

Synthesizing Sign Language by Connecting Linguistically Structured Descriptions to a Multi-track Animation System

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Linguistics and Animation

- Animation supports sign linguistics by providing
 - Target for synthesis and translation
 - Visualization of the linguistic encoding
 - Platform for testing theory
- Linguistics provides sign animation with rules that
 - Help structure human animation of sign
 - Specifies how human motion changes with meaning
 - Helps create novel utterances from prior animation



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Goals of the present effort

- Diverse efforts around the world
 - Different sign languages
 - Different representations of sign
 - Different animation techniques
- Explore connecting
 - A structured linguistics description of sign (LIMSI's AZee)
 - A hybrid animation system (DePaul's Synthesizer)
- Neither specifically designed to work with the other

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AZee description of SL

- Very basic assumptions:
 - language productions create observable forms carrying intended meaning
 - systematic links between the two specify the language (**production rules**)
 - languages allow for compositional structures
- No assumed language level or hierarchy:
 - **multi-linearity** at all levels
 - **no functional partitioning** of the articulator set (body)
- Experimental corpus search approach for rules to surface

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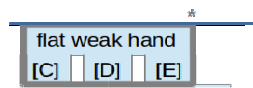
AZee rules

- A production rule is a tuple:

<semantic function, parameter list>

- Examples:

<restaurant, [optional *loc*]>



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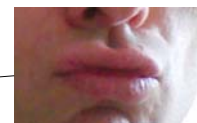
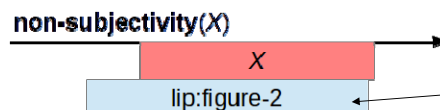
AZee rules

- A production rule is a tuple:

<semantic function, parameter list>

- Examples:

<non-subjectivity, [X: judgement]>



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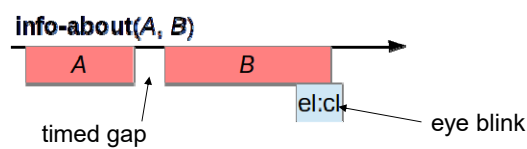
AZee rules

- A production rule is a tuple:

<semantic function, parameter list>

- Examples:

<info-about, [A: topic, B: info]>

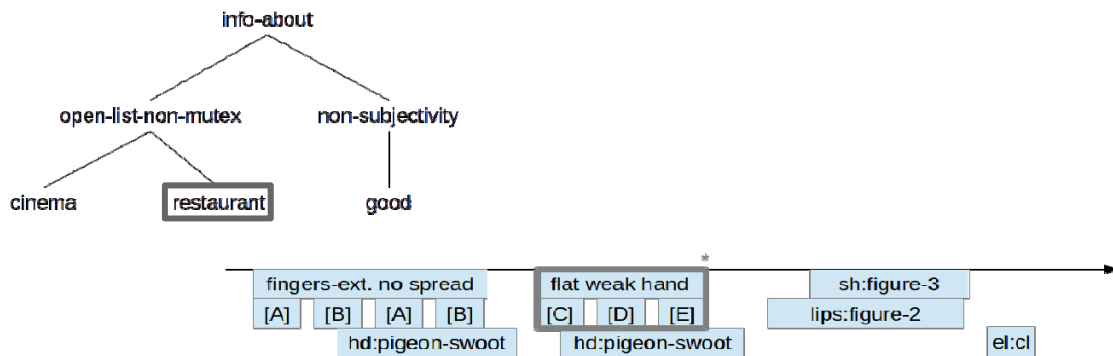


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AZee rule nesting

- A parameter for one rule can be given as a signed form produced by another rule (recursive nesting)

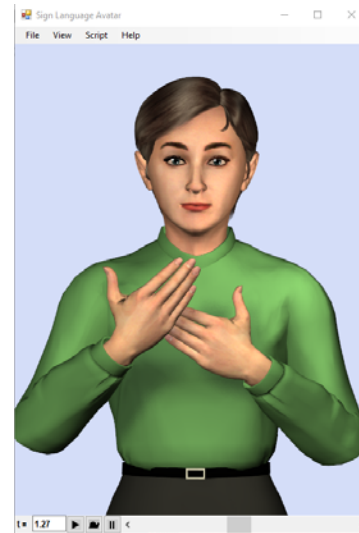


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Hybrid animation

- Combine any or all of
 - Traditional animation
 - Procedural animation
 - Motion capture
- Use the technique most appropriate to each process



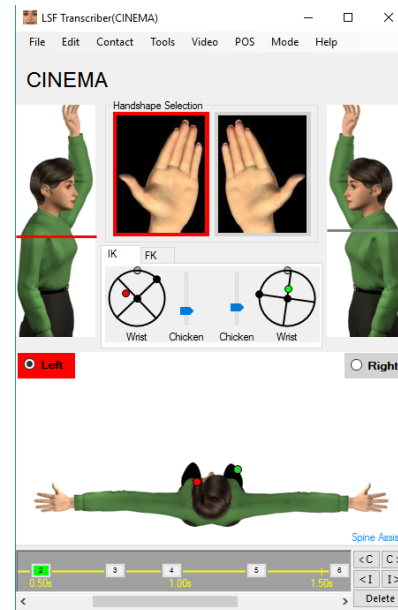
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Paula: Tuned to Sign

- Interface tuned to SL
 - Uses language of sign (e.g. handshape)
 - Encourages **sparse** key frames
- Artists animate basic blocks
 - Build lexical blocks/glosses
 - Setup rules for procedures like spatial verb agreement
- Procedural techniques shorten animation cycle
 - Spine assist (McDonald, 2013)
 - Ambient motion (McDonald, 2015)



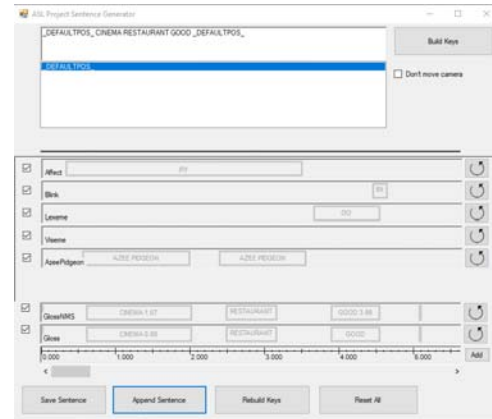
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Paula: A layered, multi-linear approach

- Multiple processes layered to form utterances
 - Lexical units
 - Non manual syntax signals
 - Blinking
 - Head movement, etc.
- Complex timing
 - Asynchronous block timing
 - Possible to tie dependent together
- No track “owns” specific geometry



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Comparing the two systems

Azee

- Produces a multi-linear asynchronous representation
- No-functional partitioning
- Hierarchical representation with nested information

Paula

- Multi-linear asynchronous animation tracks
- Multiple tracks can affect same geometry
- Mixture of animation styles

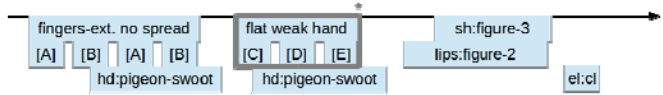
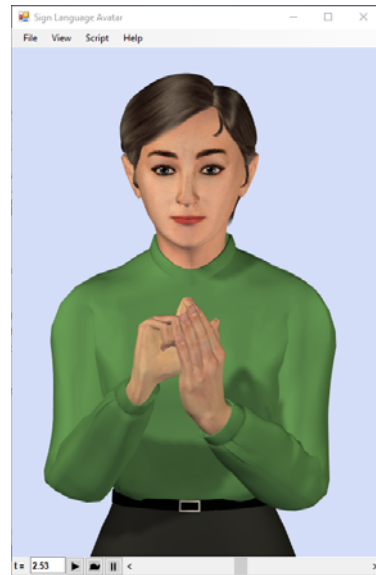
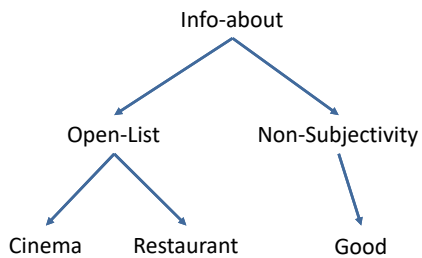
Guiding Principle: The coarser the basic animation blocks, the more natural the final animation

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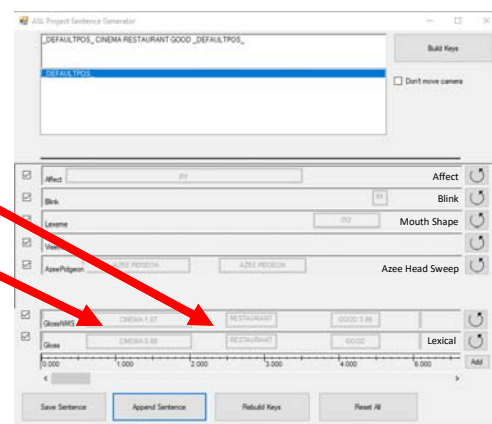
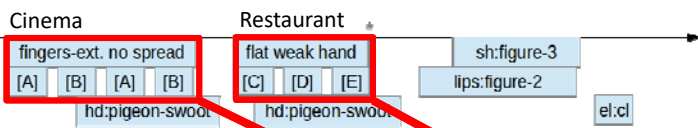
Animating AZee



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Animating AZee



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Animating AZee

The image shows a timeline for animating AZee. The timeline is divided into two sections: 'Cinema' and 'Restaurant'. In the 'Cinema' section, there are two keyframes for 'fingers-ext. no spread' with keys [A] and [B]. In the 'Restaurant' section, there are three keyframes for 'flat weak hand' with keys [C], [D], and [E]. Below the 'Cinema' section, there are two keyframes for 'hd:pigeon-swoot'. Below the 'Restaurant' section, there are two keyframes for 'sh:figure-3' and 'lips:figure-2', and one keyframe for 'el:cl'. Red arrows point from the 'hd:pigeon-swoot' keyframes to the 'AzeePigeon' controls in the software interface. The software interface is titled 'Aze Project Sentence Generator' and shows a list of default lipos. Below the list, there are controls for 'Affect', 'Blink', 'Mouth Shape', and 'Azee Head Sweep'. The 'Azee Head Sweep' controls are set to 'Azee Pigeon'. At the bottom, there are buttons for 'Save Sentence', 'Append Sentence', 'P rebuild Keys', and 'Reset All'.

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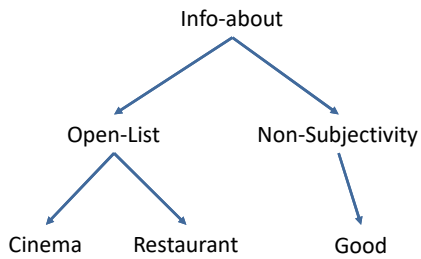
Animating AZee

The image shows a timeline for animating AZee. The timeline has three main segments: 'fingers-ext. no spread' with sub-segments [A] and [B], 'flat weak hand' with sub-segments [C], [D], and [E], and 'sh:figure-3'. Below the 'fingers-ext. no spread' segment is a box labeled 'hd:pigeon-swoot'. Below the 'flat weak hand' segment is another box labeled 'hd:pigeon-swoot'. A red box highlights 'lips:figure-2' and 'el:c' on the timeline. To the right is a screenshot of the 'AZee Project Sentence Generator' software. The software interface includes a list of sentences, a 'Build Keys' button, and a 'Don't move camera' checkbox. Below these are several control panels for 'Affect', 'Blink', 'Lipshape', 'Mouth Shape', 'Volume', 'AzeePigeon', 'Azee Position', 'Azee Head Sweep', 'ClearPMS', 'Cinema 1.01', 'Restaurant', 'Good 1.01', 'Clear', 'Cinema 3.01', 'Restaurant', 'Good', and 'Lexical'. A timeline at the bottom of the software interface shows a scale from 0:00 to 6:00. At the bottom of the slide, there are logos for 'Limsi' and 'DEPAUL UNIVERSITY'.

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Results



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Conclusion

- A first attempt at connecting two mature systems
- Capitalizes on the functional similarity of the two systems
- Bridges from the multi-linear block output of AZee to the multi-track animation system of the DePaul Synthesizer
- Future work:
 - Still relies on manual tuning of timing and duration
 - Need to expand the range of supported language processes and vocabulary

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Thank You

Questions?

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