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## Toward a Better Understanding of Nonmanual Signals through Acquisition and Synthesis

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# **Toward a Better Understanding of Nonmanual Signals through Acquisition and Synthesis**

Although there has been substantive progress in the study of the manually-produced elements of sign languages, understanding the roles of nonmanual signals (NMS) is still an open area. Notations of onset and duration of static poses do not fully capture the structure and function of NMS.

Previous work has demonstrated that NMS are manifest at all levels of language, ranging from the phonemic, morphological and syntactic to the prosodic and pragmatic. Further, NMS functioning at different language levels can co-occur on the face and on the spine. For instance, on the face, syntactic and lexical elements can co-occur in ASL when a yes/no question involves the sign NOT-YET. Syntactic and morphological elements can co-occur when a WH-question involves modifiers such as CHA or pursed lips. It is not yet clear whether these are always isolated to localized areas of the face. For example, a facial pose indicating that an object is very tiny can involve the brows. If this modifier is present in the production of a WH-question, which also involves the brows, how does the modifier affect the production of the syntactic marker?

Things are no less interesting when considering the spinal column. The head can mark negation, which is a simple case in isolation; however this can co-occur with subject/object agreement in plain verbs. How do the two interact?

Critical to the characterization of NMS functionality is the creation of additional language corpora for further study. This will require techniques for gathering exemplars that go beyond simply avoiding influence from spoken language. New techniques are necessary to provide sufficient structure such that the resulting elicitations vary only in the NMS produced.

Our work is in the acquisition and reproduction of American Sign Language via 3D animation. Computerized language synthesis provides a means to study multifunctionality and co-occurrence in NMS. Creating NMS via 3D computer animation provides a test bed for new ideas. Evaluating a proposed representation begins with a synthesis of a visual production from the representation. The resulting animation must not only be understandable but also be acceptable to the Deaf community. Current synthesizer technology can portray simple syntactic NMS in addition to affect, but further understanding is necessary to progress beyond this point.

One of the goals of this effort has been to develop an appropriate open standard to facilitate knowledge sharing. Extant facial animation standards were designed to support speaking characters, and it is not entirely clear whether such standards are appropriate for characterizing facial NMS.