facial cues.

Rather than using a facial model such as FAP to generate facial expressions by modifying Facial Animation Parameters, we use it to logically emerge the semantic and syntactic roles within facial expressions of in given sign language. In animation systems, resulting facial expressions are generally seen as a factor of blending between two or more stereotypical facial expressions. In an embodied system, the facial expressions are rather the result of conicting or supporting facial cues, various means for various effects. These agreements and binds between facial cues are constrained by linguistic rules and graphical limits captured in the embodied avatar model.

## MODEL

There are various animation models used signing avatars : models that consist in joints (such as H-anim), muscles (FAC), meshes (FAP), blobs, displacement maps and 2D mapping and layering. Our original H-anim model was simple enough to express the \_rst rules of logically composing basic facial expressions but lacked such important dimensions for sign languages asas frowning, puffing, lip shapes, tongue positions (through teeth) and nose wrinkling. With the H-anim joints for eye ball, eye brow, eye lid, we have modelled the first three linguistic agreements of YES/NO questions, WH questions and eye gaze agreements (follow finger, point to an instantiated referent in signing space).

To study the role of facial cues in the facial expressions of a given sign language, a limited but representative list of useful expressions in SouthAfrican SignLanguage is first built. The task was then to create the H-anim joint model and then the FAP mesh model associated with each facial expression.

Each facial expression is classified in one of the three classes : Affective, Attentive or linguistic. Again, this is a functional simplification which will explain how facial expressions will later interact between each others. Each class has generic parameters that all its facial expressions will inherit. An abstract "sign" might be associated with 1 to many di\_erent partial facial expressions from di\_erent classes. Only once the sign or communication act is instantiated will certain of these candidate facial expressions be used. Partial facial expressions also duration, frequency, envelope and timing to relate to each others in sequence, in parallel and labelled as overlapping, start at, etc ... for make reasoning with temporal logic possible.

```
Linguistic
|-Grammatical
|-- e.g. Yes/No Questions, Wh_ Questions, Deictic (gaze agreements)
|-Lexical Semantic
|-- Size and Form (e.g. PREGNANT, BIG, FAT, SKINNY)
|-- Relax/Strain (e.g. HEADACHE, BORED)
```

#### Attentional

|-- Certainty (YES, NO, MAYBE)

|-- Salience (IMPORTANT)

|-- Correctness (GOOD, BAD, WRONG)

#### Affective (Signing Avatar or Role Transfer)

|-- State (AWAKE, AWARE, CURIOUS, BORED, THOUGHTFUL, DISTRESSED, SATISFIED)

|-- Emotion (FEAR, JOY, ANGER, RELIEF)

|-- Attitude (KIND, DISAPPROVING, REPROACHFUL, ADMIRINGOF)

Note that the lexical semantic parameters Relax/Strain for the sign BORED does not provide the same dimension as the affective parameter for the state of boredom. One parametrized the intensities that can be applied when enunciating the lexical item while the other defines the state of the signing avatar or the personified referent during the process of enunciation.

Each partial facial expression is then expressed at the lowest level using FAP in terms of facial animation parameters. This supersedes our H-anim joint model for the head, which was rather limited in terms of facial cues. The logic has thus been generalised to FAP but the signing avatar face currently support H-anim only.

Finally, there are agreements at the lexical level between the partial facial expressions and other head, shoulder, arm or manual gestures. One example of facial cues and body gesture agreement is exemplified by the eye gaze agreement case. For instance, when using demonstrative such as THIS/THAT or pronouns such as HE/SHE/IT, HIM/HER/IT, IS/HER/ITS etc. . . , the eye gaze must follow the deictic gesture to the place in which the agent has been instantiated.

## CONCLUSION

This abstract gives the basis on which we have simplified, formalised and implemented agreements between facial expressions and between facial expressions and body gestures in the domain of sign languages. We have used a top-down approach to classify and parametrize facial expressions in different gestural classes. The gesture composition systems can now use a bottom-up approach to build facial expression with linguistic and graphical constraints using these partial facial expressions. The resulting facial expressions are not simply a blend of images but rather a composite of competing linguistic, attentional and affective cues.