

# Body and head movements in three sign languages: ASL, LSF and LSQ

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UQÀM

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# Objective

We explore, through comparative description of three SL (American: ASL, French: LSF, and Quebec: LSQ), the notion of discrete units for body (BM) and head movement (HM). More precisely, we present a comparison of:

- The distribution (frequency and dependency) of movement types
- The ways of structuring information are encoded by these specific movements

**Movements described**

lateral tilt, forward/backward lean, rotation

**Way of structuring information considered**

instantiation, relation, modification, perspective change

# Context

Non Manual Markers play a role at all grammatical levels and are multifunctional (e.g. Each NMM can express several different grammatical functions/Each grammatical function can be realised by several different NMM (Herrmann and Steinbach, 2011)).

The BM described in literature on SL grammar (tilt, lean or rotation) have been associated with different functions: focus (Wilbur and Patschke, 1998; Van der Kooij *et al.*, 2006), subject agreement (Parisot, 2003) and role-shift (Enberg-Pedersen, 1995; Poulin and Miller, 1995; Quer, 2005) amongst others.

Even if specific functions are attributed to different HM, it is not always clear whether these HM are produced in association with corresponding BM (e.g. HM and BM for subject agreement (Bahan, 1996) or topic (Sze, 2011)).

When researches propose a functional distinction between the different types of BM (e.g. BM for different types of focus (Wilbur and Patschke, 1998)), these are generally not presented specifically.

# Research question

1

Do the three SL have a different distribution (frequency) of BM and HM?

2

Are BM and HM independent units?

3

Do they have differential effects on meaning or are they just varieties of expressing spatial mapping in general?

# Methods

## Corpus

- Collected narratives from the same stimuli
- 3 participants (4 narratives per subject)
- Transcription and codification with MSsynchro and ELAN

## Categories of codification for head (H) and body (B)

- **Form**
- **Dependency**
- **Structure of information:** instantiation, relation, modification, perspective change

# Integration of MSSynchro results in ELAN

Fichier Edition Annotation Acteur Type Rechercher Affichage Options Fenêtre Aide

Gaffe Texte Sous-titres Lexicon

▼ Tronc Rot Longitud

Nr	Annotation	Temps de d...	temps de fin	Durée
10	[96]G	00:03:22.930	00:03:23.623	00:00:00.693
11	[103]Dj[-W1-]	00:03:23.623	00:03:25.834	00:00:02.211
12	[121]Gj[v]	00:03:25.834	00:03:26.692	00:00:00.858
13	[135]Gj[-v-t]	00:03:27.920	00:03:29.306	00:00:01.386
14	[142]Dg[-X3-]	00:03:29.306	00:03:29.768	00:00:00.462
15	[145]Gj[-t]	00:03:29.824	00:03:32.032	00:00:02.208
16	[145a]Gj[-X3-]	00:03:32.032	00:03:32.299	00:00:00.267
17	[153]Gj[t]	00:03:32.497	00:03:34.741	00:00:02.244
18	[171]G	00:03:36.127	00:03:37.315	00:00:01.188
19	[178]Dg(X3)	00:03:37.315	00:03:38.437	00:00:01.122
20	[184]Gg[-X1-]	00:03:38.437	00:03:39.625	00:00:01.188
21	[190]Dj(r)	00:03:39.625	00:03:39.947	00:00:00.322
22	[192a]Dj[-r-]	00:03:39.947	00:03:40.252	00:00:00.305
23	[195]Gg[X3]	00:03:40.252	00:03:41.407	00:00:01.155
24	[204]Gg(r-q)	00:03:41.407	00:03:42.958	00:00:01.551

00:03:04.445 Sélection: 00:03:35.218 - 00:03:38.021 2803

Mode de sélection Mode de boucle

Tête Rot AntéroPost  
Tronc Rot AntéroPost  
Tête Rot MedioLat  
Tronc Rot MedioLat  
Tête Rot Longitud  
Tronc Rot Longitud

0 00:03:05.000 00:03:06.000 00:03:07.000 00:03:08.000 00:03:09.000 00:03:10.000 00:03:11.000 00:03:12.000 00:03:13.000 00:03:14.000

[54] 0 00:03:05.000 00:03:06.000 00:03:07.000 00:03:08.000 00:03:09.000 00:03:10.000 00:03:11.000 00:03:12.000 00:03:13.000 00:03:14.000

Tête Rot AntéroPos [26]  
Tête Rot Longitud [26]  
Tête Rot MedioLat [30]

[3]D [12]Dj[-t] [13]D [13.1]D [31]Dc(Z) [44]G [4] [1]AR [5]AVa(P) [15]AR [20]AVc(Z3) [23]AR [28]AVc(Z) [32]AR [35]AV [38]AVf(X2) [41]AVg(X3) [45]AVh[w]

# Methods

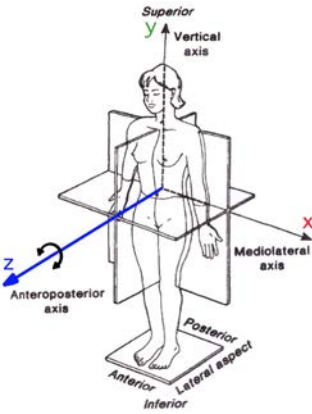
## Corpus

- Collected narratives from the same stimuli
- 3 participants (4 narratives per subject)
- Transcription and codification with MSsynchro and ELAN

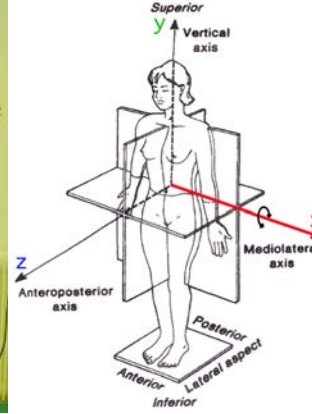
## Categories of codification for head (H) and body (B)

- **Form**
- **Dependency**
- **Structure of information:** instantiation, relation, modification, perspective change

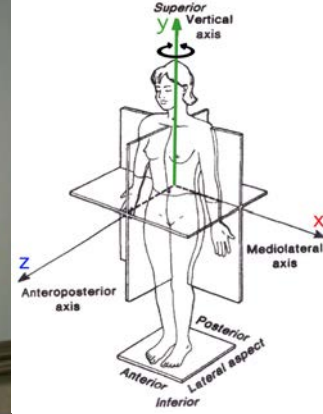
# BM



Lateral tilt

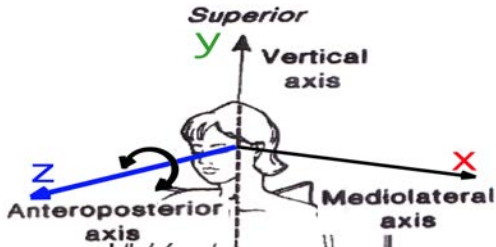


B/F lean

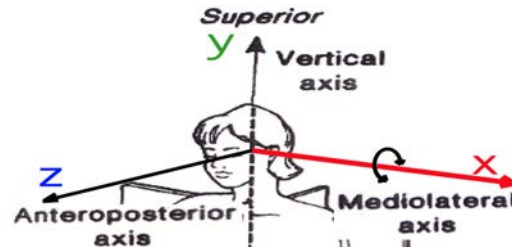


Rotation

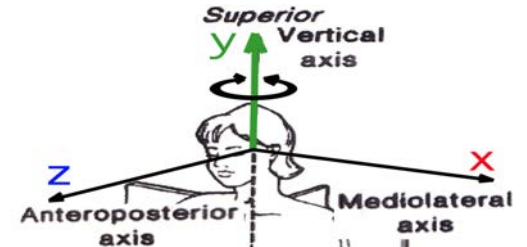
# HM



Lateral tilt



B/F lean



Rotation



# Methods

## Corpus

- Collected narratives from the same stimuli
- 3 participants (4 narratives per subject)
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## Categories of codification for head (H) and body (B)

- **Form**
- **Dependency**
- **Structure of information:** instantiation, relation, modification, perspective change

# Head/body movements non structurally related

## Three principal groupings

---

- Idiosyncratic/natural movements of the signer
- Movements in harmony with the movement of certain signs and assimilated movements to facilitate the production of specific signs (evident in LSQ & ASL) (e.g. postural changes of the head and torso (Mauk and Tyrone, 2008))
- Attitudes & character of the persons assumed in role-shifts

# Q1

## Do the three SL have a different distribution (frequency) of BM and HM ?

Table 1	Frequency (token/sec)			
	Structurally related		Non related	
	HM	BM	HM	BM
ASL-S	<b>1.05</b>	0.35	1.32	1.22
LSF-S	0.37	<b>0.87</b>	2.07	1.70
LSQ-S	0.57	0.52	1.06	0.55
Average	1.23		2.64	

Global frequently ratios  
1/s for 2.15/s

# Q1

## Do the three SL have a different distribution (frequency) of BM and HM ?

Table 2

Distribution of subtypes of head and body movement by Frequency ratio						
HM			BM			
	rot	tilt	lean	rot	tilt	lean
ASL-S	0.37	0.17	0.50	0.22	0.07	0.05
LSF-S	0.15	0.02	0.20	0.37	0.32	0.17
LSQ-S	0.11	0.09	0.36	0.18	0.27	0.06
Average	0.21	0.09	0.35	0.25	0.22	0.09
	0.21			0.18		

# Q2

## Are BM and HM independent units?

Distribution according to temporal simultaneity

Table 3	HM or BM	HM with BM		Total
		Same Referent	Distinct referent	
ASL-S	68% (38)	28.5 % (16)	3.5 % (2)	56
LSF-S	50% (25)	38% (19)	12% (6)	50
LSQ-S	73% (49)	15% (10)	12% (8)	67
Average	0.7	0.35	0.11	

Distribution of simultaneous BH and HM towards same referent

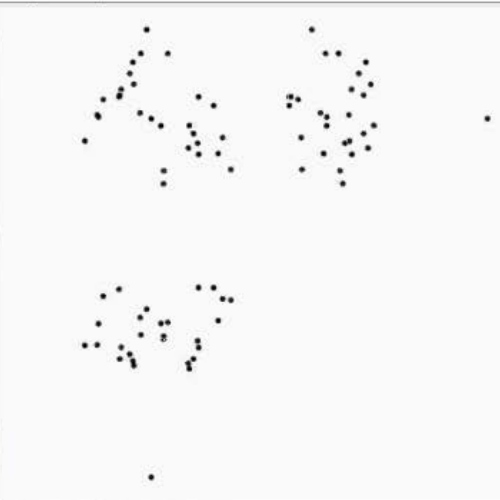
Table 4	Same function	Distinct function	Total /HM and BM towards same referent
Same referent	73% (33)	27% (12)	45

Distribution of simultaneous HM and BM towards two distinct referents

Table 5	Same referent	Distinct referent	Total /global
Distinct function	12/173 (7%)	16/173 (9%)	28/173 (16%)

# BM and HM towards same referent with same function

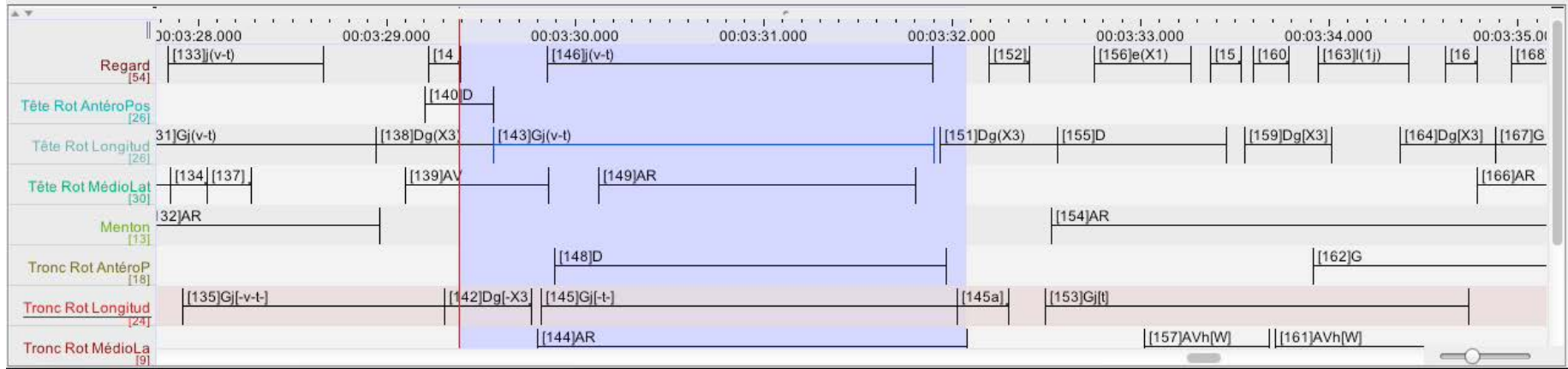
Fichier Edition Annotation Acteur Type Rechercher Affichage Options Fenêtre Aide



Grille				
Texte				
Sous-titres				
Lexicon				
▼ Tronc Rot Longitud				
> Nr	Annotation	Temps de d...	temps de fin	Durée
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11	[103]Dj[-W1-]	00:03:23.623	00:03:25.834	00:00:02.211
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13	[135]Gj[-v-t]	00:03:27.920	00:03:29.306	00:00:01.386
14	[142]Dg[-X3-]	00:03:29.306	00:03:29.768	00:00:00.462
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23	[195]Gg[X3]	00:03:40.252	00:03:41.407	00:00:01.155
24	[204]Gg(r-q)	00:03:41.407	00:03:42.958	00:00:01.551

00:03:29.395

Sélection: 00:03:29.395 - 00:03:32.083 2688



# Q2

## Are BM and HM independent units?

Distribution according to temporal simultaneity

Table 3	HM or BM	HM with BM		Total
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Distribution of simultaneous BH and HM towards same referent

Table 4	Same function	Distinct function	Total /HM and BM towards same referent
Same referent	73% (33)	27% (12)	45

Distribution of simultaneous HM and BM towards two distinct referents

Table 5	Same referent	Distinct referent	Total /global
Distinct function	12/173 (7%)	16/173 (9%)	28/173 (16%)

# BM and HM towards same referent with distinct functions

The interface displays a video of a person performing a task, alongside 3D point cloud models of a hand in different positions. A table on the right lists annotations with their corresponding time intervals and durations. Below the table is a detailed timeline showing the sequence of movement events for various body parts over time.

Nr	Annotation	Temps de d...	temps de fin	Durée
6	[46]Gh(w)	00:03:14.112	00:03:18.325	00:00:04.213
7	[46b]Gg[-X3-]	00:03:18.325	00:03:19.062	00:00:00.737
8	[74]Gg[X3]	00:03:19.666	00:03:20.557	00:00:00.891
9	[83]Dj(v)	00:03:20.689	00:03:21.591	00:00:00.902
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21	[190]Dj(r)	00:03:39.625	00:03:39.947	00:00:00.322

**Timeline of Movement Events:**

- Regard [54]:** W1, [61]clign, [64]e, [65]clig, [68], [72], [7], [79]??, [84]j(v), [86]clignement, [94]j(v), [99]cl
- Tête Rot AntéroPos [26]:** [55]D[w1], [57]G[w1], [58]D[w1], [62]Dg(X3), [76]D, [80]D, [88]G, [101]G
- Tête Rot Longitud [26]:** [54]G[w1], [59]D[w1], [69]Gi(W1), [82]G, [92]Gj[v], [100]Di(W1)
- Tête Rot MédioLat [30]:** [60]AVi(W1), [63]AR, [70]AV, [78]ARj(v), [89]AV, [102]AV
- Menton [13]:** [67]AVe, [71]AVi, [87]AV
- Tronc Rot AntéroP [18]:** [56]D, [75]D, [91]Gj[v], [104]
- Tronc Rot Longitud [24]:** [46b]Gg[-X3-], [74]Gg[X3], [83]Dj(v), [96]G, [103]D
- Tronc Rot MédioLa [9]:** [66]AVg, [73]AV[-X], [90]AV, [98]AV



# Q2

## Are BM and HM independent units?

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Distribution of simultaneous BH and HM towards same referent

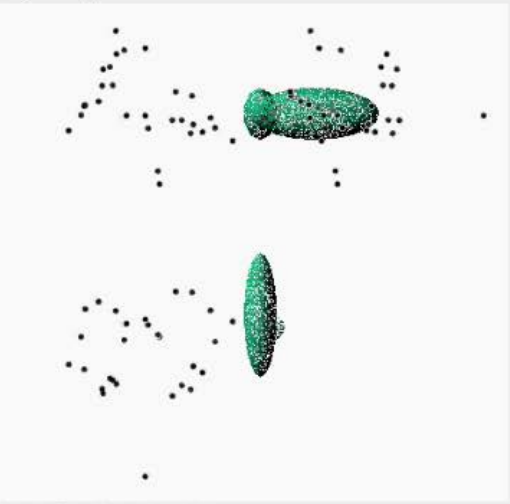
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Table 5	Same referent	Distinct referent	Total /global
Distinct function	12/173 (7%)	16/173 (9%)	28/173 (16%)

# BM and HM towards two referents with distinct functions

Fichier Edition Annotation Acteur Type Rechercher Affichage Options Fenêtre Aide



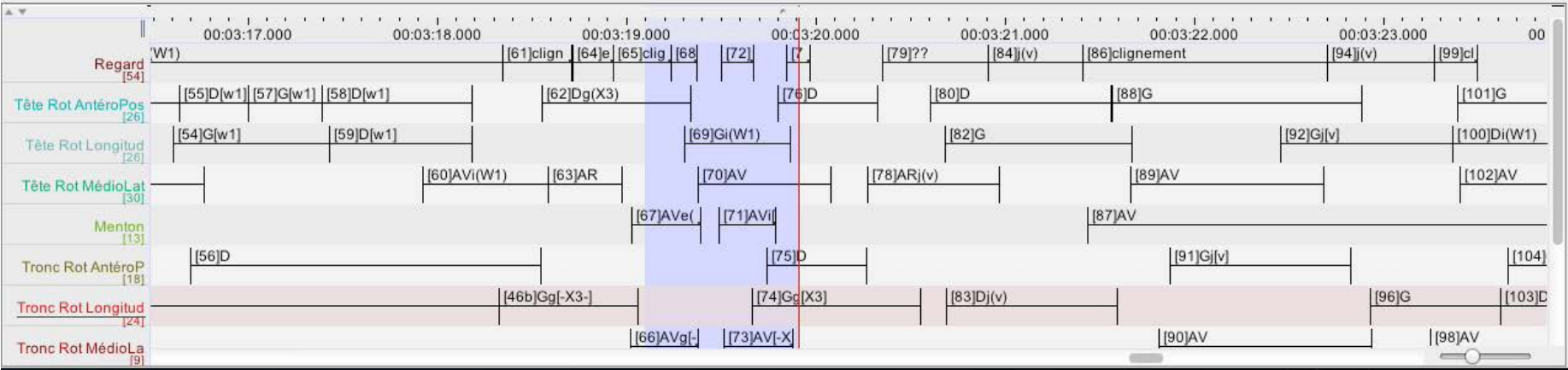
Grille Texte Sous-titres Lexicon

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00:03:19.921

Sélection: 00:03:19.103 - 00:03:19.921 818



# Q2

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Distribution according to temporal simultaneity

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Distribution of simultaneous BH and HM towards same referent

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Distribution of simultaneous HM and BM with distinct functions

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# Descriptive results

- Most H or B movements are non structurally related
- Higher frequency of HM for the ASL-S
- Higher frequency of BM for the LSF-S
- More or less equal distribution of BM and HM for the LSQ-S
- Higher frequency for lean (H) and rotation (H and B) than lateral tilt
- Few B and H in complementary distribution
- Most of the occurrences of HM or BM were produced towards a single referential unit, and they were associated with only one function

# Isolating the signer effect?

Table 6	Frequency (token/sec)	
	Structurally related	Non related
	HM + BM	HM + BM
ASL-S	1.40	2.55
LSF-S	1.20	3.77
LSQ-S	1.09	1.62
Average	1.23	2.64

# Future considerations

- Kind of discourse (evaluative in the 3 cases) could explain the higher frequency of body rotation and head lean mostly used for evaluative marking (role shift, emphasis, focus, topic)
- Signer or language effect through variation of frequency
- Tendency(?) or category of forms(?) for function marking
- Relation of both movements with eye gaze

# Body and head movements in three sign languages: ASL, LSF and LSQ

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UQÀM

TISLR 11: 12th July, London UK

Frequency of the category of function for the ASL signer

Table 7	BM	HM
instantiation	0,000	0,018
relation	0,003	0,019
modification	0,011	0,045
perspective change	0,088	0,071

Frequency of the category of function for the LSF signer

Table 8	BM	HM
instantiation	0,042	0,017
relation	0,014	0,000
modification	0,008	0,017
perspective change	0,092	0,042

Frequency of the category of function for the LSQ signer

Table 9	BM	HM
instantiation	0,011	0,016
relation	0,000	0,006
modification	0,003	0,016
perspective change	0,076	0,057



Frequency of the form of the movement for each category of function for the ASL signer

Table 10

	BM			HM		
	rot	lean	tilt	rot	lean	tilt
instantiation	0	0	0	0,025	0,025	0,005
relation	0	0	0,008	0,017	0,033	0,008
modification	0,008	0,017	0,008	0,017	0,1	0,017
perspective change	0,213	0,013	0,038	0,125	0,088	0

Frequency of the form of the movement for each category of function for the LSF signer

Table 11

	BM			HM		
	rot	lean	tilt	rot	lean	tilt
instantiation	0,075	0,025	0,025	0,025	0,025	0
relation	0	0,042	0	0	0	0
modification	0,008	0,017	0	0,025	0,025	0
perspective change	0,125	0,075	0,075	0,075	0,05	0

Frequency of the form of the movement for each category of function for the LSQ signer

Table 12

	BM			HM		
	rot	lean	tilt	rot	lean	tilt
instantiation	0,016	0,016	0	0	0,033	0,016
relation	0	0	0	0	0,017	0
modification	0	0,005	0,005	0	0,044	0,005
perspective change	0,082	0,016	0,131	0,057	0,082	0,033


Table 13		tronc			tête		
		rot	lean	tilt	rot	lean	tilt
instantiation		0,000	0,000	0,000	0,025	0,025	0,050
relation	pl	0,000	0,000	0,000	0,000	0,000	0,000
	coordination	0,000	0,000	0,000	0,050	0,100	0,000
	relative	0,000	0,000	0,025	0,000	0,000	0,025
	<b>total</b>	<b>0,000</b>	<b>0,000</b>	<b>0,008</b>	<b>0,017</b>	<b>0,033</b>	<b>0,008</b>
modification	topic	0,000	0,000	0,000	0,025	0,050	0,000
	focus	0,000	0,025	0,000	0,025	0,150	0,025
	emphase	0,025	0,025	0,025	0,000	0,100	0,025
	<b>total</b>	<b>0,008</b>	<b>0,017</b>	<b>0,008</b>	<b>0,017</b>	<b>0,100</b>	<b>0,017</b>
perspective change	jdr	0,300	0,025	0,075	0,150	0,175	0,000
	autre	0,125	0,000	0,000	0,100	0,000	0,000
	<b>total</b>	<b>0,213</b>	<b>0,013</b>	<b>0,038</b>	<b>0,125</b>	<b>0,088</b>	<b>0,000</b>

Table 14

		tronc			tête		
		rot	lean	tilt	rot	lean	tilt
instantiation	total	<b>0,075</b>	<b>0,025</b>	<b>0,025</b>	<b>0,025</b>	<b>0,025</b>	<b>0,000</b>
relation	pl	0,000	0,000	0,000	0,000	0,000	0,000
	coordination	0,000	0,125	0,000	0,000	0,000	0,000
	relative	0,000	0,000	0,000	0,000	0,000	0,000
	total	<b>0,000</b>	<b>0,042</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>
modification	topic	0,025	0,000	0,000	0,025	0,000	0,000
	focus	0,000	0,025	0,000	0,025	0,075	0,000
	emphase	0,000	0,025	0,000	0,025	0,000	0,000
	total	<b>0,008</b>	<b>0,017</b>	<b>0,000</b>	<b>0,025</b>	<b>0,025</b>	<b>0,000</b>
perspective	jdr	0,225	0,125	0,100	0,125	0,100	0,000
	change	0,025	0,025	0,050	0,025	0,000	0,000
	total	<b>0,125</b>	<b>0,075</b>	<b>0,075</b>	<b>0,075</b>	<b>0,050</b>	<b>0,000</b>

Table !5		tronc			tête		
		rot	lean	tilt	rot	lean	tilt
instantiation	total	<b>0,016</b>	<b>0,016</b>	<b>0,000</b>	<b>0,000</b>	<b>0,033</b>	<b>0,016</b>
relation	pl	0,000	0,000	0,000	0,000	0,000	0,000
	coordination	0,000	0,000	0,000	0,000	0,050	0,000
	relative	0,000	0,000	0,000	0,000	0,000	0,000
	total	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,017</b>	<b>0,000</b>
modification	topic	0,000	0,000	0,000	0,000	0,066	0,000
	focus	0,000	0,016	0,016	0,000	0,033	0,016
	emphase	0,000	0,000	0,000	0,000	0,033	0,000
	total	<b>0,000</b>	<b>0,005</b>	<b>0,005</b>	<b>0,000</b>	<b>0,044</b>	<b>0,005</b>
perspective change	jdr	0,164	0,033	0,246	0,115	0,164	0,033
	autre	0,000	0,000	0,016	0,000	0,000	0,033
	total	<b>0,082</b>	<b>0,016</b>	<b>0,131</b>	<b>0,057</b>	<b>0,082</b>	<b>0,033</b>

## Annotation protocole :

- two annotators (for the eye gaze, the head and body movements)
- each annotator works on a file
- for the annotation, each annotator uses the 3D data produced with MSSynchro (curves and markers) to segment the 2D video 
- when the file is completed, the two annotators, together, go through each file to revise them and discuss about the changes, if necessary.



Tronc Rot Longitud

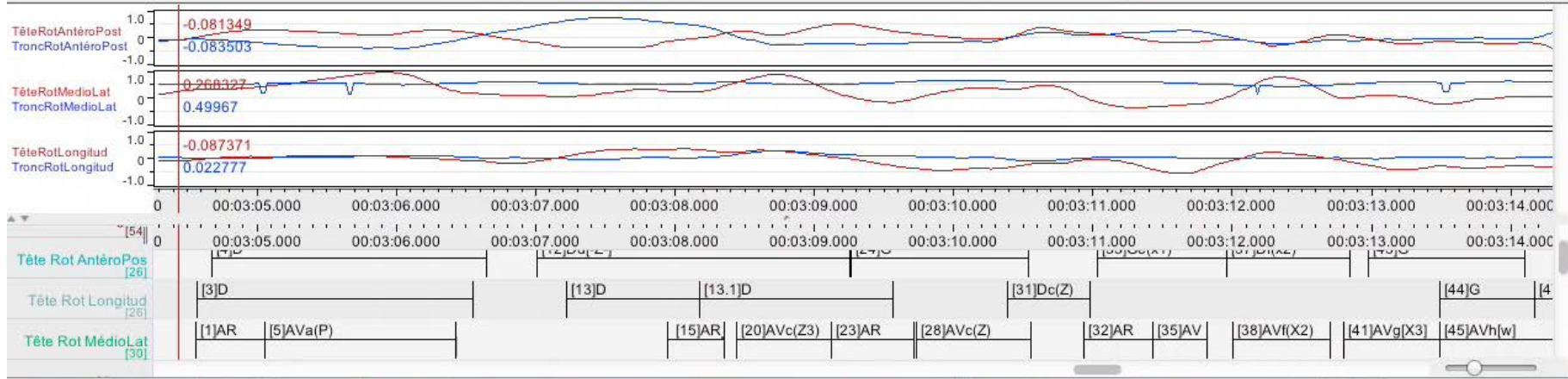
Nr	Annotation	Temps de d...	temps de fin	Durée
10	[96]G	00:03:22.930	00:03:23.623	00:00:00.693
11	[103]Dj[-W1-]	00:03:23.623	00:03:25.834	00:00:02.211
12	[121]Gj[v]	00:03:25.834	00:03:26.692	00:00:00.858
13	[135]Gj[-v-t]	00:03:27.920	00:03:29.306	00:00:01.386
14	[142]Dg[-X3-]	00:03:29.306	00:03:29.768	00:00:00.462
15	[145]Gj[-t]	00:03:29.824	00:03:32.032	00:00:02.208
16	[145a]Gj[-X3-]	00:03:32.032	00:03:32.299	00:00:00.267
17	[153]Gj[t]	00:03:32.497	00:03:34.741	00:00:02.244
18	[171]G	00:03:36.127	00:03:37.315	00:00:01.188
19	[178]Dg(X3)	00:03:37.315	00:03:38.437	00:00:01.122
20	[184]Gg[-X1-]	00:03:38.437	00:03:39.625	00:00:01.188
21	[190]Dj(r)	00:03:39.625	00:03:39.947	00:00:00.322
22	[192a]Dj[-r-]	00:03:39.947	00:03:40.252	00:00:00.305
23	[195]Gg[X3]	00:03:40.252	00:03:41.407	00:00:01.155
24	[204]Gg(r-q)	00:03:41.407	00:03:42.958	00:00:01.551

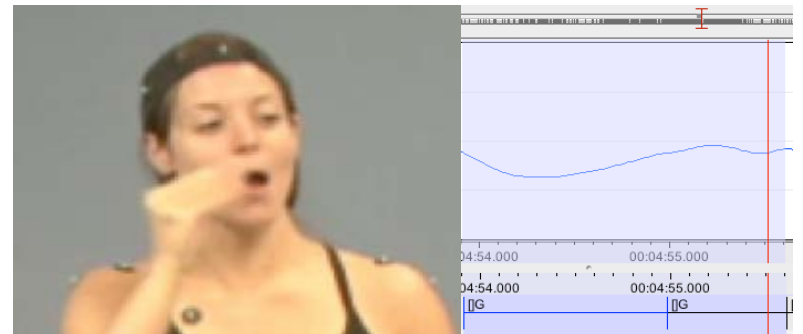
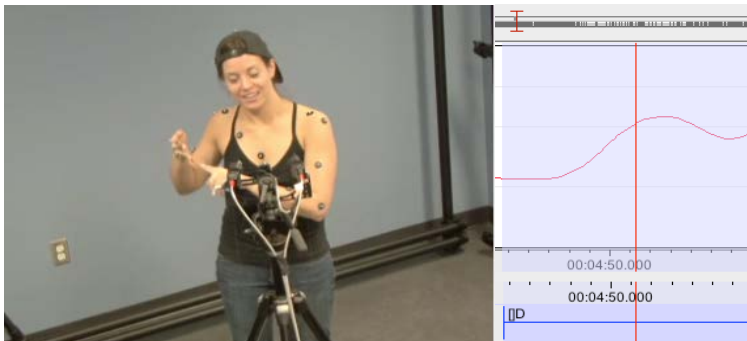
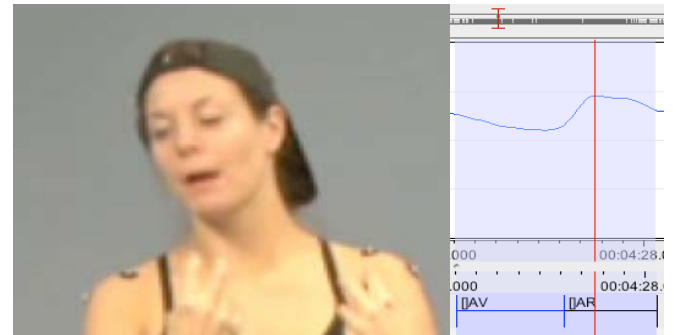
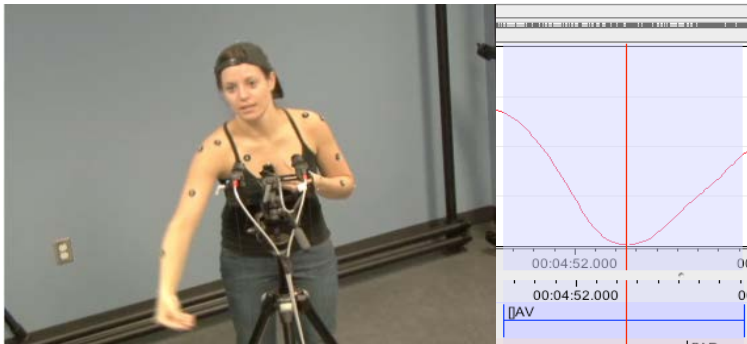
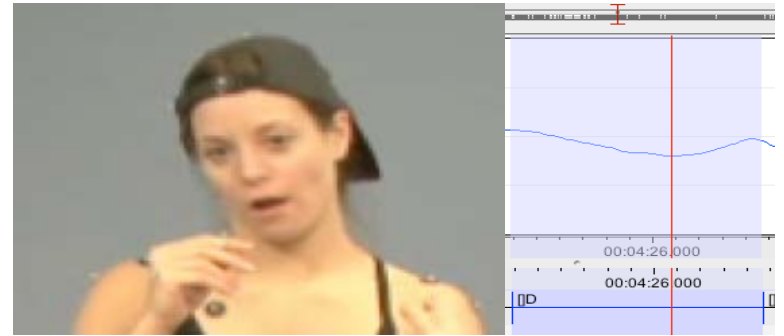
00:03:04.445

Sélection: 00:03:35.218 - 00:03:38.021 2803



Mode de sélection  Mode de boucle





# Revue de la littérature

ASL:

- Pour les NP, les mouvements de la tête et du tronc servent à les introduire dans le discours (Shepard-Kegl, 1985) ou à établir un focus contrastif (Neidle *et coll.*, 2000 ; Petronio, 1993 ; Wilbur et Patschke, 1998).
- Pour les VP, ils marquent l'accord avec le sujet (Bahan, 1996) et servent au renforcement positif ou négatif du sens du verbe (rotation médiolatérale) (Wilbur et Patschke, 1998).
- Pour le discours, ils mettent en évidence les tours de parole (Engberg-Pedersen, 2004) et le discours rapporté (Bahan, 1996 ; Engberg-Pedersen, 2004 ; Wilbur et Patschke, 1998)



# Revue de la littérature

LSF:

- Les mouvements de la tête et du tronc servent à marquer les frontières syntaxiques (Cuxac, 2000).
- Les rotations antéropostérieures marquent la coordination (Jouisson, 1995).
- Le tronc marque le jeu de rôle, le discours rapporté (Bras *et coll.*, 2004 ; Millet, 2006) ou la pronominalisation d'un référent (Bras *et coll.*, 2004).
- La tête gère la cohésion coréférentielle (Cuxac, 2004).

# Revue de la littérature

LSQ:

tronc : trois positions :

inclinaison avant/arrière : marque la saillance sur un NP ou sur une unité du discours (Parisot, 2003)

inclinaison latérale : intervient dans le marquage de l'argument au niveau structurel

rotation : intervient pour le marquage du jeu de rôle au niveau pragmatique (Dubuisson et coll, 1999)

tête :

utilisée ni pour l'accord, ni pour l'association spatiale impliquée au niveau structurel, pour des informations sur la structure (focus ou saillance d'un NP ou d'une phrase) (Parisot, 2009)

Total of BS and HT acting as SA marker		
	HT	BS
ASL	28	14
LSF	1	23
LSQ	3	43

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Head or Body only (detail)											
Lateral tilt		Rotation			Forward/back lean			Forward thrust			
ASL	LSF	LSQ	ASL	LSF	LSQ	ASL	LSF	LSQ	ASL	LSF	LSQ
0	0	13	1	0	6	0	2	1	0	1	
0	0	4	0	0	1	0	2	0	0	0	

Detail of occurrences of BS and HT (Spatial association)											
Head	Lateral tilt			Rotation			Forward/back lean			Forward thrust	
	ASL	LSF	LSQ	ASL	LSF	LSQ	ASL	LSF	LSQ	ASL	LSQ
Spatial association	8	0	0	13	1	0	6	0	2	1	0

Lateral tilt			Rotation			Forward/back lean		
ASL	LSF	LSQ	ASL	LSF	LSQ	ASL	LSF	LSQ
1	6	31	12	17	8	1	0	4
0	2	5	4	3	0	0	0	0

Body	Lateral tilt			Rotation			Forward/back lean		
	ASL	LSF	LSQ	ASL	LSF	LSQ	ASL	LSF	LSQ
Spatial association	1	6	31	12	17	8	1	0	4