Categorical vs. gradient properties of handling handshapes in British Sign Language
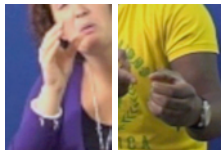
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Handling Handshapes (HHS)

◆ Represent how the hand is shaped when handling an object
◆ Describe part of handled obj. that gradiently varies in size ➡ is there gradient variation in HHS aperture?

Handling HS

Part/Whole Entity Handshapes

◆ Signer's hand becomes the object
◆ Discrete & closed set of handshapes (little or no gradient variation)
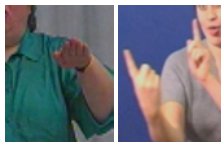
☞ discrete (categorical) linguistic set of HHS?
☞ or gestural (analogue) handling depictions?

Entity HS

Some approaches to analysis of HHS

◆ Discrete set of commonly used HHS depicting how objects are grasped (Zwitserlood 2003, Brennan 1992)
◆ Non-linguistic gestural depiction continuously mapping visual information on sign form (Cogill-Koez 2000)
◆ Blends of linguistic and gestural elements? (Liddell 2003)

HHS examples

Study 1: Categorical perception (CP) of HHS

◆ CP = stimuli perceived as category members despite continuous variation in form (Liberman et al. 1967) – discrimination peak on cat. boundary
◆ CP may arise as a result of linguistic processing, e.g. /p/ vs. /b/ (Eng.)
◆ In sign language, CP found for phonemic handshapes in ASL lexical signs PLEASE vs. SORRY (Emmorey et al. 2003; Baker et al. 2005), ASL Size & Shape Specifiers in deaf signers (Emmorey & Herzig 2003)
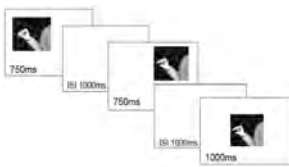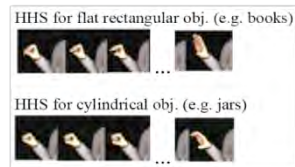
Research question

☞ Do deaf BSL signers, in comparison with hearing non-signers, perceive the continuous differences in handling handshapes categorically?

Participants

15 deaf BSL signers (deaf & signed BSL before age 6)
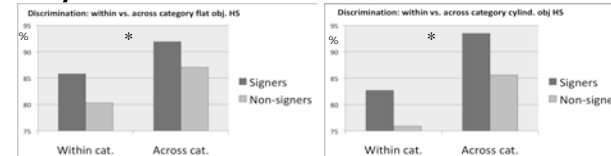18 hearing non-signers (English speakers - no sign language experience

Stimuli

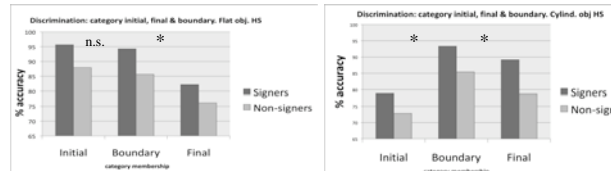HS Discrimination – same or different?

HHS for flat rectangular obj. (e.g. books)

HHS for cylindrical obj. (e.g. jars)

Study 1: Results

Discrimination: within vs. across category flat. HS

Discrimination: within vs. across category cylind. obj HS

* $F_{(1,31)} = 19.3$, p<.001

* $F_{(1,31)} = 5.6$, p<.05

Discrimination: category initial, final & boundary. Flat obj. HS

Discrimination: category initial, final & boundary. Cylind. obj HS

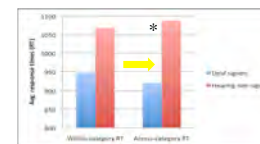* $F_{(2, 54)} = 25.4$, p < 0.001

* $F_{(2, 54)} = 20.4$, p < 0.001

Category boundary determined by labelling task!

Discrimination accuracy – highest at boundary for both HHS continua BUT within category accuracy also relatively high – weak CP effect

Reaction times – interaction!
Cylindrical HHS: signers RTs speed up for across-boundary HHS
> easier to discern?
* $F_{(1,31)} = 5.8$, p<0.05

Study 1: Summary of Results

◆ HHS used to describe handling of cylindrical objects are perceived categorically – but failed to obtain CP effect for flat obj. HHS!
◆ Similar patterns of performance by signers and non-signers point away from existence of linguistic (phonemic) categories for HHS in BSL
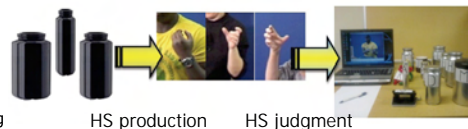
Study 2: HHS production & judgment task

Research question

☞ Do deaf BSL signers & hearing gesturers encode (& decode) gradient information about object sizes by means of discrete HHS?

Participants

Producers: 9 deaf signers & 18 hearing gesturers (9 co-speech/9 panto)
Judges: 6 deaf signers & 14 hearing gesturers (7 co-speech/7 panto)

Procedure

(adapted from Emmorey & Herzig 2003: exp. 2C)

HS production   HS judgment

Predictions

We hypothesised categories of size of graspable objects (adapted from Goldin-Meadow et al. 2007)

Table: Cylindrical obj. categories

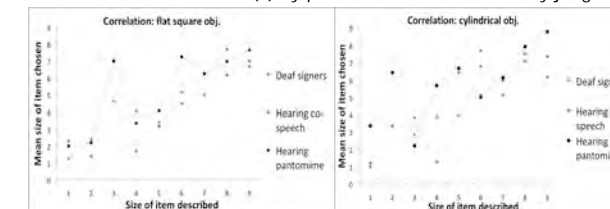Low correlation within category
➡ categorical encoding

High correlation within category
➡ gradient encoding

Size diameter (mm) (items)	Example HHS elicited	Fingers-thumb distance (in)	Cat. size (arbitrary label)
30 (1)		0	Touch (T)
40-70 (2-5)		<0-3	Small (S)
80-110 (6-9)		>3	Large (L)

Study 2: Results

Item viewed and described (x) by producers vs. item chosen by judges (y)

Correlation: flat square obj.

Correlation: cylindrical obj.

HHS – object correlation within vs. across cat. a) flat & b) cylindrical obj.

		Category status	Deaf signers	Hearing co-speech	Hearing panto
Flat, square objects		within cat. (S)	.74 (.47)	.85 (.35)	.99 (.03*)
		across cat.	.91 (.01*)	.96 (.00*)	.93 (.00*)
Cylindrical objects		within cat. (S)	.15 (.85)	-.18 (.82)	.99 (.01*)
		across cat.	.83 (.01*)	.77 (.03*)	.86 (.02*)

◆ Across continua high correlation between items described by the producers vs. items chosen by the judges overall for all 3 groups
◆ Within hypothesised categories of graspable object sizes deaf & hearing judges (co-speech) were at chance matching objects with handshapes for both object continua → categorical encoding of size
◆ For hearing (panto) high correlation within cat. → analogue encoding

Conclusion

◆ HHS comprise a more conventionalised, gestural system shared by both deaf signers & hearing gesturers (co-speech) – more evidence needed to show whether these categories are linguistic for signers
◆ If speech is suppressed, hearing gesturers (pantomime) are more attuned to fine changes in object / HHS size and show analogue encoding

◆ Qualitative differences

HHS articulation between deaf signers (DS) & hearing gesturers (co-speech) (HC):

Observed HHS features	DS	HC
Lax	-	+
Crisp/well formed	+	-
Fingers spread	-	+
Selected fingers	-	+