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

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## Abstract

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.

**Keywords:** LSF, mouth features, productive signs

## 1. Introduction

Non-manual features are an integral facet of sign languages (SL). Their relevance has been stressed by different authors, from different theoretical and descriptive backgrounds: (Boyes Braem, 2001), (Boyes Braem & Sutton-Spence, 2001), (Ebbinghaus & Hessmann, 2001), (Fontana, 2008) and (Sutton-Spence, 2007) to name but a few.

In this paper, we present evidence from a LSF case study, with narratives from 6 adult signers. In this study, picture stimuli (the Horse Story) as well as video stimuli (Tom & Jerry cartoons) have been used in order to identify the role of non-manual features such as gaze, facial expressions and mouth features. Hereafter, we will discuss the importance of mouth features as markers of the alternation between **Lexical Units** (LU) and **Highly Iconic Structures** (HIS),<sup>1</sup> also called **Productive Signs** (Johnston & Schembri, 2007) and **Classifier Constructions** in the literature (Emmorey, 2003).<sup>2</sup>

Based on our qualitative and quantitative analysis, we propose to consider mouth features, *i.e.* **mouthings** on the one hand versus **mouth gestures** on the other hand, as markers, respectively, of LU versus HIS.<sup>3</sup> 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 a typology of mouth features, together with an ELAN annotation template for such non-manual features. Finally, based on our corpus and on the model presented in (Cuxac, 2000), (Sallandre, 2003) and (Garcia & Sallandre, 2014), we propose a discussion of the role of mouth features found in HIS as predicate modifiers.

## 2. Terminology and concepts for the study of SLs from a semiological perspective

In this section, we provide terminological and conceptual elements for the study of SLs from a semiological perspective. These elements are given so as to overcome terminological divergences stemming from different traditions in the study of SLs. A more detailed account of equivalences and discrepancies between the semiological model and other approaches can be found in (Garcia & Sallandre, 2014).

The classes discussed in Table 1 below are restricted to **Transfer Units** (TU) in Cuxac's terminology, *i.e.* non-lexical units. In the semiological approach, TUs are considered as belonging to the overall linguistic system of Sign Languages, on a par with LUs (or frozen signs). They are seen as the manifestation of an illustrative intent, which aims at conveying meaning "by showing", whereas the use of frozen signs falls under a non-illustrative intent, where meaning is conveyed "without showing".

1 See (Cuxac, 2000) and (Cuxac & Sallandre, 2007) for a thorough presentation of the semiological model.

2 These distinctions are further discussed in section 2 below.

3 In other words, we consider mouthings as markers of frozen signs, whereas mouth gestures are associated with Productive Signs and Classifier Constructions.

With this crucial dichotomy in mind (illustrative *vs.* non-illustrative intent), the distinctions proposed by C. Cuxac's model can be seen as elaborations on categories used in the literature. This model also provides a sound and consistent framework for categories which are still debated in SL linguistics, thanks to its semiological foundation.

<i>SL Structures in the general literature</i>	<i>SL Structures in the Semiological Model</i>
Frozen or Lexical Signs	Lexical Units
Classifier Handshapes	Proforms
Classifier Constructions	Transfers of Size and Shape (TSS)
	Situational Transfers (ST)
Role Shifts Constructed Actions	Personal Transfers (PT)
Constructed Dialogues	Personal Transfers with reported speech
Multiple References	Double Transfers (PT + ST)

Table 1: Terminological equivalences and discrepancies in different SL linguistics frameworks<sup>4</sup>

As Table 1 shows, one of the salient features of the semiological model is to provide a uniform and consistent way of classifying seemingly unrelated structures, under the illustrative intent (signing by showing). It should be noted that this model posits a continuum between Highly Iconic Structures (non-lexical units) and Lexical Units. Non-lexical units such as Classifier Constructions, Role Shifts, Constructed Actions, Constructed Dialogues, and Multiple References are thus seen as instances of the general Transfer category, which further distinguishes between core constructions and composed ones: TSS, ST and PT are core constructions. These constructions can, in turn, be combined with each other, as in the case of DT (PT + ST), or in the case of reported speech in a PT mode. In the latter case, the overall PT structure can integrate reported speech realized either with LU, or TU. Even though this paper is focused on mouth-feature, it is worth noting that in the semiological model, non-manual parameters in general are an integral part of the theory. For example, eye gaze direction (towards hands *vs.* towards the interlocutor) is a very salient indicator of the LU *vs.* TU boundary.

### 3. Mouthings and mouth gestures in LSF narratives

(Petitta, Sallandre & Rossini, 2013) present a comparative case study on LSF and Italian Sign Language (LIS), using narratives based on picture as well as video stimuli. The

<sup>4</sup> Adapted from (Garcia & Sallandre, 2014).

main outcomes of this initial corpus-based study were the following:

- mouth features exhibit similar functions and roles in both LSF and LIS, their overall distribution in the corpus advocates in favour of their being a fundamental aspect of Sign Languages;
- a fundamental distinction can be drawn between **mouthings** and **mouth gestures**.

In the work presented here, we focus on the relationships between mouth features and the different structures proposed by (Cuxac, 2000) and (Sallandre, 2003) for LSF.

**Mouthings** can be defined as the (semi)articulation of lexical units (“words”) from a given spoken language, in conjunction with manual and other non-manual features (gaze, facial expression, body movement).

It should be noted that mouthings serve essentially as non-manual visual cues associated with the manual ones. As such, they sometimes exhibit Gestalt-like properties: the actual fine-grained and complete articulation is not necessary; the most salient or conventionalized aspects of the “word” are sufficient. For example, in LSF, such mouthings will include actual French words, such as in LU CHEVAL + “cheval” (horse).<sup>5</sup>



Figure 1: LU HORSE with associated mouthing [ʃəv] (LS-Colin corpus, the Horse Story), (Cuxac et. al., 2002)

Figure 1 above gives an example of a mouthing associated with a LU.

Mouthings are not restricted to semantic words (Verbs, Nouns) borrowed from spoken languages: they can encompass grammatical words or even (parts of) broader constituents, and they can also be found in association with full-fledged manual signs, as well as other manual units, such as pointings (Figure 2). Mouthings are highly dependent on the particular oral language the signer is most familiar with, therefore, these mouth features are language-specific.

<sup>5</sup> Important variations can be observed in mouthings's realizations by different signers: from truncated forms [ʃəv], or [val], to the complete form [ʃəval].



Figure 2: Pointing associated with mouthing [la] (there), (CREAGEST corpus), (Sallandre & L'Huillier, 2011)

**Mouth gestures**, on the other hand, can be defined as mouth features which are not associated with actual words in any given spoken language. They include motions and actions stemming from the mouth:

puffed cheeks, with or without air expulsion, as in Figure 3;

- expelling air in a “whistling” fashion, with stretched lips;
- vibrating lips while expelling air, with or without vibrating vocal cords;
- moving tongue sideways while signing;
- moving mouth in a downwards fashion, etc.



Figure 3: HIS description (Transfer of Size and Shape) with associated mouth gesture “a big bump is forming on Jerry's head” (CREAGEST corpus), (Sallandre & L'Huillier, 2011)

Contrary to mouthings, mouth gestures appear widely spread throughout sign languages,<sup>6</sup> and are not related to any given oral language.

6 (Petitta, Sallandre & Rossini, 2013) show similar distribution patterns of mouthings and mouth gestures in LSF and Italian Sign Language (LIS).

Alongside these main mouth features, we propose to further distinguish **idiosyncratic mouth features**. These mouth-features are complementary to mouthings and mouth gestures insofar as they seem associated strictly with a subset of LUs, of which they appear to function as incorporated and mandatory parameters. Furthermore, they form a very limited paradigm of mainly plosive consonant-like configurations (eg.: [pi], [pæ], [po]), and they do not appear to commute with one another. An example of such an idiosyncratic mouth feature is the lexical unit: TYPIQUE + [pi] (typical of someone or something).<sup>7</sup>

#### 4. The distribution of mouthings, mouth gestures and idiosyncratic mouth features

##### 4.1. Mouthings and Lexical Units

In our study, mouthings appeared clearly associated with Lexical Units: actual mouthings appear in the context of a LU being signed; they can also appear in non-LU contexts: with pointings and Personal Transfers with reported speech.

<i>Mouth Features</i>	<i>S1</i>	<i>S2</i>	<i>S3</i>	<i>S4</i>	<i>S5</i>	<i>S6</i>	<i>Avg.</i>
Mouthing	27	33	24	22	35	21	27
Mouth gesture	13	16	25	28	14	38	22
Nothing	54	44	49	49	45	38	46
Idio-synchratic	2	1	3	2	5	2	2
Unsure	3	6	0	0	2	1	2
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Table 2: Distribution of mouth features in the Tom & Jerry cartoon retelling sub-corpus in LSF by six signers

Table 2 above gives an overall view of the distribution of mouth patterns in the Tom & Jerry data, by six different signers. The main conclusions we can draw from our observations are the following:

- most of the time (46%), units are realized without any mouth feature whatsoever;
- when mouth features are realized, they divide almost evenly between mouthings (27%) and mouth gestures (22%);
- idiosyncratic mouth features are marginal.

Other quantitative elements from our study indicate a clear association between lexical units and mouthings, with the added parameter of text grammar: as mentioned

7 Lexical Units associated with such idiosyncratic mouthings correspond to LSF idioms.

before, our study is based on narratives, not elicited corpora or dialogues, which implies a common overall structure for all narratives. More precisely, mouthings are used for introducing actants (characters in the stories) and new topics,<sup>8</sup> while HIS and other mouth features are used throughout the narratives to elaborate on each actant's behaviour. The only cases of mouthings found in HIS are associated with reported speech.

## 4.2. Mouth gestures and Highly Iconic Structures

Based on the observations made on the LSF corpus described above, we can posit that mouth gestures are highly correlated with HIS, which are non lexical units. These observations appear consistent with the very foundation of Cuxac's semiological model, which lays the emphasis on the notion of semiotic intent. The clear-cut distinction we have identified in our corpus could be explained in the terms of the semiologic model: mouthings and lexical units belong to the “signing without showing” intent, while mouth gestures and HIS belong to the “signing by showing” one.

## 4.3. Annotating mouth features with ELAN

In this section, we discuss an annotation template for mouth features for ELAN, a multimodal corpus annotation software.<sup>9</sup>

As presented above, mouth features fall into two main categories: mouthings and mouth gestures. Alongside these two main categories, **idiosyncratic mouthings** can also be found. We therefore propose an annotation template for the different types of mouth features mentioned above, which associates the different structures in Cuxac's model.

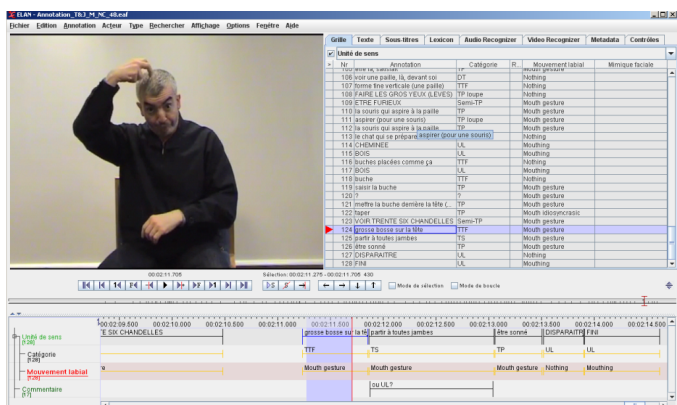


Figure 4: Annotating an HIS+mouth gesture with ELAN

In this template, mouthings and mouth gestures are children of a topmost “Sense Unit” node, and they are further distinguished according to the main dichotomy

8 This distribution is consistent with earlier studies, such as (Sallandre, 2003).

9 Elan is distributed by the Max Planck Institute for Psycholinguistics (Nijmegen, The Netherlands). It is available at <http://tla.mpi.nl/tools/tla-tools/elan/>. See (Crasborn & Sloetjes, 2008) for more details on annotating SLs with ELAN.

posited in the model between LU and HIS. Figure 4 shows an annotated example of an HIS associated with a mouth gesture. In the example above, the proposed hierarchy for annotating mouth features is the following:

- Sense Unit
  - Category
  - Mouth feature
    - Mouthing
    - Mouth gesture
    - Idiosyncratic
    - None
    - Unsure
- Comments.

This hierarchy is designed for the specific annotation of mouth-features, but these elements are a part of a more general template (manual/non manual params).

The Sense Units tier holds basic glosses (here in French), which delimit the different units, regardless of their category (LU/TU, pointings, etc.). The Categories tier further specifies the nature of any given Sense Unit: LU, pointing, PT, TSS, DT, etc. Each Category element is symbolically associated to its Sense Unit mother-node, which entails that Sense Units and Categories share the same exact boundaries. Mouth-feature elements are: mouthings, mouth gestures and idiosyncratic elements, as presented above. The mouth-feature tier can also be instantiated by a "Nothing", or an "Unsure" tag. As presented in Table 2, the majority of LUs are realized without any associated mouth-feature, thus making it necessary to annotate both their presence (and nature) and their absence, in order to provide quantitative as well as qualitative elements. In some occasions, annotators are not able to reliably detect mouth features, either for very material reasons (one hand is located in front of the signer's face) or because lip-reading is essentially error-prone. In those cases, dubious mouth features are marked as Unsure. Finally, the Comments tier, which is on the same level as the Sense Unit one, holds all doubts, questions and transient annotation considerations.

The hierarchy outlined above is currently being used in experimental annotations for LSF corpora (both adult and children productions), as presented here, as well as other SL corpora.<sup>10</sup> It was designed so as to be easily integrated into other templates, even ones not in accordance with the semiological model mentioned above.

## 5. Discussion

We have presented elements from narratives in LSF which show the fundamental role of mouth features as visual cues for the distinction between lexical units and non lexical signs. Based on the distribution observed in our corpus, which appears consistent with the model presented in (Cuxac, 2000) and subsequently updated in (Sallandre, 2003) and (Garcia & Sallandre, 2014), we have proposed a template for the annotation of such non-manual parameters.

10 See (Sallandre & Garcia, 2013) for an NGT mouth-features annotation example with the proposed hierarchy.

Mouth-gestures patterns encountered in TSS (Transfers of Size and Shape), a subtype of HIS, are typically used for descriptions: the hands depict the overall shape of a given object, while mouth and facial expression provide information on the dimensions of the object: mouth gestures and facial expression tell us how fine, broad, big, small etc. the depicted object is, according to the signer. As such, they could be considered fundamentally as modifiers, comparable to Adverbs for spoken languages: Figure 3 shows how the “mouth downwards+puffed cheeks” pattern can be associated to a Proform (C handshape) and a facial expression to convey the meaning that, after Tom hit himself with a log (in order to get at Jerry who was stealing cream from him with a straw) a really BIG bump is forming on his head.

Mouth gestures can also be used with PT (Personal Transfers). In these structures, the signer typically embodies the main participant, using his hands and body to describe both manner and path.<sup>11</sup> In these structures, mouth gestures such as the “whistling” pattern, or the “vibrating lips” one can be used to convey aspectual properties on the main predicate: the action can be depicted as swift, or slow, durative, punctual, bounded vs. unbounded, or even iterative, with the help of different mouth patterns. As such, mouth gestures not only give fundamental cues as to the nature of the structure being signed (LU vs. HIS), but it also can be considered as the equivalent of modality and aspectual markers at the predicative level. It is worth noting that the distribution of mouth features presented in Table 2 for narratives can also be observed among different genres (descriptive, prescriptive), sign languages,<sup>12</sup> as well as in children's productions. Mouthings appear as very salient non-manual cues, marking not only the realization of a Lexical Unit, but also a change of topic or the introduction of actants in narratives. The distinction between mouthings (truncated or complete coarticulation of spoken words in conjunction with LUs) vs. mouth gestures seems therefore to open new perspectives for both the manual annotation and automatic processing of sign language structures. From the manual annotation viewpoint, focusing specifically on mouthings and mouth gestures would provide annotators a clear-cut criterion for detecting non-lexical units and topic changes. From the SL automatic processing perspective, mouth-features could boost the automatic recognition of manual signs: if a word contour is detected with some level of confidence, then the current unit is bound to be a Lexical Unit. Conversely, if no word contour can be reliably detected despite a clear mouth movement, then the current unit is likely to be a non-frozen sign, and should therefore be marked as such for later human processing.

<sup>11</sup> See (Sallandre *et al.*, 2010).

<sup>12</sup> Similar distribution patterns have been observed in (Petitta, Sallandre & Rossini, 2013), a contrastive study on mouth features in LSF and LIS.

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