Towards a multi-modal construction grammar: the visual-spatial modality

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Research in the field of construction grammar focusses predominantly on spoken languages, with a growing interest in multi-modal analyses that consider speech, gestures and facial expressions (see e.g. Zima and Bergs, 2017; Feyaerts et al., 2022). Although these approaches have succeeded in establishing a foundation for multi-modal construction grammars, they rarely provide concrete formalisations of multi-modal constructions. In our talk, we will discuss the usage of Fluid Construction Grammar (FCG) as a framework for modelling the constructions of sign languages, which rely exclusively on the visual-spatial modality for encoding meaning in communication. Instances of sign language constructions are the usage of 3D-space for marking semantic argument roles, the usage of facial expressions for marking questions, and the usage of head movements for marking negation or affirmation. Our work builds on previous work by van Trijp (2015), who discussed the suitable nature of Fluid Construction Grammar for modelling sign languages and provided a first formalisation. Our implementations can easily be extended to the multi-modal constructions found in spoken languages, as they too require the inclusion of information from the visual-spatial modality.

We test our implementation on two examples provided by van Trijp (2015), which concern parametric variation and multi-linearity. Parametric variation occurs when one phonological parameter of a sign (handshape, orientation, location or movement) is modified, slightly changing the meaning associated with the sign (van Trijp, 2015). Multi-linearity on the other hand refers to the simultaneous usage of different body articulators (e.g. hands, face, body) to convey meaning (van Trijp, 2015). The Hamburg Sign Language Notation System (Hanke, 2004) and its XML extension Signing Gesture Markup Language (Elliott et al., 2004) are used to formally represent the phonetic aspects of the signed expressions. Figure 1 shows the example of parametric variation, where the sign for ball can be performed with an enlarged movement, to indicate that the referent is large. Figure 2 shows the construction application process for this example in comprehension, where the ball-cxn matches on the dictionary parameters associated with ball, and the big-cxn matches on the parameter indicating the enlarged movement. Figure 3 shows the same process in formulation, where the ball-cxn matches on the meaning of ball, and the big-cxn on the meaning of big.

Our model succeeds in providing concrete implementations of sign language constructions, but several open questions remain to be addressed, such as how to synchronize different articulators within constructions, which patterns and constructions make up the grammars of sign languages, and how to encode them. We hope to discuss these questions further at ICCG, exploring the potential of construction grammar and its computational frameworks when it comes to modelling multi-modality in general, and sign languages specifically.

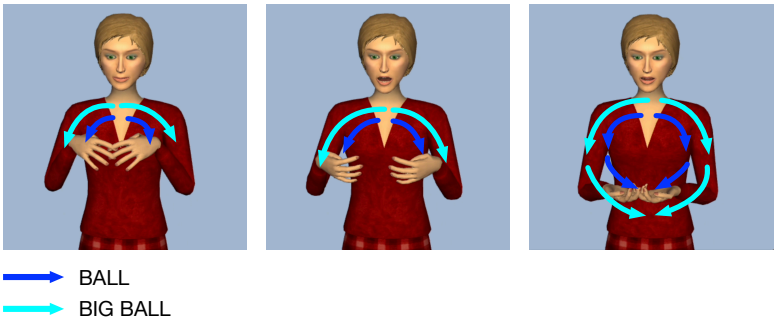
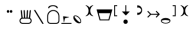
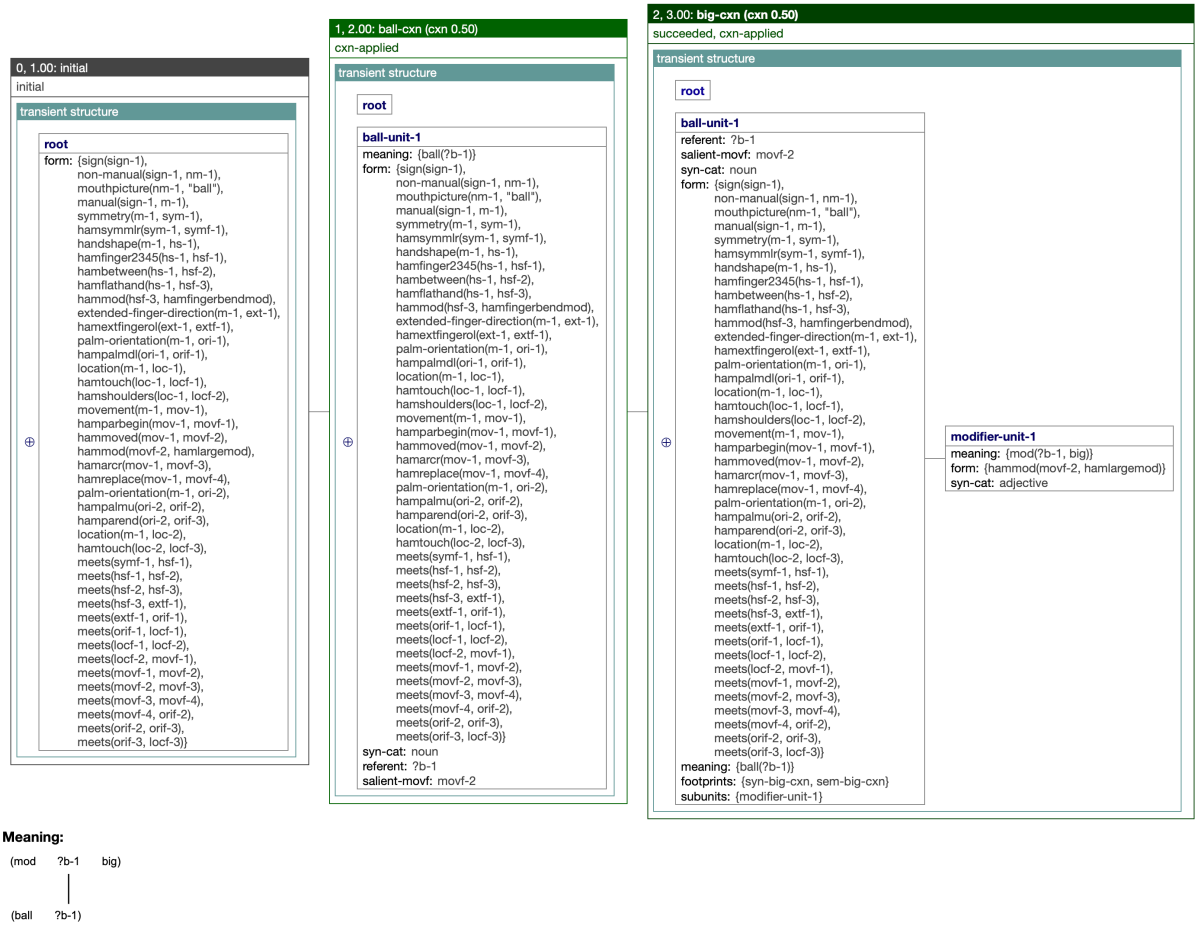


Figure 1: Example of parametric variation. The movement parameter of the sign can be performed larger to add the meaning of big to the referent of the sign. The image was generated using the SiGML-player software.

Comprehending the following signed utterance:

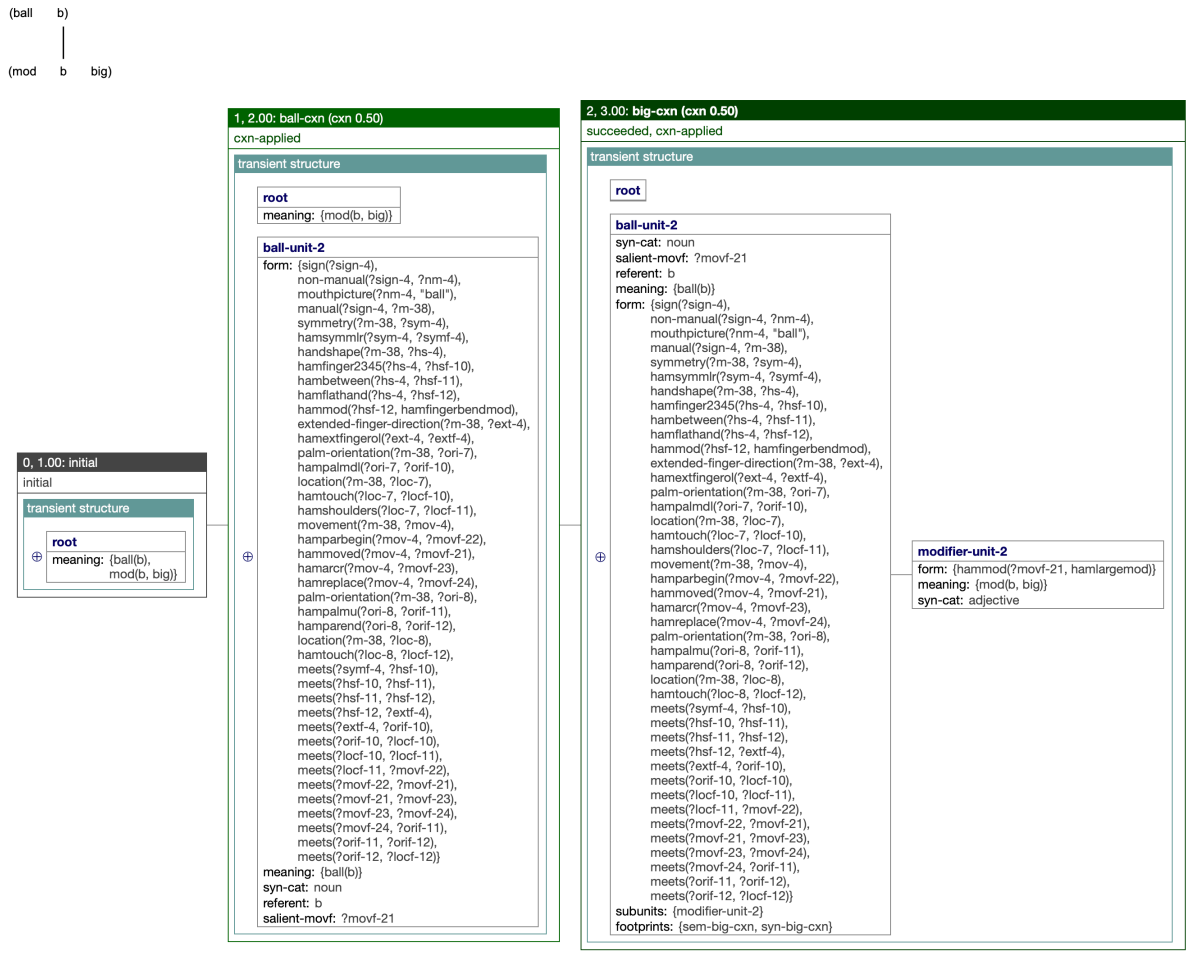




Meaning:

Figure 2: Construction application process in comprehension for the signed expression big ball. First the ball-cxn matches on the dictionary parameters for ball, and then the big-cxn matches on the parameter indicating the enlarged movement.

Formulating



Produced the following signed utterance:

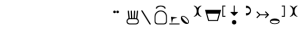


Figure 3:Construction application process in production for the signed expression big ball. First the ball-cxn matches on the meaning for ball, and then the big-cxn matches on the meaning for large.

References

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