

**6th Workshop on the Representation and Processing of
Sign Languages:
Beyond the Manual Channel**

Reykjavik, Iceland, 31 May 2014

ABSTRACTS

Editors:

**Onno Crasborn, Eleni Efthimiou, Stavroula-Evita Fotinea, Thomas Hanke, Julie
Hochgesang, Jette Kristoffersen, Johanna Mesch**

Workshop Programme

09:00 – 10:30	Session A – Oral/Signed: <i>Linguistic Signals in the Face</i>
10:30 – 11:00	Coffee break
11:00 – 13:00	Session B - Posters: <i>Annotation Issues</i>
13:00 – 14:00	Lunch break
14:00 – 16:00	Session C - Posters: <i>Language Technology</i>
16:00 – 16:30	Coffee break
16:30 – 18:00	Session D – Oral/Signed: <i>Integration</i>

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Session A: Linguistic Signals in the Face

Saturday 31 May, 09:00 – 10:30

Chairperson: Julie Hochgesang

Oral/Signed Session

Discourse-based annotation of relative clause constructions in Turkish Sign Language (TID): A case study

Okan Kubus

The functions of relative clause constructions (RCC) should be ideally analyzed at the discourse level, since the occurrence of RCCs can be explained by looking at interlocutors' use of grammatical and intonational means (cf. Fox and Thompson, 1990). To date, RCCs in sign language have been analyzed at the syntactic level with a special focus on cross-linguistic comparisons (see e.g. Pfau and Steinbach, 2005; Branchini and Donati, 2009). However, to our knowledge, there is no systematic corpus-based analysis of RCCs in sign languages so far. Since the elements of RCCs are mostly non-manual markers, it is often unclear how to capture and tag these elements together with the functions of RCCs. This question is discussed in light of corpus-based data from Turkish Sign Language. Following Biber et al. (2007), the corpus-based analysis of RCCs in TID follows the "top-down" approach. In spite of modality-specific issues, the steps in the process of annotation and identification of RCCs in TID fairly resemble this approach. The advantage of using these multiple steps is that the procedure not only captures the discourse functions of the RCCs but also identifies different strategies for creating RCCs based on linguistic forms.

Release of experimental stimuli and questions for evaluating facial expressions in animations of American Sign Language

Matt Huenerfauth and Hernisa Kacorri

We have developed a collection of stimuli (with accompanying comprehension questions and subjective-evaluation questions) that can be used to evaluate the perception and understanding of facial expressions in ASL animations or videos. The stimuli have been designed as part of our laboratory's on-going research on synthesizing ASL facial expressions such as Topic, Negation, Yes/No Questions, WH-questions, and RH-questions. This paper announces the release of this resource, describes the collection and its creation, and provides sufficient details to enable researchers determine if it would benefit their work. Using this collection of stimuli and questions, we are seeking to evaluate computational models of ASL animations with linguistically meaningful facial expressions, which have accessibility applications for deaf users.

Computer-based tracking, analysis, and visualization of linguistically significant nonmanual events in American Sign Language (ASL)

Carol Neidle, Jingjing Liu, Bo Liu, Xi Peng, Christian Vogler and Dimitris Metaxas

Our linguistically annotated American Sign Language (ASL) corpora have formed a basis for research to automate detection by computer of essential linguistic information conveyed through facial expressions and head movements. We have tracked head position and facial deformations, and used computational learning to discern specific grammatical markings. Our ability to detect, identify, and temporally localize the occurrence of such markings in ASL videos has recently been improved by incorporation of (1) new techniques for deformable model-based 3D tracking of head position and facial expressions, which provide significantly better tracking accuracy and recover quickly from temporary loss of track due to occlusion; and (2) a computational learning approach

incorporating 2-level Conditional Random Fields (CRFs), suited to the multi-scale spatio-temporal characteristics of the data, which analyses not only low-level appearance characteristics, but also the patterns that enable identification of significant gestural components, such as periodic head movements and raised or lowered eyebrows. Here we summarize our linguistically motivated computational approach and the results for detection and recognition of nonmanual grammatical markings; demonstrate our data visualizations, and discuss the relevance for linguistic research; and describe work underway to enable such visualizations to be produced over large corpora and shared publicly on the Web.

Session B: Annotation

Saturday 31 May, 11:00 – 13:00

Chairperson: Jette Kristoffersen

Poster Session

Mouth features as non-manual cues for the categorization of lexical and productive signs in French Sign Language (LSF)

Antonio Balvet and Marie-Anne Sallandre

In this paper, we present evidence from a case study in LSF, conducted on narratives from 6 adult signers. In this study, picture and video stimuli have been used in order to identify the role of non-manual features such as gaze, facial expressions and mouth features. Hereafter, we discuss the importance of mouth features as markers of the alternation between frozen (Lexical Units, LU) and productive signs (Highly Iconic Structures, HIS). Based on qualitative and quantitative analysis, we propose to consider mouth features, i.e. mouthings on the one hand, and mouth gestures on the other hand, as markers, respectively, of LU versus HIS. As such, we propose to consider mouthings and mouth gestures as fundamental cues for determining the nature, role and interpretation of manual signs, in conjunction with other non-manual features. We propose an ELAN annotation template for mouth features in Sign Languages, together with a discussion on the different mouth features and their respective roles as discourse and syntactic-semantic operators.

Eye gaze annotation practices: Description vs. interpretation

Annelies Braffort

If sharing best practices and conventions for annotation of Sign Language corpora is a growing activity, less attention has been given to the annotation of non-manual activity. This paper focuses on annotation of eye gaze. The aim is to report some of the practices, and begin a discussion on this topic, to be continued during the workshop. After having presented and discussed the nature of the annotation values in several projects, and having explained our own practices, we examine the level of interpretation in the annotation process, and how the design of annotation conventions can be motivated by limitations in the available annotation tools.

An annotation scheme for mouth actions in sign languages

Onno Crasborn and Richard Bank

This paper describes the annotation scheme that has been used for research on mouth actions in the Corpus NGT. An orthographic representation of the visible part of the mouthing is supplemented by the citation form of the word, a categorisation of the type of the mouth action, the number of syllables in the mouth action, (non)alignment of a corresponding sign, and a layer representing some special functions. The scheme has been used for a series of studies on Sign Language of the Netherlands. The structure and vocabularies for the annotation scheme are described, as well as the

experiences in its use so far. Annotations will be published in the second release of the Corpus NGT annotations in late 2014.

A hybrid formalism to parse sign languages

Rémi Dubot and Christophe Collet

Sign Language (SL) linguistic is dependent on the expensive task of annotating. Some automation is already available for low-level information (eg. body part tracking) and the lexical level has shown significant progresses. The syntactic level lacks annotated corpora as well as complete and consistent models. This article presents a solution for the automatic annotation of SL syntactic elements. It exposes a formalism able to represent both constituency-based and dependency-based models. The first enables the representation of structures one may want to annotate, the second aims at fulfilling the holes of the first. A parser is presented and used to conduct two experiments on the solution. One experiment is on a real corpus, the other is on a synthetic corpus.

Annotation of mouth activities with iLex

Thomas Hanke

In a purely bottom-up approach an annotation practice used for mouth activities would try to describe the phenomena and leave it to a second step to classify (e.g. between mouthing and mouth gestures) and relate (e.g. to spoken language words). For practical reasons, however, the first step is often skipped, and separate coding systems are applied to what is categorised either as mouthing derived from spoken language or mouth gesture where there is no obvious connection between the meaning expressed and any spoken language words expressing that same meaning. This happens not only for time (=budget) reasons, but also because it is difficult for coders to describe mouth visemes precisely if the sign/mouth combo already suggests what is to be seen on the mouth. While there are established coding procedures to avoid influence as far as possible (like only showing the signer's face, provided video quality is good enough), they make the approach very time-consuming, even if not counting quality assurance measures like inter-transcriber agreement. Some projects undertaken at the IDGS in Hamburg therefore leave it with a spoken-language-driven approach: The mouth activity is classified as either mouth gesture or mouthing, and in the latter case the German word is noted down that a competent DGS signer "reads" from the lips, i.e. that word from the set of words to be expected with the co-temporal sign in its context that matches the observation. Standard orthography is used unless there is a substantial deviation. For mouth gestures, holistic labels are used. These two extremes span a whole spectrum of coding approaches that can be used for mouth activities. The poster shows how iLex, the Hamburg sign language annotation workbench, supports the whole range of solutions from more time-series-like systems to those evaluating co-occurrence and semantic relatedness, from novice-friendly decision trees to expert-only modes.

Mouth-based non-manual coding schema used in the Auslan corpus: Explanation, application and preliminary results

Trevor Johnston and Jane van Roekel

We describe a corpus-based study of one type of non-manual in signed languages (SLs) — mouth actions. Our ultimate aim is to examine the distribution and characteristics of mouth actions in Auslan (Australian Sign Language) to gauge the degree of language-specific conventionalization of these forms. We divide mouth gestures into categories broadly based on Crasborn et al. (2008), but modified to accommodate our experiences with the Auslan data. All signs and all mouth actions are examined and the state of the mouth in each sign is assigned to one of three broad categories: (i) mouthings, (ii) mouth gestures, and (iii) no mouth action. Mouth actions that invariably occur while

communicating in SLs have posed a number of questions for linguists: which are ‘merely borrowings’ from the relevant ambient spoken language (SpL)? Which are gestural and shared with all of the members of the wider community in which signers find themselves? And which are conventionalized aspects of the grammar of some or all SLs? We believe this schema captures all the relevant information about mouth forms and their use and meaning in context to enable us to describe their function and degree of conventionality.

Signing thoughts! A methodological approach within the semantic field work used for coding nonmanuals which express modality in Austrian Sign Language (ÖGS)

Andrea Lackner and Nikolaus Riemer

Signing thoughts gives the possibility to express unreal situations, possibilities and so forth. Also, signers may express their attitude on these thoughts such as being uncertain about an imagined situation. We describe a methodological approach within the semantic field work which was used for identifying nonmanuals in Austrian Sign Language (ÖGS) which tend to occur in thoughts and which may code (epistemic and deontic) modality. First, the process of recording short stories which most likely include lines of thoughts is shown. Second, the annotation process and the outcome of this process is described. The findings show that in almost all cases the different annotators identified the same non-manual movements/positions and the same starting and ending points of these nonmanuals in association with the lexical entries. The direction of motion was distinguished by a contrast of movement. Some nonmanuals were distinguished due to intensified performance, size of performance, speed of performance, an additional movement component, or additional body tension. Finally, we present nonmanuals which frequently occur in signed thoughts. These include various epistemic markers, a deontic marker, indicators which show the hypothetical nature of signed thoughts, and an interrogative marker which is different to interrogative markers in direct questions.

Addressing the cardinals puzzle: New insights from non-manual markers in Italian Sign Language

Lara Mantovan, Carlo Geraci and Anna Cardinaletti

This paper aims at investigating the main linguistic properties associated with cardinal numerals in LIS (Italian Sign Language). Considering this issue from several perspectives (phonology, prosody, semantics and syntax), we discuss some relevant corpus and elicited data with the purpose of shedding light on the distribution of cardinals in LIS. We also explain what triggers the emergence of different word/sign orders in the noun phrase. Non-manual markers are crucial in detecting the two particular subcases.

Taking non-manuality into account in collecting and analyzing Finnish Sign Language video data

Anna Puupponen, Tommi Jantunen, Ritva Takkinen, Tuija Wainio and Outi Pippuri

This paper describes our attention to research into non-manuals when collecting a large body of video data in Finnish Sign Language (FinSL). We will first of all give an overview of the data-collecting process and of the choices that we made in order for the data to be usable in research into non-manual activity (e.g. camera arrangement, video compression, and Kinect technology). Secondly, the paper will outline our plans for the analysis of the non-manual features of this data. We discuss the technological methods we plan to use in our investigation of non-manual features (i.e. computer-vision based methods) and give examples of the type of results that this kind of approach can provide us with.

Visualizing the spatial working memory in mathematical discourse in Finnish Sign Language

Päivi Rainò, Marja Huovila and Irja Seilola

In this paper, we will present problems that arise when trying to render legible signed texts containing mathematical discourse in Finnish Sign Language. Calculation processes in sign language are carried out using fingers, both hands and the three-dimensional neutral space in front of the signer. Specific hand movements and especially the space in front of the body function like a working memory where fingers, hands and space are used as buoys in a regular and syntactically well-defined manner when retrieving, for example, subtotals. As these calculation processes are performed in fragments of seconds with both hands that act individually, simultaneity and multidimensionality create problems for traditional coding and notation systems used in sign language research. Conversion to glosses or translations to spoken or written text (e.g. in Finnish or English) has proven challenging and what is most important, none of these ways gives justice to this unique concept mapping and mathematical thinking in signed language. Our proposal is an intermediary solution, a simple numeric animation while looking for a more developed, possibly a three-dimensional representation to visualise the calculation processes in signed languages.

Use of nonmanuals by adult L2 signers in Swedish Sign Language – Annotating the nonmanuals

Krister Schönström and Johanna Mesch

Nonmanuals serve as important grammatical markers for different syntactic constructions, e.g. marking clause types. To account for the acquisition of syntax by L2 SSL learners, therefore, we need to have the ability to annotate and analyze nonmanual signals. Despite their significance, however, these signals have yet to be the topic of research in the area of SSL as an L2. In this paper, we will provide suggestions for annotating the nonmanuals in L2 SSL learners. Data is based on a new SSL as L2 corpus from our on-going project entitled “L2 Corpus in Swedish Sign Language.” In this paper, the combination of our work in grammatical analysis and in the creation of annotating standards for L2 nonmanuals, as well as preliminary results from the project, will be presented.

Session C: Language Technology

Saturday 31 May, 14:00 – 16:00

Chairperson: Johanna Mesch

Poster Session

Synthesizing facial expressions for sign language avatars

Yosra Bouzid, Oussama El Ghouli and Mohamed Jemni

Sign language is more than just moving the fingers or hands; it is a visual language in which non manual gestures play a very important role. Recently, a growing body of research has paid increasing attention to the development of signing avatars endowed with a set of facial expressions in order to perform the actual functioning of the sign language, and gain wider acceptance by deaf users. In this paper, we propose an effective method to generate facial expressions for signing avatars based on the physics-based muscle model. The main focus of our work is to automate the task of the muscle mapping on the face model in the correct anatomical positions and the detection of the jaw part by using a small set of MPEG-4 Feature Points of the given mesh.

Implementation of an automatic sign language lexical annotation framework based on Propositional Dynamic Logic

Arturo Curiel and Christophe Collet

In this paper, we present the implementation of an automatic Sign Language (SL) sign annotation framework based on a formal logic, the Propositional Dynamic Logic (PDL). Our system relies heavily on the use of a specific variant of PDL, the Propositional Dynamic Logic for Sign Language (PDL_{SL}), which lets us describe SL signs as formulae and corpora videos as labelled transition systems (LTSs). Here, we intend to show how a generic annotation system can be constructed upon these underlying theoretical principles, regardless of the tracking technologies available or the input format of corpora. With this in mind, we generated a development framework that adapts the system to specific use cases. Furthermore, we present some results obtained by our application when adapted to one distinct case, 2D corpora analysis with pre-processed tracking information. We also present some insights on how such a technology can be used to analyze 3D real-time data, captured with a depth device.

Creation of a multipurpose sign language lexical resource: The GSL lexicon database

Athanasia-Lida Dimou, Theodore Goulas, Eleni Efthimiou, Stavroula-Evita Fotinea, Panagiotis Karioris, Michalis Pissaris, Dimitris Korakakis and Kiki Vasilaki

The GSL lexicon database is the first extensive database of Greek Sign Language (GSL) signs, created on the basis of knowledge derived from the linguistic analysis of natural signers' data. It incorporates a lemma list that currently includes approximately 6,000 entries and is intended to reach a total number of 10,000 entries within the next two years. The design of the database allows for classification of signs on the basis of their articulation features as regards both manual and non-manual elements. The adopted information management schema accompanying each entry provides for retrieval according to a variety of linguistic properties. In parallel, annotation of the full set of sign articulation features feeds more natural performance of synthetic signing engines and more effective treatment of sign language (SL) data in the framework of sign recognition and natural language processing.

When non-manuals meet semantics and syntax: Towards a practical guide for the segmentation of sign language discourse

Silvia Gabarró-López and Laurence Meurant

This paper aims to contribute to the segmentation of sign language (SL) discourses by providing an operational synthesis of the criteria that signers use to segment a SL discourse. Such procedure was required when it came to analyse the role of buoys as discourse markers (DMs), which is part of a PhD on DMs in French Belgian SL (LSFB). All buoy markers found in the data had to be differentiated in terms of scope: some markers (like most list buoy markers) seemed to be long-range markers, whereas others (like most fragment buoy markers) seemed to have a local scope only. Our practical guide results from a hierarchized and operationalized synthesis of the criteria, which explain the segmentation judgments of deaf (native and non-native) and hearing (non-native) signers of LSFB who were asked to segment a small-scale (1h) corpus. These criteria are a combination of non-manual, semantic and syntactic cues. Our contribution aims to be shared, tested on other SLs and hopefully improved to provide SL researchers who conduct discourse studies with some efficient and easy-to-use guidelines, and avoid them extensive (and time-consuming) annotation of the manual and non-manual cues that are related to the marking of boundaries in SLs.

Last train to “Rebaudengo Fossano”: The case of some names in avatar translation

Carlo Geraci and Alessandro Mazzei

In this study, we present an unorthodox case study where cross-linguistic and cross modal information is provided by a “non-manual” channel during the process of automatic translation from spoken into sign language (SL) via virtual actors (avatars). Specifically, we blended written forms (crucially, not subtitles) into the sign stream in order to import the names of less-known train stations into Italian Sign Language (LIS). This written Italian-LIS blending is a more effective compromise for Deaf passengers than fully native solutions like fingerspelling or using the local less-known SL names. We report here on part of an on-going project, LIS4ALL, aiming at producing a prototype avatar signing train station announcements. The final product will be exhibited at the train station of Torino Porta Nuova in Turin, Italy.

How to use depth sensors in sign language corpus recordings

Rekha Jayaprakash and Thomas Hanke

Recently, combined camera and depth sensor devices caused substantial advances in Computer Vision directly applicable to automatic coding a signer’s use of head movement, eye gaze, and, to some extent, facial expression. Automatic and even semi-automatic annotation of nonmanuals would mean dramatic savings on annotation time and are therefore of high interest for anyone working on sign language corpora. Optimally, these devices need to be placed directly in front of the signer’s face at a distance of less than 1m. While this might be ok for some experimental setups, it is definitely nothing to be used in a corpus setting for at least two reasons: (i) The signer looks at the device instead of into the eyes of an interlocutor. (ii) The device is in the field of view of other cameras used to record the signer’s manual and nonmanual behaviour. Here we report on experiments determining the degradation in performance when moving the devices away from their optimal positions in order to achieve a recording setup acceptable in a corpus context. For these experiments, we used two different device types (Kinect and Carmine 1.09) in combination with one mature CV software package specialised on face recognition (FaceShift). We speculate about the reasons for the asymmetries detected and how they could be resolved. We then apply the results to the studio setting used in the DGS Corpus project and show how the signers’ and cameras fields of view are influenced by introducing the new devices and we are happy to discuss the acceptability of this approach.

Weakly supervised automatic transcription of mouthings for gloss-based sign language corpora

Oscar Koller, Hermann Ney and Richard Bowden

In this work we propose a method to automatically annotate mouthings in sign language corpora, requiring no more than a simple gloss annotation and a source of weak supervision, such as automatic speech transcripts. For a long time, research on automatic recognition of sign language has focused on the manual components. However, a full understanding of sign language is not possible without exploring its remaining parameters. Mouthings provide important information to disambiguate homophones with respect to the manuals. Nevertheless most corpora for pattern recognition purposes are lacking any mouthing annotations. To our knowledge no previous work exists that automatically annotates mouthings in the context of sign language. Our method produces a frame error rate of 39% for a single signer.

Estimating head pose and state of facial elements for sign language video

Marcos Luzardo, Ville Viitaniemi, Matti Karppa, Jorma Laaksonen and Tommi Jantunen

In this work we present methods for automatic estimation of non-manual gestures in sign language videos. More specifically, we study the estimation of three head pose angles (yaw, pitch, roll) and the state of facial elements (eyebrow position, eye openness, and mouth state). This kind of estimation facilitates automatic annotation of sign language videos and promotes more prolific production of annotated sign language corpora. The proposed estimation methods are incorporated in our publicly available SLMotion software package for sign language video processing and analysis. Our method implements a model-based approach: for head pose we employ facial landmarks and skin masks as features, and estimate yaw and pitch angles by regression and roll using a geometric measure; for the state of facial elements we use the geometric information of facial elements of the face as features, and estimate quantized states using a classification algorithm. We evaluate the results of our proposed methods in quantitative and qualitative experiments.

The “how-to” of integrating FACS and ELAN for analysis of non-manual features in ASL

Kristin Mulrooney, Julie Hochgesang, Carla Morris and Katie Lee

The process of transcribing and annotating non-manual features presents challenges for sign language researchers. This paper describes the approach used by our research team to integrate the Facial Action Coding System (FACS) with the EUDICO Linguistic Annotator (ELAN) program to allow us to more accurately and efficiently code non-manual features. Preliminary findings are presented which demonstrate that this approach is useful for a fuller description of facial expressions.

Non-manuals and markers of (dis)fluency

Ingrid Notarrigo and Laurence Meurant

This paper focuses on the analysis and annotation of non-manual features in the framework of a study of (dis)fluency markers in French Belgian Sign Language (LSFB). In line with Götz (2013), we consider (dis)fluency as the result of the combination of many independent markers (‘fluencemes’). These fluencemes may contribute either positively or negatively to the efficiency of a discourse depending on their context of appearance, their specific combination, their position and frequency. We show that the non-manual features in LSFB make distinctions within pauses and palm-up signs in a consistent way and contribute to the value of the manual marker. The selection of a limited number of relevant combinations of nonmanuals, in the context of pauses and palm-up signs, proves to simplify the annotation process and to limit the number of features to examine for each nonmanual. The gaze and the head appear to be necessary and sufficient to describe pauses and palm-up signs accurately. Though these findings are limited to this pilot study, they will pave the way to the next steps of the broader research project on (dis)fluency markers in LSFB this work is part of.

Session D: Integration

Saturday 31 May, 16:30 – 18:00

Chairperson: Onno Crasborn

Oral/Signed Session

Analysis for synthesis: Investigating corpora for supporting the automatic generation of role shift*John McDonald, Rosalee Wolfe, Robyn Moncrief and Souad Baowidan*

In signed languages, role shift is a process that can facilitate the description of statements, actions or thoughts of someone other than the person who is signing, and sign synthesis systems must be able to automatically create animations that portray it effectively. Animation is only as good as the data used to create it, which is the motivation for using corpus analyses when developing new tools and techniques. This paper describes work-in-progress towards automatically generating role shift in discourse. This effort includes consideration of the underlying representation necessary to generate a role shift automatically and a survey of current annotation approaches to ascertain whether they supply sufficient data for the representation to generate the role shift.

Non-manual features: The right to indifference*Michael Filhol, Mohamed Nassime Hadjadj and Annick Choisier*

This paper discusses the way sign language can be described with a global account of the visual channel, not separating manual articulators in any way. In a first section, it shows that non-manuals are often either ignored in favour of manual focus, or included but given roles that are mostly different from the mainly hand-assigned lexical role. A second section describes the AZee model as a tool to describe Sign Language productions without assuming any separation, neither between articulators nor between grammatical roles. We conclude by giving a full AZee description for one of the several examples populating the paper.

Segmenting the Swedish Sign Language corpus: On the possibilities of using visual cues as a basis for syntactic segmentation*Carl Börstell, Johanna Mesch and Lars Wallin*

This paper deals with the possibility of conducting syntactic segmentation of the Swedish Sign Language Corpus (SSLC) on the basis of the visual cues from both manual and nonmanual signals. The SSLC currently features segmentation on the lexical level only, which is why the need for a linguistically valid segmentation on e.g. the clausal level would be very useful for corpus-based studies on the grammatical structure of Swedish Sign Language (SSL). An experiment was carried out letting seven Deaf signers of SSL each segment two short texts (one narrative and one dialogue) using ELAN, based on the visual cues they perceived as boundaries. This was later compared to the linguistic analysis done by a language expert (also a Deaf signer of SSL), who segmented the same texts into what was considered syntactic clausal units. Furthermore, these segmentation procedures were compared to the segmentation done for the Swedish translations also found in the SSLC. The results show that though the visual and syntactic segmentations overlap in many cases, especially when a number of cues coincide, the visual segmentation is not consistent enough to be used as a means of segmenting syntactic units in the SSLC.