The research that I'm going to present to you today is about **pointing in sign languages**. It focuses the kinds of functions that pointing serves for signers, and considers how those functions emerge. But it's also about the **kinds of evidence** we can take into account when we study pointing: it shows that if we look not just at the hands, but at other signals on the body—in particular, **eye gaze**— we can better explain how pointing develops grammatical functions in sign languages.

Road Map

Background:

- What are **indicating expressions**?
- How do they develop grammatical functions in sign languages?

Research Question:

- What happens to **eye gaze** as indicating expressions develop grammatical functions?

Our Study:

- Eye gaze in the indicating expressions of signers and speakers

3

At the beginning of this talk I'll introduce *indicating expressions:* linguistic expressions in signed and spoken languages that serve to direct attention, that is, to point.

I'll bring our focus to sign languages, asking how indicating expressions develop grammatical functions for signers. I'll call your your attention to one proposal that posits that in sign languages, indicating begins as a *gestural* phenomenon, and later develops its many attested functions through a process of **grammaticalization.**

I'll introduce you to our research question, which focuses on the eye gaze component that accompanies indicating expressions. We ask: what happens to gaze when indicating expressions take on grammatical functions in sign languages?

And finally, I'll present our study, which investigates eye gaze in the indicating expressions used by signers of a young sign language, ISL, and makes comparisons with indicating expressions of hearing users of spoken language.

Indicating Expressions

- **Indicate** the location of an object or the direction of movement

- **Coordinate** the attentional focus of the communicative partners

(cf. Clark, 1996, 2005; Fricke, 2014; Carpenter et al, 1998).

4

Indicating expressions are linguistic expressions that point: that is, they (i) direct attention to physical space and (ii) coordinate the attention of the communicative partners. Multiple types of expressions point, including spoken language demonstratives like English *this* and *that,* as well as manual points—which **speakers** often use alongside demonstratives, and which signers use as indicating expressions in sign languages.

Functions of indicating expressions

| Exophoric	Endophoric
Real-world referring	Discourse referring

 "Look at **that**!"

 "Language? We could talk about **that** all day"

(cf. Fillmore 1982, Levinson 2004, Diessel 1999, 2005)

5

Indicating expressions serve two broad linguistic functions: the first is the **exophoric** function of referring to, and locating, items in the real world [Exophoric animation appears; discuss example]. The second is the **endophoric** function of referring to items in the discourse [Endophoric animation appears; discuss example].

Functions of indicating expressions

Exophoric — Real-world referring

Endophoric — Discourse referring
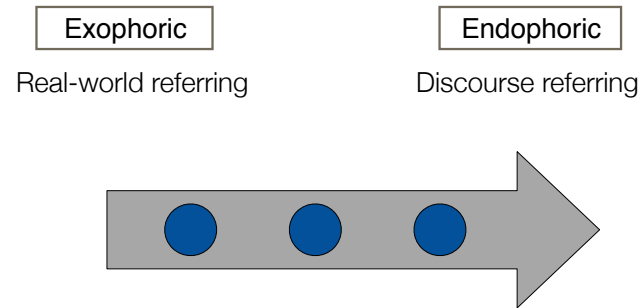
(cf. Fillmore 1982, Levinson 2004, Diessel 1999, 2005)

6

These two functions are related: there is a good deal of evidence to show that indicating expressions start with a world-referring function, and only later do they develop a discourse-referring function through a process of language change that is referred to in linguistics as **grammaticalization**.
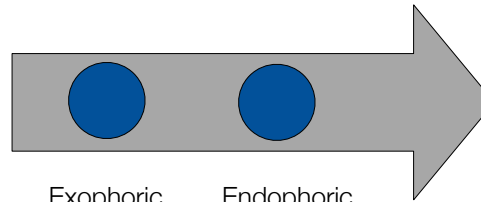
Much of the evidence for this grammaticalization process comes from studies of demonstrative expressions, that is, spoken language indicating expressions. This research has shown that when indicating expressions take on new functions, they undergo semantic bleaching—that is, lose the world-referring component of their meaning—and they become reduced in form.
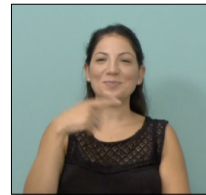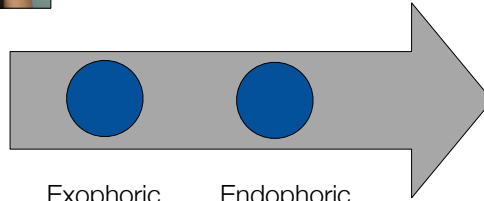
One proposal from the literature suggests that the same grammaticalization process may take place for the indicating expressions of sign languages—that is, points. Pfau and Steinbach (2006) suggested that points in sign languages may originate with an exophoric (world-referring) function and develop endophoric (discourse-referring) functions over time.

["gestural points" animation appears] Their proposal suggests that so-called **"gestural points"** serve as input to the grammaticalization process—that is, as the source of the exophoric points found at the earliest stages of sign language emergence —and that **after pointing has entered a sign language**, it can develop endophoric functions as a result of grammaticalization.

who, somewhere along the way, conventionalise pointing with a discourse-referring function.

This proposal caught our attention. As researchers studying the emergence of a young sign language in Israel, we wanted to know whether we could find empirical evidence for the grammaticalization process that Pfau and Steinbach postulated. But as we considered hypotheses for testing the theory empirically, we ran up against two challenges:

What about the signals that accompany indicating expressions?
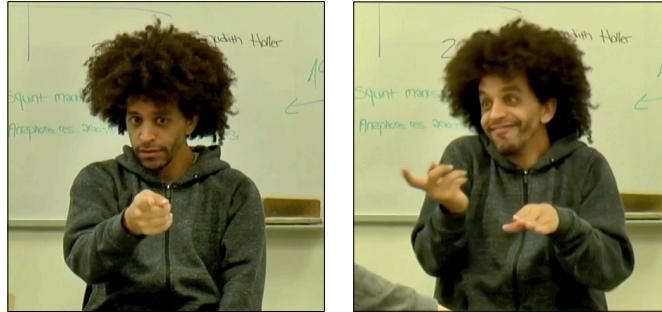
Eye gaze reinforces the locative component of the manual point

(Cf Pfeiffer 2010)

First, Pfau & Steinbach's proposal discusses pointing with the hands alone. But of course pointing is very often performed using multiple articulators. Signers can reinforce the manual point with shifting their torsos, turning their heads, and perhaps most importantly, directing their eye gaze. **Eye gaze** in particular has been shown to reinforce the manual pointing signal, helping to very finely pinpoint the location of the pointing target.

We wondered where non-manual signals like these fit into the story about the development of pointing functions in sign languages.

What about the indicating expressions of non-signers?

"Gestural Points"   Exophoric   Endophoric
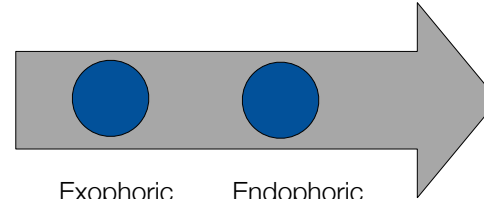
Gestures can be a source for sign language grammaticalization
(cf. Janzen & Schaffer 2002; Wilcox 2005, 2009)

10

Second, Pfau & Steinbach's proposal accounts for the emergence of pointing functions in sign language alone.

["Gestural points" animation, including the non-signer image, appears]

 P&S **do** suggest that **speakers** play a role. They say that **speakers**' "gestural points" may contribute to the earliest stage of the grammaticalization chain.
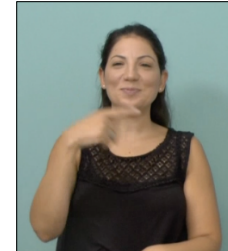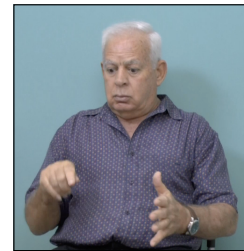
[Lower animation appears]

A small literature suggests that gestures *do* feed into the grammaticalization processes of sign languages

But it is not clear how to conceptualize the role of speakers and their input in this particular grammaticalization story.

With all of these concerns in mind, we set out to design a study about pointing grammaticalization in Israeli Sign Language, or ISL. ISL is a young sign language that is just 90 years old. Many of its very first users are still living, and their signing can offer us a window on what the language looked like when it was first emerging. We can contrast the signing of older signers with young ISL signers who can show us the language in its current state. Asking a question about the differences between older and younger signers, and assuming that this will help us to understand how the language changed over time, assumes the validity of Labov's Apparent Time Hypothesis. I won't go into the hypothesis here but if there are any questions I'll be glad to discuss the method during questions.

In this study we wanted to account for the role of so-called "Gestural points" in the grammaticalization process of pointing. For this reason, our study included Hebrew speakers as well as as ISL signers in the design of the study.

Hypotheses

Exophoric   Endophoric

- Semantic bleaching
- Reduction in form
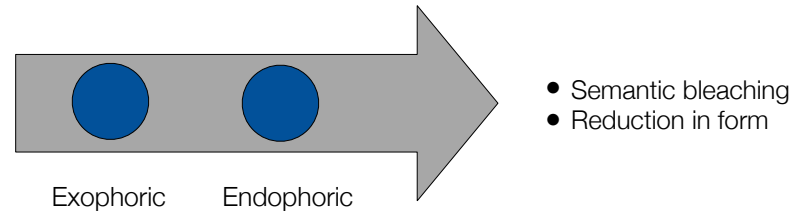
H1. As manual points take on grammatical functions in ISL,
signers rely less on gaze to reinforce the pointing signal

12

We developed a set of two hypotheses that would help us to test the current story about how points develop in young sign languages.

Our first hypothesis was about the two very typical CHARACTERISTICS of grammaticalization that one ought to find at the far end of the grammaticalization chain: semantic bleaching and reduction.

We thought that gaze behaviour might be the key to finding both of these types of evidence. First, for semantic bleaching: if points later in the grammaticalization chain are becoming bleached of their locative information—that is, ceasing to draw attention to spaces in the real world—we would expect that signers would not use gaze alongside these points to finely locate their targets. Second, for reduction: if the gaze-reinforced point to the real world is considered the starting place, then a point produced without the reinforcement of gaze would, in our understanding, constitute a reduced signal.

[ANIMATION]

—We hypothesised, then, that for points with endophoric, OR LANGUAGE-INTERNAL, functions in ISL, we would see a decrease in the use of gaze as a reinforcing signal alongside the manual point.
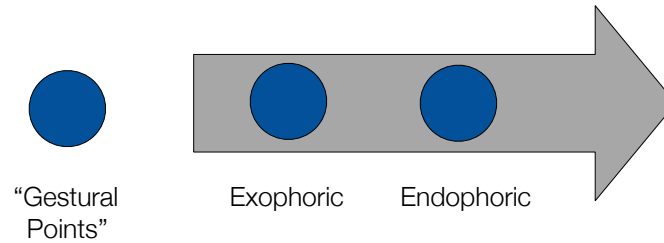
Our second hypothesis was about the role of gesturers in the story. As we understand Pfau & Steinbach's proposal, gesture falls at the outset of the SIGN LANGUAGE GRAMMATICALIZATION chain. It feeds into a stage where signers are using points with exophoric functions only. So it follows from this story that gesturers should behave like they are pointing toward the real world.

Now, to raise a cautionary note: there is a literature about pointing alongside speech that shows that gesturers use points for many functions.   So it isn't clear that the story that's represented here is the right one about gesturers.

But in order to test what we think follows from the Pfau & Steinbach proposal, we created a hypothesis about this story.

—We hypothesised, then, that gesturers would consistently rely on gaze towards the target to reinforce the pointing signal. That would be consistent with gesturers feeding points INTO a chain where gaze gets reduced LATER.

Participants

29 ISL Signers

—2 age groups: apparent time—

(Cf. Labov 1962, Sankoff 2006)

12 older   17 younger
(55-75)   (20-54)

16 Hebrew Speakers

—Single age group: 22-64—

We collected data from two communities in Israel: Deaf signers of ISL signers (organized into two are groups, in order to make a comparison across different generations of speakers) and hearing speakers of Hebrew.

Tasks
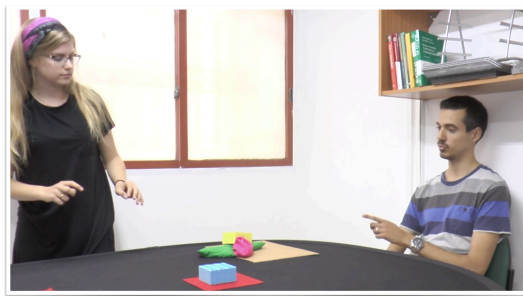
- Stacks & Squares
  (modified from Cooperrider et al, 2018)

- Story retelling
  (Charlie Chaplin narratives:
  The Lion's Cage, The Kid)

15

To elicit points with a variety of functions, we used two referential communication tasks.

Dataset

After excluding *pantomime* and *interactions with the stimulus images:*
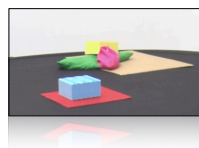
	exophoric	endophoric
ISL Signers	247	182
Hebrew Speakers	114	53

Rich dataset of point w world-ref and and disc-referring fucntions. Signers pointed more than gesturers, but we had a large set of indicating expressions from both groups. Brief description of exclusion criteria here.

Coding

- All manual points coded for:

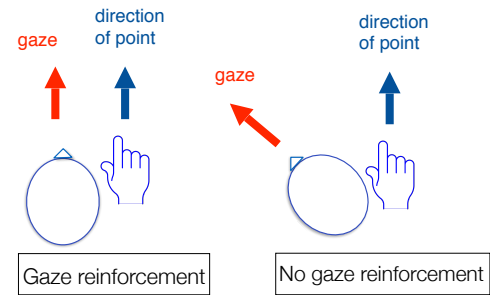 - Function of point

Exophoric	Endophoric
Real-world referring	Discourse referring

Coding

- All manual points coded for:

- Gaze reinforcement

Results

Results: Manual points reinforced with gaze across groups
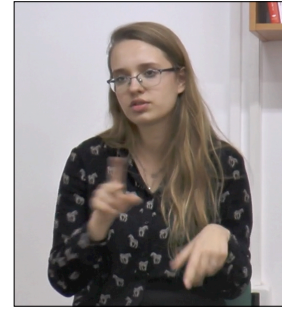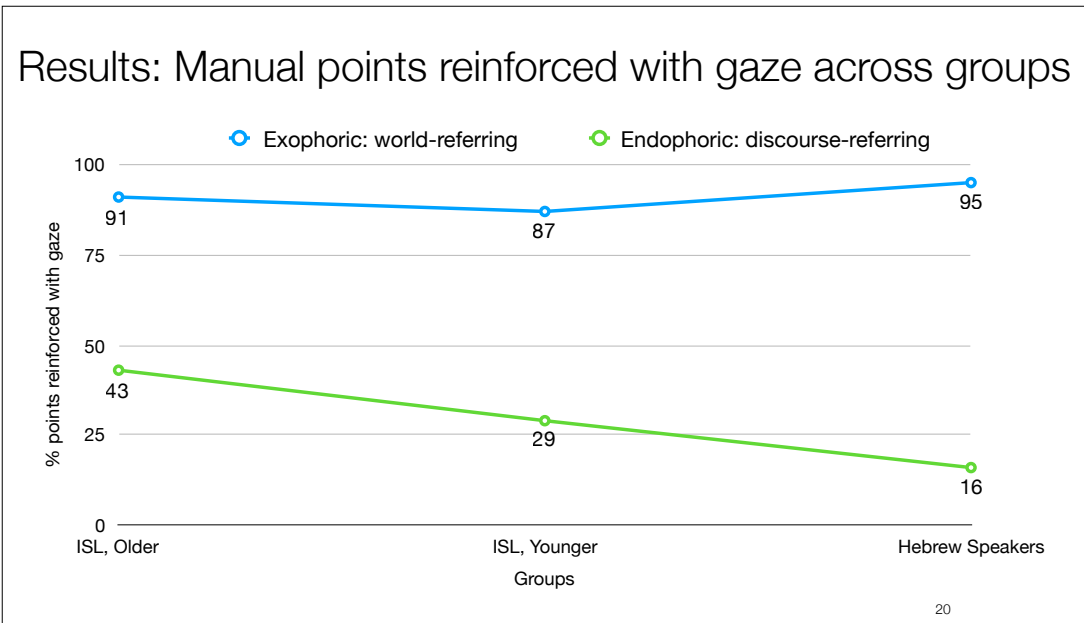
Here you can see the percentage of all points that were reinforced with gaze, for two types of points: exophoric, or world-referring, and endophoric, or discourse-referring.

On the horizontal (x) axis you can see our three participant groups: older signers, younger signers, and speakers.   On the vertical (y) axis you can see the the percentage of points that were reinforced by gaze toward the target.

First, the results for the exophoric, or world-referring points:

[Animation shows the Exophoric results for all 3 groups]

Members of all 3 groups nearly always reinforced exophoric points with gaze. This was what we anticipated, since gaze reinforcement makes it possible for these points to more precisely indicate their real-world targets.

Now the results for the endophoric, or discourse-referring points, where the participants should have no real-world target:

[Animation shows the Older Signer Endophoric result]

Older signers produce endophoric points with gaze reinforcement just under half of the time. This makes their endophoric points quite different from their exophoric ones. But even with this difference, older signers still do produce a substantial number of endophoric points with gaze reinforcement.

Our first hypothesis was that younger signers more more strongly mark endophoric points by much less gaze reinforcement than older signers.

[Animation shows the Younger Signer Exophoric result]

Results: Manual points reinforced with gaze across groups
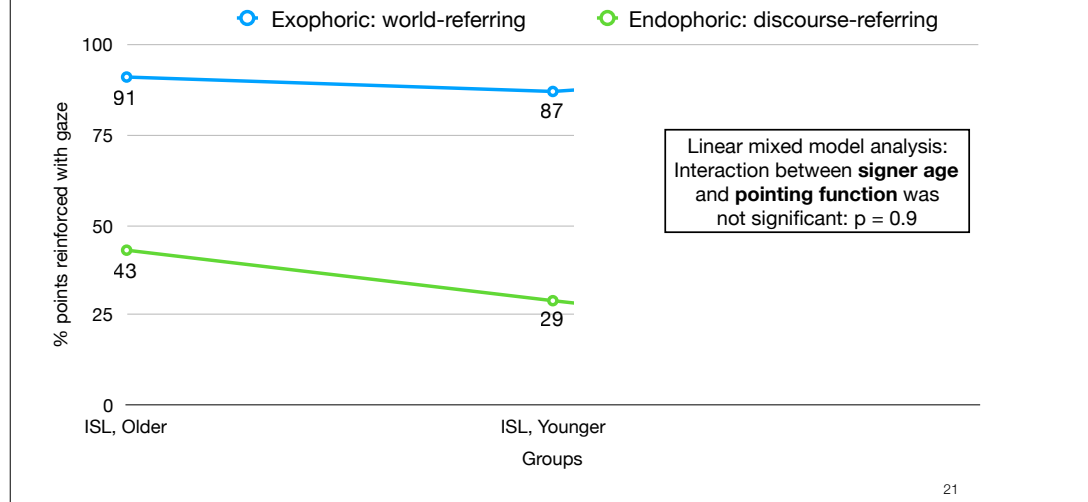
Now, we want to speak directly to the lack of significance of the effect:
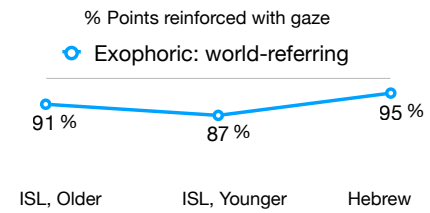We ran a linear mixed mixed model analysis to see whether the interaction between **signer age group** and **pointing functio**n would be significant. That is, we looked to see whether younger signers reinforced endophoric points with gaze significantly **less than older signers.** While we saw the trend in the dataset, the model did not find a significant interaction.

Here is what we suspect is happening here. We are still running participants for the study, and the group of people that we are calling "younger" largely contains people in their 40s, with just a few very young singers in their 20s. As we continue to run participants, our goal is to break this group down into **middle-aged signers** and **younger signers.** On the the basis of what we are seeing in the very youngest signers in our current dataset, we expect that this group will pattern much more like the gesturers, with very little gaze reinforcement on endophoric points. So, we expect that the trend we are seeing now will be strengthened, so that the interaction we are looking for will be significant. We will keep the academic community informed as we continue to run study participants!

For now we want to show you what the trend actually looks like in the behaviour of our participants.

Exophoric: gaze aligned across groups

% Points reinforced with gaze

○ Exophoric: world-referring

91 %   87 %   95 %

ISL, Older   ISL, Younger   Hebrew

Signers of all ages, as well as gesturers, overwhelmingly produced exophoric points with reinforcing gaze towards the target.

Endophoric: differences across groups
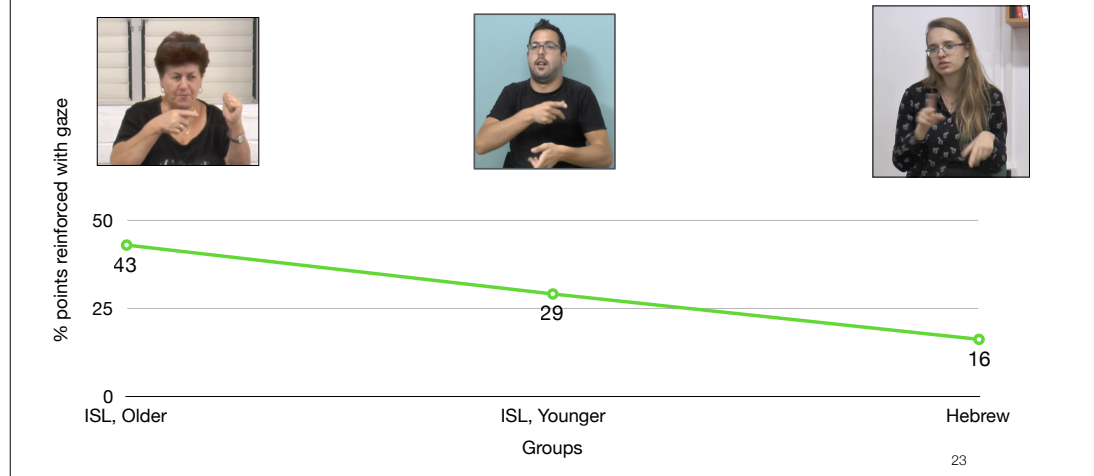
The result of interest to us concerns the endophoric points, where we saw a pattern of decreased gaze reinforcement across older signers, younger signers, and gesturers.

Endophoric: Older Signers

IX CHARLIE **IX** RUN-AWAY

'*he*, *Charlie*, *he* runs away

For endophoric points, older signers showed considerable variation. In 43% of cases, they reinforced a manual point with gaze in the same direction.

Endophoric: Older Signers

eyegaze
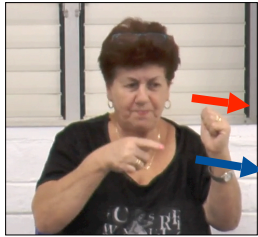
direction
of point

<u>IX</u> CHARLIE <u>IX</u> RUN-AWAY

25

Let's have a look at the video - look out for the point with gaze as you can see in this screenshot.

Endophoric: Older Signers

eyegaze

direction
of point

26

Here it is again in slow motion.

Endophoric: Older Signers

LION **IX** ASLEEP

*The lion, **it** was asleep*

27

Of course, because older signers showed so much variability there were plenty of cases in which signers produced endophoric points without gaze reinforcement.

Endophoric: Older Signers

eyegaze

direction
of point

28

I'm wondering whether we might more accurately represent the variability of the older group by including an aligned example from an older signer here. We'll remind the audience that the older group reinforced their points with gaze 43% of the time.
Then we can keep the non-aligned examples from younger signers and Hebrew speakers, reminding the audience that members of these groups were much more likely to produce points without reinforcing gaze.

Endophoric: Older Signers

eyegaze

direction
of point

29

Here it is in slow motion.

Endophoric: Younger Signers

HORSE RUN FRIGHTEN **IX** RUN WHAT
OPEN-AND-CLOSE-DOOR

The horse startles Charlie Chaplin;
he *runs and opens and slams*
the [cage] door

For endophoric points, younger signers showed a strong pattern of decoupling gaze from the manual point.

In this example, the younger signer describes a scene where Charlie Chaplin runs from a horse straight into a lion's cage. Here he places Charlie Chaplin on his left (this is the audience's right). In this example his gaze remains on the addressee while he points to Charlie's location.

Endophoric: Younger Signers

eyegaze

direction of point

31
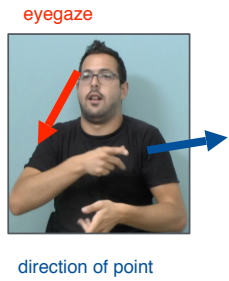
Look out again for the point shown here on the screen.

Endophoric: Younger Signers

eyegaze

direction of point

32

Here it is again in slow motion.

We found that gesturers showed a pattern of non-alignment of gaze and manual pointing, much like that of younger signers…now we'll look at an example from a gesturer.

Endophoric: Gesturers
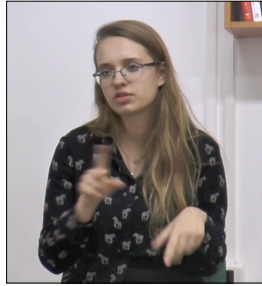
yeʃ im ha-yeled ha-ze

'there is, with that boy'
(that boy has)

Needs the Hebrew IPA transcript here.

Endophoric: Gesturers

eyegaze

direction of point

Endophoric: Gesturers

eyegaze

direction of point
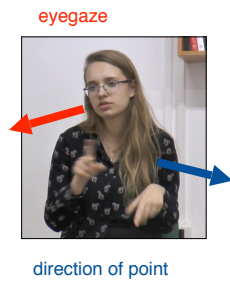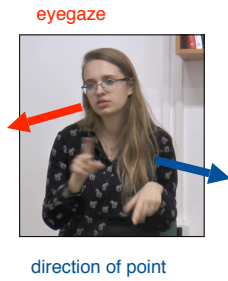
Here it is in slow motion.

Results Summary

✅ H1. As manual points take on new functions in ISL,
    signers rely less on gaze to reinforce the pointing signal

❌ H2. Gesturers, by contrast, consistently rely on gaze
    to reinforce the pointing signal

[H2]…instead, gesturers decoupled gaze from point in exophoric contexts even more than young signers.

Discussion

What accounts for the similarity between
gesturers and young signers?

For this study we formulated a hypothesis about gesturers that reflected our understanding of the Pfau & Steinbach's 2006 proposal on sign language pointing. As we understood them, Pfau & Steinbach were suggesting that gesturers feed only points with exophoric functions into the grammaticalization chain. So we created hypothesis that presumed that gesturers would have a pointing behaviour that doesn't differentiate between exophoric and endophoric pointing since these different functions wouldn't yet have conventionalised for them.

[Animation appears with "hearing non-signers…." plus refs]

But of course there is is a considerable literature on the use of pointing in gesturers that would have supported the opposite prediction. Hearing non-signers rely heavily on pointing for reference tracking—an endophoric function. **That function must have developed for gesturers, as well.**

Discussion

What accounts for the similarity between
gesturers and young signers?

Hearing non-signers *also* use points with endophoric functions

Cf. Levelt (1985); Gullberg (2006); Perniss and Ozyrek (2015)

Hearing non-signers don't point *exactly like signers*, but they
have many formal and functional similarities.

Cf. Fenlon et al (2018)

38

For this study we formulated a hypothesis about gesturers that reflected our understanding of the Pfau & Steinbach's 2006 proposal on sign language pointing. As we understood them, Pfau & Steinbach were suggesting that gesturers feed only points with exophoric functions into the grammaticalization chain. So we created hypothesis that presumed that gesturers would have a pointing behaviour that doesn't differentiate between exophoric and endophoric pointing since these different functions wouldn't yet have conventionalised for them.

[Animation appears with "hearing non-signers…." plus refs]

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Discussion

What accounts for the similarity between
gesturers and young signers?

• Both groups use
mature linguistic systems

(Cf. Meir & Sandler, 2008; Dachkovsky, 2018;
Dachkovsky, Stamp & Sandler, 2018)

39

What gesturers and young signers have in common is a full linguistic system.

We have much evidence from other studies (cite Sveta's dissertation, our Frontiers paper, and Meir & Sandler book) that older signers' ISL is not yet fully systematic and conventionalized, and that the language is in a state of flux. We have shown that the interaction between a fully conventionalized language and point/gaze is an important area for future research in both modalities.

Summary

- In ISL, gaze increasingly decouples from endophoric (discourse-referring) points.

- This provides 2 kinds of evidence that indicating expressions are **grammaticalizating** in the language:

  - Semantic bleaching of the point's real-world-space referring component

  - Reduction in the form of the pointing

- …and it makes young signers look **more like** Hebrew speaking gesturers, who also use a **mature linguistic system**

Thank you:
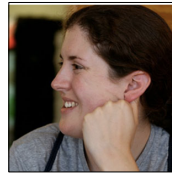
*Wendy Sandler,
Svetlana Dachkovsky,
Rose Stamp*
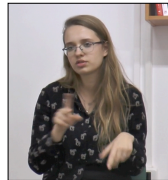
*ISL signing and Hebrew
speaking participants*

References

Carpenter, M., Nagell, K., & Tomasello, M. (1998). Social cognition, joint attention, and communicative competence from 9 to 15 months of age. Monographs of the Society for Research in Child Development, 63(4), 1–143.

Clark, H. H. (1996). Using Language. Cambridge: Cambridge University Press.

Clark, H. H. (2005). Coordinating with each other in a material world. Discourse Studies, 7(4–5), 507–525.

Cooperrider, K., Slotta, J., & Nuñez, R. (2018). The Preference for Pointing With the Hand Is Not Universal. Cognitive Science, 42(4), 1375–1390.

Dachkovsky, S., Stamp, R., & Sandler, W. (2018). Constructing Complexity in a Young Sign Language. Frontiers in Psychology, 9. DOI: 10.3389/fpsyg.2018.02202

Diessel, H. (1999). Demonstratives: Form, function and grammaticalization. Amsterdam: John Benjamins.

Diessel, H. (2005). Distance contrasts in demonstratives.

Fenlon, J., Cooperrider, K., Keane, J., Brentari, D., & Goldin-Meadow, S. (2019). Comparing sign language and gesture: Insights from pointing. Glossa: A Journal of General Linguistics, 4(1), 2. DOI: http://doi.org/10.5334/gjgl.499

References

Fillmore, C. J. (1982). Towards a Descriptive Framework for Spatial Deixis. Speech, Place and Action: Studies in Deixis and Related Topics, 31–59.

Fricke, E. (2014). 136. Deixis, gesture, and embodiment from a linguistic point of view. In C. Müller, A. Cienki, E. Fricke, S. Ladewig, D. McNeill, & J. Bressem (Eds.), Handbooks of Linguistics and Communication Science (HSK) 38/2. Berlin, München, Boston: De Gruyter.

Gullberg, M. (2006). Handling discourse: Gestures, reference tracking, and communication strategies in early L2. Language Learning, 56(1), 155–196.

Heine, B., & Kuteva, T. (2002). World Lexicon of Grammaticalization. Cambridge: Cambridge University Press.

Labov, W. (1963). The Social Motivation of a Sound Change. WORD, 19(3), 273–309. Levelt, W., Richardson, G., & Heij, L. W. (1985). Pointing and voicing in deictic expressions, 24(2), 133–164.

Levinson, S. (2004). Deixis. In L. Horn (Ed.), The handbook of pragmatics (pp. 97–121). Oxford: Blackwell.

Meir, I., & Sandler, W. (2013). A Language in Space: The Story of Israeli Sign Language. Psychology Press.

References

Perniss, P., & Özyürek, A. (2015). Visible Cohesion: A Comparison of Reference Tracking in Sign, Speech, and Co-Speech Gesture. Topics in Cognitive Science, 7(1), 36–60.

Pfau, R., & Steinbach, M. (2006). Modality-independent and modality-specific aspects of grammaticalization in sign languages. Potsdam: Universitätsverlag Potsdam.

Pfeiffer, T. (2010). Understanding Multimodal Deixis with Gaze and Gesture in Conversational Interfaces. Doctoral Dissertation, University of Bielefeld, Bielefeld, Germany.

Sankoff, J. (2018). Language Change Across the Lifespan. Annual Review of Linguistics, 4, 297–316.

Shaffer, B., & Janzen, T. (2000). Gesture, lexical words, and grammar: Grammaticalization processes in ASL. Proceedings of the Annual Meeting of the Berkeley Linguistics Society, 26(1), 235–245.

Wilcox, S. (2005). Routes from gesture to language. Revista Da Abralin, 4(1/2), 11—45

Wilcox, S. (2009). Symbol and symptom: Routes from gesture to signed language. Annual Review of Cognitive Linguistics, 7(1), 89-110.