Example of corpus-based SL research: The case of mouth actions in Auslan (Australian Sign Language)

Trevor Johnston
Centre for Language Sciences
Department of Linguistics
Macquarie University
Sydney, Australia

Charles University, Prague
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Abstract

In this talk I give an example of corpus-based research. I describe a recent study of one type of non-manual in signed languages (SLs) — mouth actions. I examine the distribution and characteristics of mouth actions in Auslan (Australian Sign Language) to gauge the degree of language-specific conventionalization of these forms. I describe the coding schema for those non-manuals that are mouth-centred. 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 (both of which we have already briefly characterized), and (iii) no mouth action. The data in this study has been drawn from the Auslan corpus of native or near-native signers. Fifty video clips were selected from the corpus, representing 38 individuals, 3 text types (monologue, dialogue, and elicited) during 5 hours and 58 minutes of the corpus, representing c. 17,000 manual sign tokens. The texts consisted of 25 monologues (narratives of which there were 25 retellings of two Aesop's fables); 10 dialogic texts (free conversation or responses to a series of interview questions); and 15 sessions of 40 elicited picture descriptions. 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? 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 or lexicon of some or all signed languages?

Outline

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  - Characteristics of different types of mouth actions
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Introduction

Core questions

1. Are mouthings borrowings but fully integrated into the SL, or examples code-blending?

2. Are mouth gestures "gestural" or conventionalized linguistic units, i.e., are there attested form/ meaning pairings which are proper to each SL (or SLs generally) rather than larger cultural groupings?

Previous research

- Categorization of mouth actions
  - mouthing vs mouth gestures
    - W-type: whole of face, enactment
    - 4-type: mouth for mouth (mimetic)
    - A-type: mouth gestures
    - E-type: empty or echo phonology
    - M-type: mouthings
- Linguistic or gestural?
  - see diagram

Three possible categorizations of mouth actions
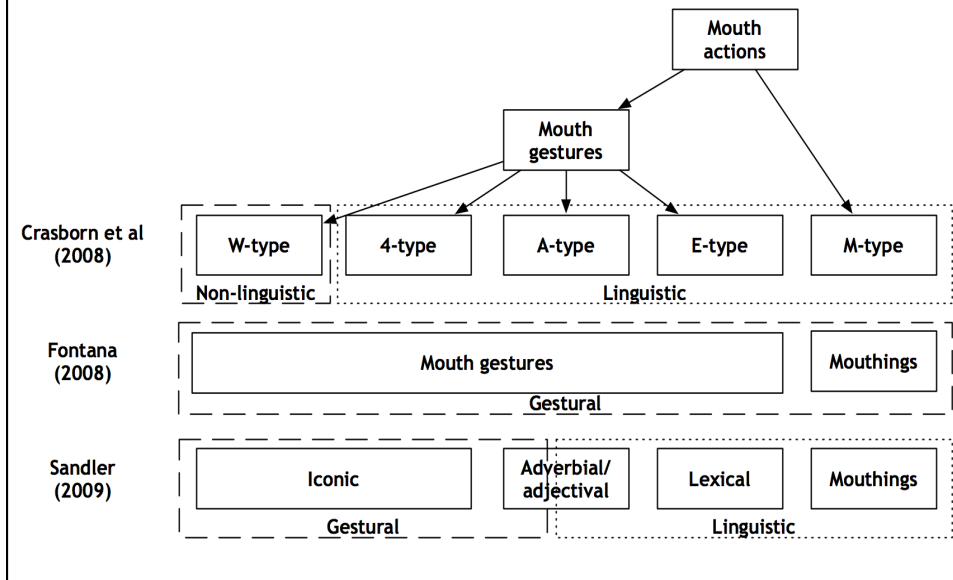
The annotated corpus

The annotations in the Auslan Corpus are made in order to conduct linguistic research using attested usage data. Automated language processing (recognition, translation, avatar generation) does not drive the methodology. However, linguistically annotated corpora are an essential resource for developing automated systems which need to abstract from, and then test themselves against, annotated SL texts.
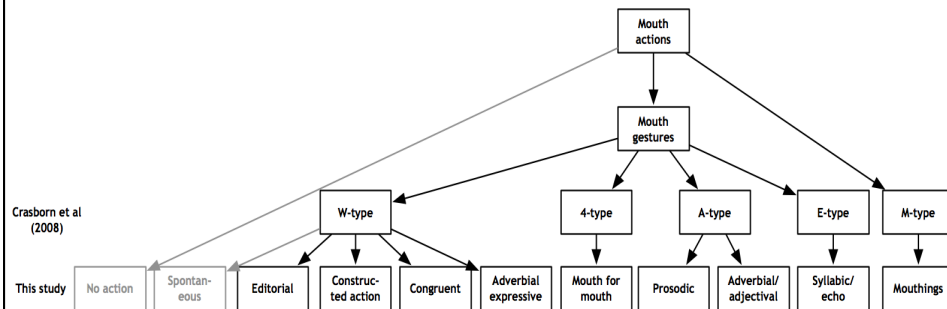
The dataset

Uses a sub-set of Auslan Corpus; 38 deaf native and near-native signers aged from 15 to 80 years; 50 clips & 3 text-types of which 25 monologues (retelling Aesop), 10 dialogic (conversation or interview), 15 sessions of 40 elicited picture descriptions; text duration 1:32 to 38:30 minutes; total manuals sign tokens 17,000 (all annotated for mouth action).

This study

Sample of mouthing annotation in ELAN

The annotation schema for mouthings

M-type (mouthing)	Annotation	Examples
Complete articulation	COMPLETE-WORD	RACE, RABBIT, VILLAGE, FAR
Initial segment	I(NITIAL)	V(ILLAGE), SA(ME), DIFF(ERENT), SH(EEP)
Medial segment	(ME)DI(AL)	(NO)TH(ING), (RE)MEM(BER) , (B)E(ST)
Final segment	(FI)NAL	(SUCCESS)FUL, (FIN)ISH, (IM)PROVE. (TO)DAY
Initial & final segment only	IN(I)TIAL	F(INI)SH, D(EA)F, S(UC)CESFUL
'suppressed' articulation*	(SUPPRESSED)	(LADY), (HAVE)
unreadable*	unreadable	
anticipatory spreading (regressive mouthing)	MOUTHING-regr	ID gloss PT:PRO1SG EXPLAIN Mouthing EXPLAIN-regr EXPLAIN *"I explained…"*
delayed spreading (progressive mouthing)	MOUTHING-prog	ID gloss FINISH PT:PRO1SG Mouthing FINISH FINISH-prog *"….I finished"*

* A 'suppressed' mouthing annotation is used in a few instances where the annotators are convinced there is underlying movement congruent with articulating a word associated with a sign, however the mouth does not actually open, e.g. the 'y' of 'lady' when signing LADY. They are identified to distinguish them from mouth gestures, e.g. a EE-like mouth gesture. Where annotators were certain a word was being mouthed—there are articulatory motions—but were simply unable to lipread it, it is annotated as *unreadable*.

Types of mouth actions annotated in this study

Crasborn et al (2008)

This study
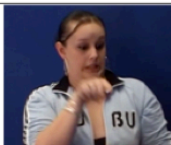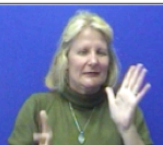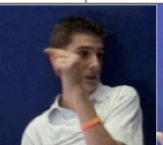
Glossary of additional mouth action categories

- **Spontaneous**
  - essentially involuntary expressions of the state of the mind of the signer (e.g., amused, confused, concerned) are not annotated
- **Editorial**
  - meta-comments about what the signer is signing
- **Constructed action**
  - enactments or 'role playing'
- **Congruent**
  - 'expression' that match the semantics of the lexical sign, such as smiling while signing HAPPY
- **Adverbial expressive**
  - modify and add meaning to the manual sign(s) and are thus adverbial (and adjectival) in function (e.g., signing DANCE while performing it in a 'lively' or 'energetic' fashion with an overall facial expression of enjoyment). However, they are not restricted to the mouth and they are also strongly enacting
- **Prosodic**
  - appear to have an emphatic role, not unlike stress in SpL, and having a tensed posture of the mouth which is held. (This sub-type is identified so that the signs of this type can be compared and contrasted to the 'traditional' category of adverbial mouth gestures.)

Most common mouth gestures (MGs) with their form codes and glosses

BLOW air moves inwards or outwards through the lips which may be pursed or rounded CN8, CN17, ON16-18	**BOTTOM-LIP-OUT** bottom lip is pushed forward, out or up CN3, CN20, ON11, ON14	**DOWN** the corners of the mouth are pulled down, mouth can be open or closed, lips can be pressed together, tense or relaxed CN4, CN22, ON4, ON9, ON15
LIP-CURL top lip is pulled up on one or both sides, as in a sneer CN1, ON5, ON10	**LIPS-OUT** lips pushed forward, as in a pout or "shh" CN11-14, CN16, ON16	**LIPS-PRESSED ('MM')** lips are pressed together but the mouth corners are relaxed CN5, CN6, CN21, CN23,
OPEN mouth is open ON1-3	**PUFF** puffed cheeks CP1-8	**SLIGHTLY-OPEN** mouth is slightly open ON6, ON12

SUCKED-IN
cheeks are sucked inwards
CN24

TONGUE ('TH')
tongue pokes out or is visibly
forward all OT codes & CN19

TRILL ('BRRR')
lips vibrate
CN7, CN9-10, CN13-15, CN18, CP5,

WIDE ('EE')
the corners of the mouth are pulled wide, mouth can be open or closed, lips can be pressed together, tense or relaxed
CN2, ON7, ON8, ON13, ON14

Open mouth codes (MG form)

Lips Open

Tongue Not Involved

Wide
- lips relaxed ON1
- stretched — Teeth Visible / Teeth not visible
- lips down ON4
- sneer ON5

Medium
- lips relaxed ON6
- stretched — Teeth Visible / Teeth not visible
- lips down ON9
- sneer ON10
- pursed ON11

Narrow
- lips relaxed ON12
- stretched — Teeth Visible / Teeth not visible
- lips down ON15
- pursed ON16

air escapes
- lips pursed ON17
- lips stretched ON18
- lips down ON19

Tongue Involved

Wide
- protruding OT1 — tip +T (left / middle), blade +B (right), whole +W
- behind teeth OT2
- behind bottom lip OT3

medium
- protruding OT4 — tip +T (left / middle), blade +B (right), whole +W
- behind teeth OT5
- behind bottom lip OT6

narrow
- protruding OT7 — tip +T (left / middle), blade +B (right), whole +W
- behind teeth OT8
- behind bottom lip OT9

Closed mouth codes (MG form)

- **no puff**
  - **lips not forward**
    - bottom lip under — CN24
    - sneer — CN1
    - together
      - stretched — CN2
      - curved up — CN3
      - curved down — CN4
      - not curved — CN5
    - neutral
      - no air escapes — CN6
      - air escapes — vibrating lips / continuous / brief / interrupted
  - **both lips forward**
    - puckered — CN11
    - curved up — CN12
    - curved down — CN13
    - not curved
      - no air escapes — CN14
      - air escapes — vibrating lips / continuous / brief / interrupted
  - **bottom lip forward**
    - tongue behind lip — CN19
    - no tongue — CN20
  - **lips not visible**
    - curved up — CN21
    - curved down — CN22
    - not curved — CN23
- **puff**
  - **1 cheek**
    - tongue in cheek — CP1
    - no tongue
      - no air escapes — CP2
      - air escapes — CP3
  - **2 cheek**
    - no air escapes — CP4
    - air escapes
      - vibrating lips — CP5
      - continuous — CP6
      - brief — CP7
      - interrupted — CP8

The annotation schema for mouth gestures

Mouth gesture	*MouthGestF* tier begins with	*MouthGestM* tier contains
E-type (echo or empty)	SYLL:GLOSS (= Syllable)	various meanings as needed Tag tier: -IM (imagistic), -MI (mimetic), -ME (metaphorical)
A-type (modifying)		
prosodic	GLOSS/CODE(H) (H = held) (see Table 3)	meaning glosses: ACTIVITY, EMPHASIS or
prosodic (non-specific)	No annotation	Tag tier: -MH (*mouthing held*)
adverbial	GLOSS/CODE (see Table 3)	meaning glosses: LARGE-AMOUNT, CARELESS, UNPLEASANT, SMOOTH, EASE, EFFORT, SMALL-AMOUNT Tag tier: -IM (imagistic), -MI (mimetic), -ME (metaphorical)
4-type (mouth for mouth)	CMO (= Congruent Mouth Only)	ENACTMENT
W-type (whole-of-face)		
spontaneous	no annotation	
editorial	COMMENT	no further annotation or various meanings as needed
CA (constructed action)	CA: (= Constructed Action)	no further annotation or various descriptions as needed,
CA using an A-type	CA:GLOSS/CODE (Table 3)	add after the CA: the A-type mouth gesture gloss/code
congruent	CWF (=Congruent Whole Face)	meaning glosses: EXPRESSION, ENACTMENT, EMPHASIS
adverbial expressive	CA:ADV (= Adverbial)	EXPRESSION
Spreading mouth gesture	ANNOTATION-cont	on all subsequent co-articulated manual sign(s)

Results

Mouth action rates in Auslan compared with other SLs*

	Auslan	BSL	NGT	SSL
Mouth actions	79%	71%	65%	90%
No mouth actions	21%	29%	35%	10%

* Data are taken from Crasborn et al. (2008).

Rate of mouth actions with manual signs

Pie chart:
- No mouth action: 21.0%
- M-type (mouthing): 57.0%
- E-type (empty/echo): 0.4%
- A-type (prosodic): 5.4%
- A-type (adverbial): 1.2%
- 4-type (mouth/mouth): 0.4%
- W-type (editorial): 6.6%
- W-type (constructed action): 5.9%
- W-type (congruent): 0.6%
- W-type (adverbial expressive): 1.5%
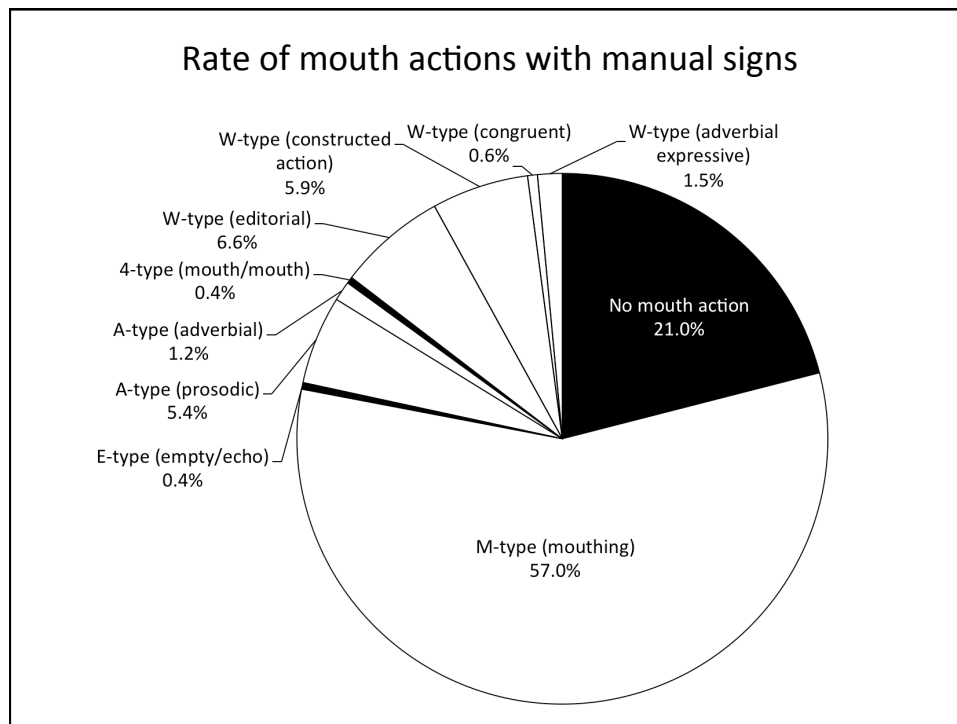
Each mouth action type as a % of all mouth actions compared to other SLs*

	Auslan	BSL	NGT	SSL	HKSL	NGT-2
M-type	72%	51%	39%	57%	35%	80%
A-type	8.4%	21%	30%	14%	17.5%	n/a
E-type	0.5%	2%	8%	7%	9.5%	n/a
4-type	0.5%	6%	6%	6%	2.5%	n/a
W-type	18.0%	20%	17%	16%	36%	n/a

* NGT-2 data from Bank et al. (2011, 2013), HKSL data from Siu Wai-yan (2007)

Mouth actions by sign type
(ranked by decreasing % of mouthing)

Mouth actions with pointing signs
(ranked by decreasing % of mouthing)

Mouth action rates by grammatical class (ranked by decreasing % of mouthing)
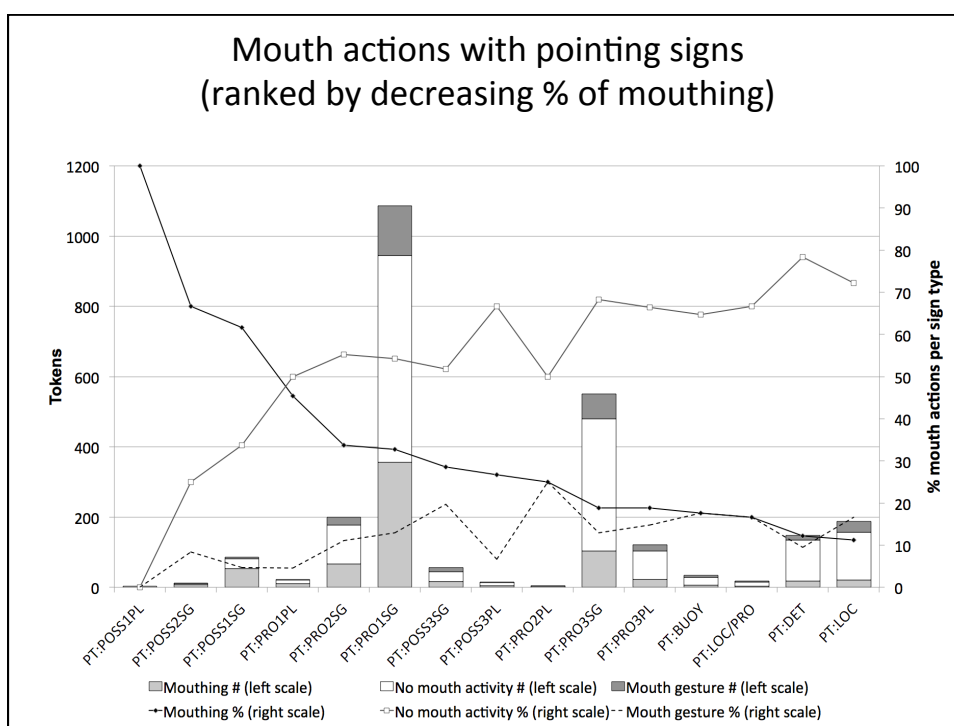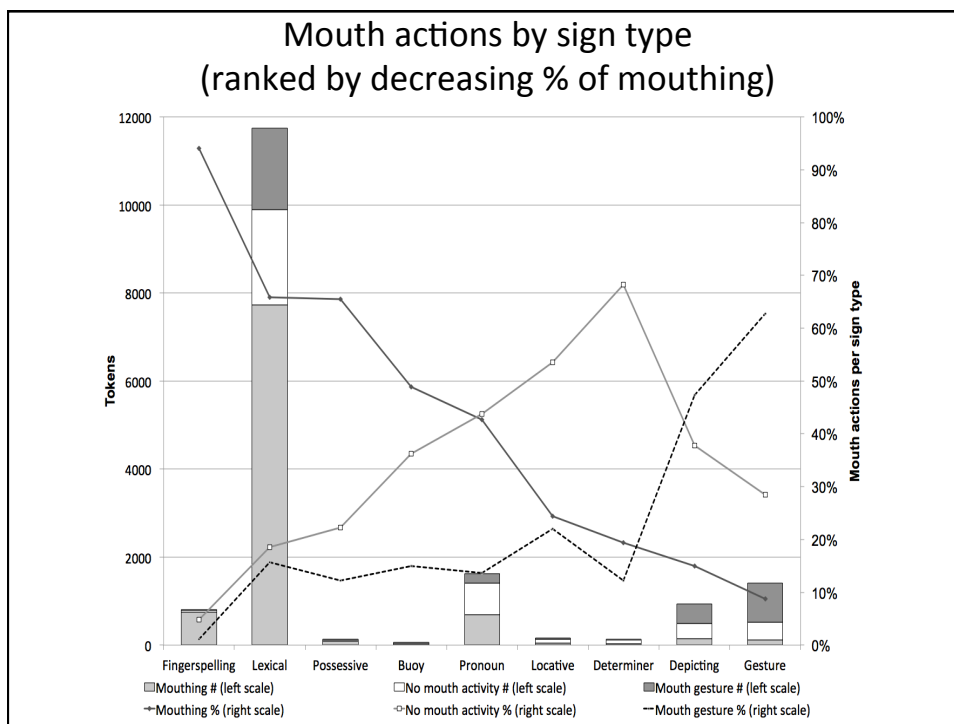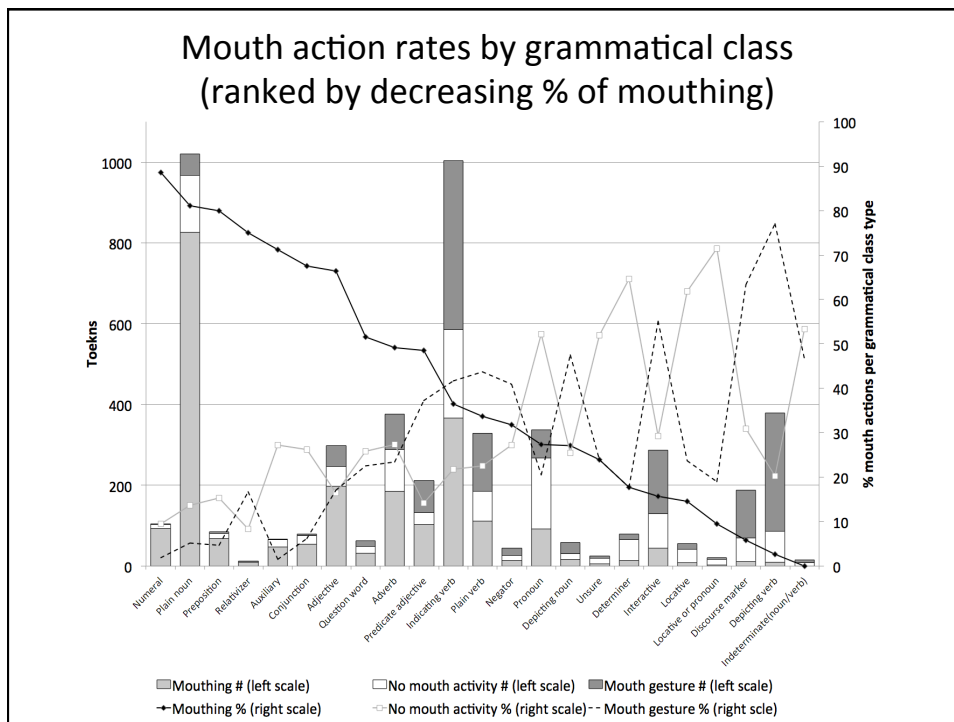
Distribution of mouthing by grammatical class of manual sign

	Auslan	BSL	NGT	SSL	ASL*	HKSL	IrishSL*
Noun	35.8%	40.3%	39.4%	42.5%	27.1%	84%	32%
Verb	26.9%	24.4%	30.6%	20.9%	15.4%	9%	23%
Adverbial	8.4%	6.4%	11.1%	10.1%	20.5%	n/a	n/a
Adjective	8.8%	12.3%	5.6%	11.2%	26.7%	2.5%	27%
Other	20.1%	16.7%	13.4%	15.2%	10.3%	4.5%	18%

* ASL and IrishSL figures calculated from data reported in Nadolske and Rosenstock (2007) and Militzer (2013)

Type of mouthing

Degree of articulation	Tokens
Full articulation	8911
Initial segment	262
Medial segment	13
Final segment	26
Initial & final segment only	23
Suppressed articulation	6
Unreadable	64
Total	**9305**

E-type mouth gestures in the dataset (N=64)

RH-IDgloss-value	MouthGestF	Tokens	RH-IDgloss-value	MouthGestF	Tokens
COINCIDENCE	PAH	11	WELL-KNOWN	PAH	1
REAL	AP	7	DS(H):ANIMAL-RUNNING	PAH	1
FINISH.FINALLY	PAH	5	ELIMINATE	THAM	1
AUTOMATIC	WOOF	4	SLEEP	PAH	1
HAVE-NOT	POOH	3	DSS(B):OBJECT-PASSES	PAH	1
BAN	AP	3	SPEED-DUST	BOOM	1
PECULIAR	PAH-PAH	2	DSM(B):ANIMAL-OVER-LINE	PAH	1
LEARN-LESSON	PAH	2	DSM(B):ANIMAL-STOPS	PAH	1
DISAPPEAR	AP	2	DIMINISH	THAM	1
DISAPPEAR	POW	1	AFTERGLOW	AM	1
RELIEVED	PAH	1	FOUND-OUT	PAH	1
UNUSUAL	PAH	1	LEARN	OOM_INHALE	1
REAL	ALAM	1	WELL-KNOWN	PAH	1
EMPTY	THAP	1	DS(H):ANIMAL-RUNNING	PAH	1
WITNESS	PAH	1	SLEEP	PAH	1
WIPE-UP	ALAM	1	DSS(B):OBJECT-PASSES	PAH	1
ELIMINATE	ALAM	1	SPASMODIC	AP	1

E-type mouth gestures by associated meanings in context

Mouth gesture form	Specific contextual meanings	# echo phonology	# echo metaphorical	# echo total	# tokens total
PAH	suddenly, quickly	26	3	29	32
AP	suddenly, abruptly	10	3	10	13
WOOF	without-impediment, automatic	0	0	0	4
ALAM	all-gone, disappear from view abruptly	1	2	3	3
POOH	nothing, negative, remove, blow away	0	3	3	3
THAM	all-gone, disappear from view	0	2	2	2
PAH-PAH	peculiar, strange	0	0	2	2
AM	sudden, complete	1	0	1	1
BOOM	all-gone, complete, energetic	1	0	1	1
OOM_INHALE	close-shave, sharp, risky, dangerous	0	1	1	1
POW	sudden, energetic	1	0	1	1
THAP	all-gone, disappear from view abruptly	0	1	1	1
Totals		**40**	**15**	**55**	**64**

Form/meaning pairings for adverbial A-type mouth gestures*

MouthGestF	MouthGestM	Specific contextual meanings	Tokens
TONGUE	CARELESS	carelessly, easily, with ease, without regard, petulantly, with deliberate careless enjoyment, reckless, slipshod, insouciant	109
TRILL	EASE	easily, unimpeded, with enjoyment	16
BLOW	SMALL-AMOUNT	little remaining, blown away,	12
BLOW	SMOOTH	smooth, unimpeded, quickly, ongoing	11
TRILL	LARGE-AMOUNT	large amount, a lot of, unimpeded, energetic, powerful, engine/machine-powered	8
TONGUE	UNPLEASANT	unpleasant, distasteful, bad	7
PUFF	LARGE-AMOUNT	large amount, a lot of, powerful	6
BOTTOM-LIP-OUT	CARELESS	careless, easily, without regard, petulantly, with deliberate careless enjoyment, reckless, slipshod, insouciant	3
LIPS-OUT	EASE	easily, without regard, petulantly, with enjoyment	2
LIPS-OUT	SMALL-AMOUNT	small amount, trivial, insignificant, nothing to worry about	2
LIPS-PRESSED	EASE	easily but deliberately, enjoyable	2
LIPS-OUT	LARGE-AMOUNT	large amout	1
PUFF	CARELESS	careless	1
TONGUE	SMOOTH	smooth	1
WIDE	EFFORT	effort	1
LIPS-PRESSED	EFFORT	effort	1
LIPS-OUT	UNCLEAR	n/a	1
SUCKED-IN	SMALL-AMOUNT	small amoutn	1
DOWN	CARELESS	careless	1
SLIGHTLY-OPEN	EFFORT	effort, concentration	1

* Again tokens with more than one possible descriptor were aggregated with a single descriptor that was the most salient.

Form/meaning pairings for prosodic A-type mouth gestures*

MG form (= EMPHASIS)	Tokens	MG form (= ACTIVITY)	Tokens
DOWN	88	WIDE	66
WIDE	78	TRILL	28
LIPS-PRESSED	65	SLIGHTLY-OPEN	22
TRILL	63	LIPS-PRESSED	22
SLIGHTLY-OPEN	38	DOWN	19
LIP-CURL	34	BOTTOM-LIP-OUT	13
PUFF	31	PUFF	8
BOTTOM-LIP-OUT	27	LIPS-OUT	8
OPEN	23	BLOW	4
BLOW	16	OPEN	3
LIPS-OUT	13	LIP-CURL	1
Totals	**476**	**Totals**	**194**

* A number of mouth gestures need to be translated from the formal codes using more than one of these descriptors (e.g., "blow, lips-out"). In these cases, the tokens were aggregated the most salient descriptor with the same general meaning.

Mouth for mouth (N=68)

ID-gloss	Tokens	ID-gloss	Tokens	ID-gloss	Tokens
GRAZE	11	EAT	5	HEARING	2
CAPTURE	10	SHOUT	3	CATCH	1
YELL	9	LAUGH	2	DSS(5):ANIMAL-TEETH	1
AMERINDIAN	6	CHEW	2	BITE	1
SPEECH	5	ANGRY	2	CHATTER-BOX	1

Spreading data

Mouth action	Tokens				Percent with spreading				
	Auslan	BSL	NGT-1	SSL	Auslan	BSL	NGT	SSL	NGT-2
M-type (mouthing)	**9618**	**560**	**299**	**831**	**5.5%**	**25%**	**20%**	**12.5%**	**12.5%**
Mouth gesture	**3427**	**539**	**458**	**624**	**14.6%**	n/a	n/a	n/a	n/a
E-type	63	20	58	99	0%	10%	5.3%	11.1%	n/a
A-type	857	231	230	205	8.3%	n/a	n/a	n/a	n/a
4-type	62	63	45	87	0%	n/a	n/a	n/a	n/a
W-type	2446	225	125	233	16.5%	n/a	n/a	n/a	n/a

Mouth action rates for individual texts

Legend: Percent mouthing, Percent Mouth gesture, Percent no mouth activity
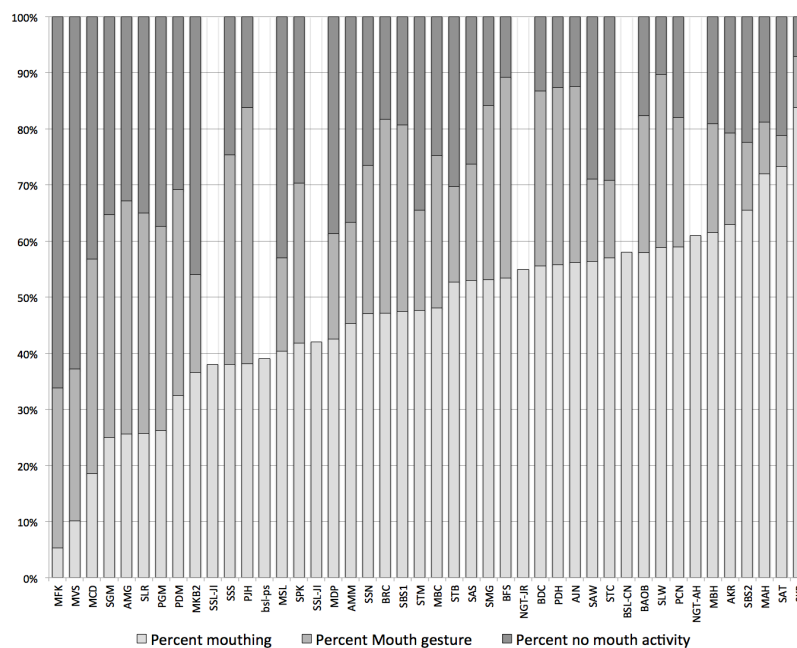
Mouth action rates across text-types

	No mouth action	M-type	E-type	A-type	4-type	W-type
Monologue (narratives, retell)	30.8	20.4	55.4	26.2	72.6	45.6
Dialogue (conversation, interview)	53.3	68.5	44.6	49.8	17.7	48.0
Elicited (sentence elicitation, picture stimulus)	15.8	11.1	0.0	23.9	9.7	6.4

Mouthing rates in different text-types with same participant
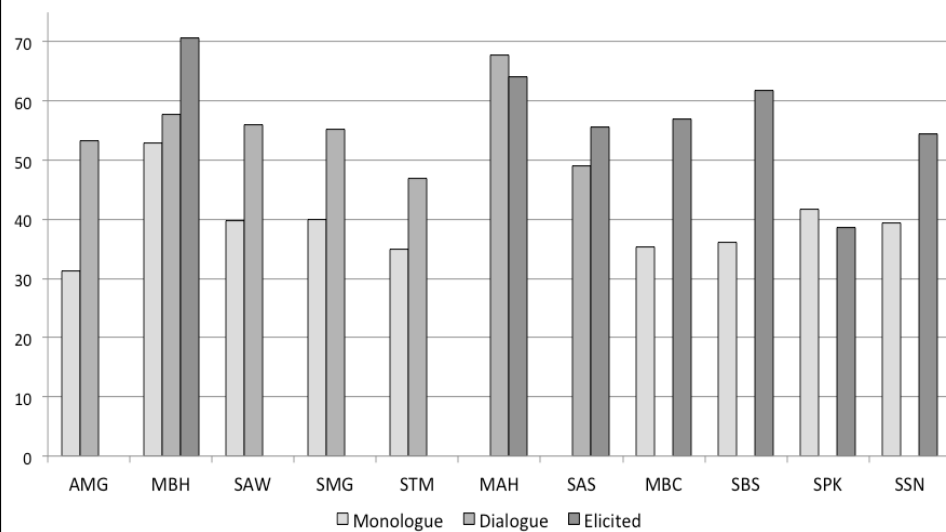
Multivariate analysis (Rbrul)

- Preliminary multivariate analysis using Rbrul showed that variation in the frequency and use of mouthing and mouth gestures was not significantly correlated to age, sex, or region. These factors have been implicated in other SL-using communities (due to location of schools and/or changing educational practices, such as oralism). Overall, the strongest non-linguistic factor linked with the variation was the individual. With respect to linguistic factors, early analysis confirms that depicting signs strongly favour the use of mouth gesture, i.e., it is statistically significant, as are the apparent correlations of mouthing and mouth gestures with various types of pointing signs. Further analysis and results are forthcoming.

Discussion

- Methodology
  - type and size of datasets
  - categorization
- Language contact and the conventionalization of mouth actions
  - Relationship of English mouthings to Auslan signs
    - lexically specified or merely standard?
  - Form/meaning pairings of mouth actions in Auslan
    - E-type and A-types

Mouthings: lexically specified or merely standard?

- 38 fully lexical signs (5 tokens or more) were always mouthed. Most lexical signs appeared with more than one mouthing. One mouthing was usually far more common than the other(s)—this is the 'standard' mouthing. Six of the 342 lexical sign types had more than 10 unique mouthings (one had 18). 26 lexical sign types never occurred with a mouthing in the dataset. Even so-called 'disambiguating' mouthings were often not made (SPOUSE with 'husband' or 'wife'.

E-types: empty & obligatory?

- E-types do not appear to be semantically 'empty' (see specific contextual meanings), as suggested in the literature. Nor were they always found with lexical sign types deemed 'multi-channel' in related SLs (e.g. COINCIDENCE, FINISH and REAL all appeared either with no mouth gesture or a mouthing). One mouth gesture, PAH, was far more frequent than the others (over 50% of tokens). Echo phonology did account for many E-types, but a 'metaphorical' link with the semantics of the sign was also possible and relevant, not just phonetics and phonology.

A-types: morphemic and language-specific?

- The majority of A-types were 'prosodic' by our definition, with only one of two very broad and general meanings (or functions). They either 'added' stress or emphasis (i.e., they instantiate stress rather than 'mark' it) or, if the co-occurring sign designated a process (a verb), they implied 'protracted activity'. It is moot if any identified mouth gesture would be considered incomprehensible to members of the wider spoken language community, given context. The most convincing candidate (TH) has been attested widely in human cultures with a congruent underlying meaning of 'social exclusion' (Smith, Chase & Lieblich, 1974) which we argue can account for all reported meanings attributed to this mouth gesture in SLs.

Conclusion 1

Mouth actions, other facial expressions, head and body movements, and other aspects of sign articulation (e.g., speed and stress) seem to work together in various complex ways. The actual mouth forms employed in the dataset varied considerably from person to person. Positing a conventional codified system for mouth actions appears not to be supported by the usage evidence, at least for Auslan. Rather, mouth actions appear to exist along a continuum of indexicality, iconicity and conventionality. The highly conventional (i.e., linguistic), should they exist, would only account for a tiny proportion of all mouth actions. So few show evidence of significant linguistic conventionalization that if these few examples are used to characterized the system this misrepresents the situation. Mouthings appear to be code-blending.

Conclusion 2