The influence of the visual modality on language structure:
Insights from sign language and gesture

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The visual modality

- *Communicative expression* in the visual modality
- Meaningful bodily action
- Hands and body as articulators in a visible space

- Two main types
  - Sign language
  - Co-speech gesture
- Integral to and constitutive of language

Communicative expression in the visual modality

- **Sign languages**
  - Natural languages that emerge within Deaf communities
  - Share linguistic properties with spoken languages on all levels
  - Process of native language acquisition parallel to spoken language
  - Neural substrates of language processing similar to spoken language
- **Co-speech gesture**
  - Ubiquitous, unwitting accompaniment to speech
  - Semantically and temporally integrated with speech
  - Not interpretable without speech

- Sign and gesture are notably different in communicative function, but share modality of expression

Affordances of the visual modality

- High degree of **iconicity**
  - Use of space and hands to create forms that resemble objects/events in visible environment
  - Object shape, location, motion

- Directly (=literally) **embodied** representation
  - Use of body to depict bodily experience
  - Action, movement, affective displays

Iconic and embodied representation for…

…in both sign and gesture

…with shared systems across sign languages

Shared systems:
Classifiers – Classifier predicates

- Handshape represents whole referent (entity) or manipulation (handling) of referent
- Placement/movement in space encodes location, motion, action information

Flat objects

Long/thin objects

Curved objects (handling of curved objects)

Classifier predicates

Canonical structure of locative expression in sign languages

TABLE
table
(Ground)

CUP
(Figure)

cup-on-

Ground before *Figure* (cf. drawing)

Classifier predicates encode referent location

Simultaneous representation of referents

Similarity of expression across sign languages

- The iconic and embodied affordances of the modality assumed to create similarity of expression across different sign languages (e.g. Aronoff et al. 2003)
  - Relative uniformity between sign languages in range of domains that rely on use of space and body (Meier 2002; Sandler & Lillo-Martin 2006)
  - In contrast to vast diversity of encoding in spoken languages in spatial domains (e.g. Levinson & Wilkins 2006; Strömqvist & Verhoeven 2004)

Similarity of expression between sign and gesture

- The iconic and embodied affordances of the modality also motivates assumptions of similarity between sign and gesture
  - Gestural (imagistic) nature of sign language structures that use space and body to depict visual-spatial-action information (e.g. Liddell 2003)

But…

- Relatively little empirical investigation in these domains
  - Few comparative studies between sign languages in spatial and action domains
  - Few comparative studies between sign and gesture in spatial and action domains
- Cross-linguistic comparison is usually cross-modal comparison, i.e. sign-spoken comparison
  - Sign-spoken comparison needs to be speech and gesture compared to sign

Language-specific variation (typology effects)

- Sign language typology is a relatively young field
- Typological variation in sign languages (Perniss, Pfau & Steinbach 2007; Pfau & Steinbach 2006; Zeshan 2004; Zeshan & Perniss 2008)
  - Possession, Existence, Interrogatives, Negation, Auxiliaries, Word order, Plurals
- Investigation has been in domains arguably less directly influenced by iconic and embodied affordances of the visual modality
  - More sign-spoken than sign-sign comparison (e.g. typology of motion event encoding, Galvan & Taub 2006)

What I will focus on today

1. Cross-linguistic investigation of two sign languages
   - German Sign Language (*Deutsche Gebärdensprache,* DGS)
   - Turkish Sign Language (*Türk Isaret Dili,* TID)

2. Cross-linguistic and cross-modal investigation of sign and spoken (+gesture) languages
   - German Sign Language (*Deutsche Gebärdensprache,* DGS) and German (speech and co-speech gesture)
   - Turkish Sign Language (*Türk Isaret Dili,* TID) and Turkish (speech and co-speech gesture)

Why DGS and TİD?

- Historically unrelated
- Similarities in historical and sociolinguistic situation
  - Compulsory deaf education since begin of 20th century
  - Oral tradition in deaf schools
- Typological distinctness of surrounding spoken languages (German and Turkish)
  - Similarities between DGS and TİD through language contact with spoken languages less likely
  - Similarities from co-speech gesture (known to be influenced by linguistic structure, Kita & Özyürek 2003) less likely
- Familiar and accessible to us!

Why German and Turkish

- Typologically distinct languages in terms of motion event encoding
  - German: satellite-framed
  - Turkish: verb-framed
- Assume differences in speech and co-speech gesture in encoding of motion events
- Familiar and accessible to us

Study 1:
Do the iconic and embodied affordances of the visual modality shape different sign languages in the same way?

Domain of spatial representation (locative expression)

Perniss, Zwitserlood & Özyürek 2015, *Language*

Data collection: Participants

- German Sign Language (DGS)
  - 12 signers (9 native, 3 early)
  - Data collected in Aachen and Essen, Germany
- Turkish Sign Language (TİD)
  - 12 signers (all native)
  - Data collected in Izmir, Turkey

Data collection: Picture descriptions

- Photographs of (topologically non-contrastive) Figure-Ground and Figure-Figure relationships
- Different objects (cups, plates, pens, boats, birds)
- Different number of tokens (1, 2, 3-4) of each object
- Discourse context

Questions

- Do we find language-specific differences between DGS and TİD in locative expression?
- Focus on features of spatial expression assumed to be particularly shaped by affordances of visual modality (and thus similar across sign languages)
  - *Entity*, *location* and *spatial relationship* representation
- Semantic specificity of forms encoding these features
  - *Entity:* Iconic vs. generic
  - *Location:* Relative location (e.g. distance between referents)
  - *Spatial relationship:* Simultaneous vs. non-simultaneous

Coding and analysis

- Analyzed expressions that contained:
  - Explicit mention of Ground (e.g. table)
  - Localisation of Figure objects (e.g. cup)
- Coded for:
  - Entity representation (localisation devices)
  - Location representation
  - Representation of spatial relationship

DGS

TABLE
cup-next-to-cup
(Ground)

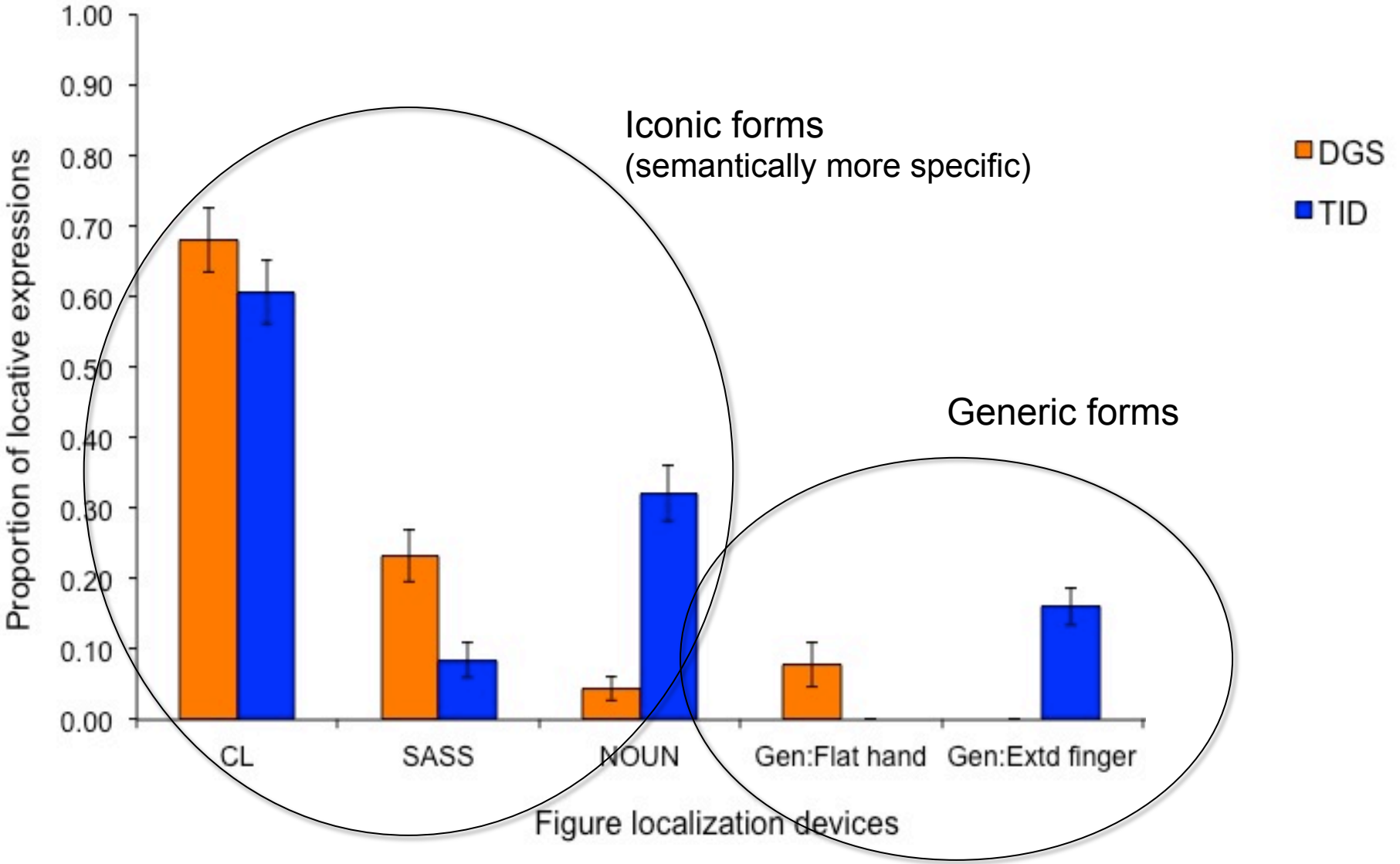
CUP

cup-on-table

(Figure)

DGS

Results: Localisation devices (entity representation)

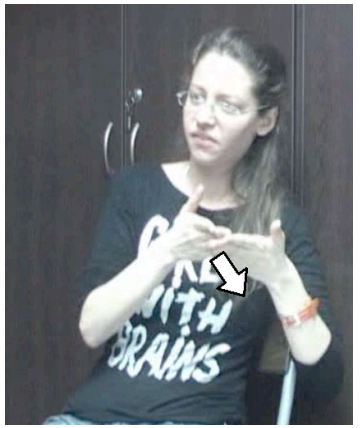


SASS = Size and Shape Specifier

TİD

Noun localisation

TİD



Noun

CL localisation

TİD

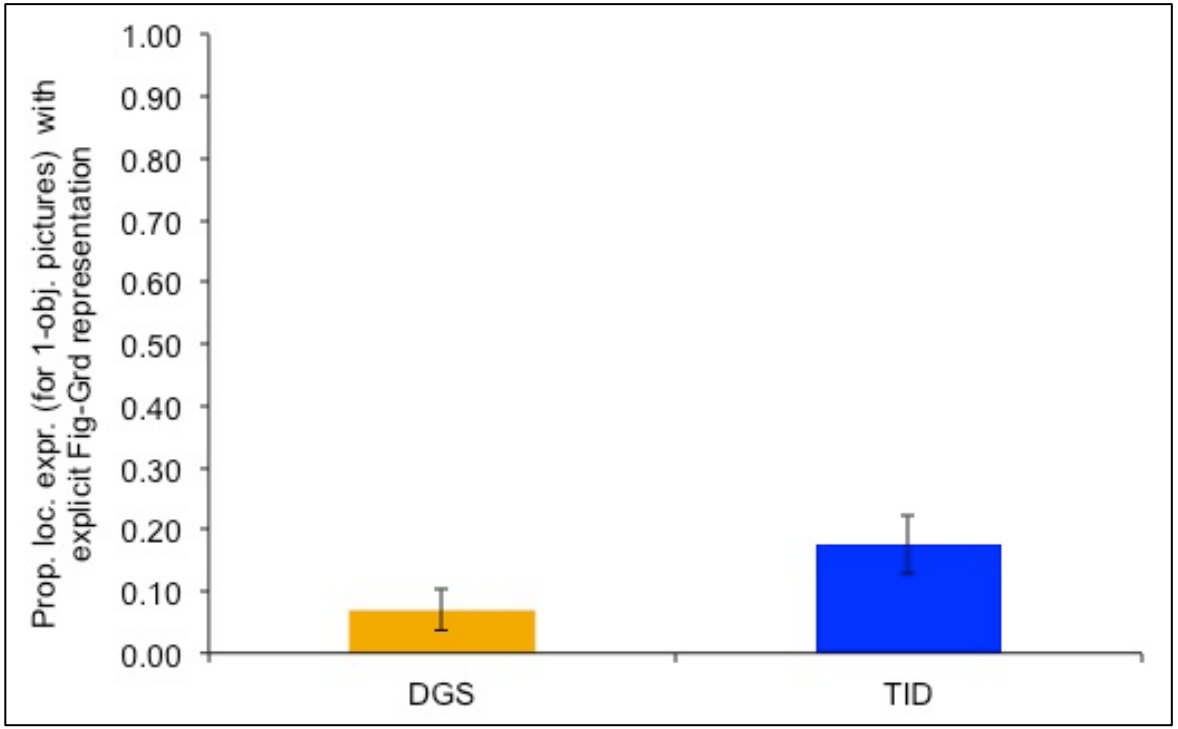
TİD generic form

- Abstracts from referent shape
  - Extended finger used for all referents
- Abstracts from location
  - Distance between fingers (finger=referent) doesn't represent relative distances
- Highlights *next-to* relationship

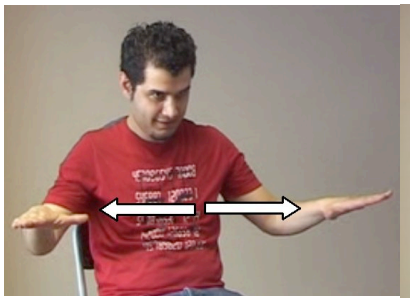
DGS generic form

- Abstracts from referent shape
  - Flat hand used for all referents
- Relative distance can be represented
  - Distance between locations marked by hand (hand=referent) can be modulated
- Highlights *next-to* relationship

Simultaneous referent representation:
Figure-Ground (*on* relationships), 1 figure only

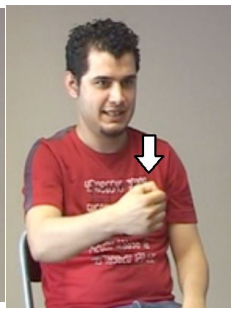


TİD



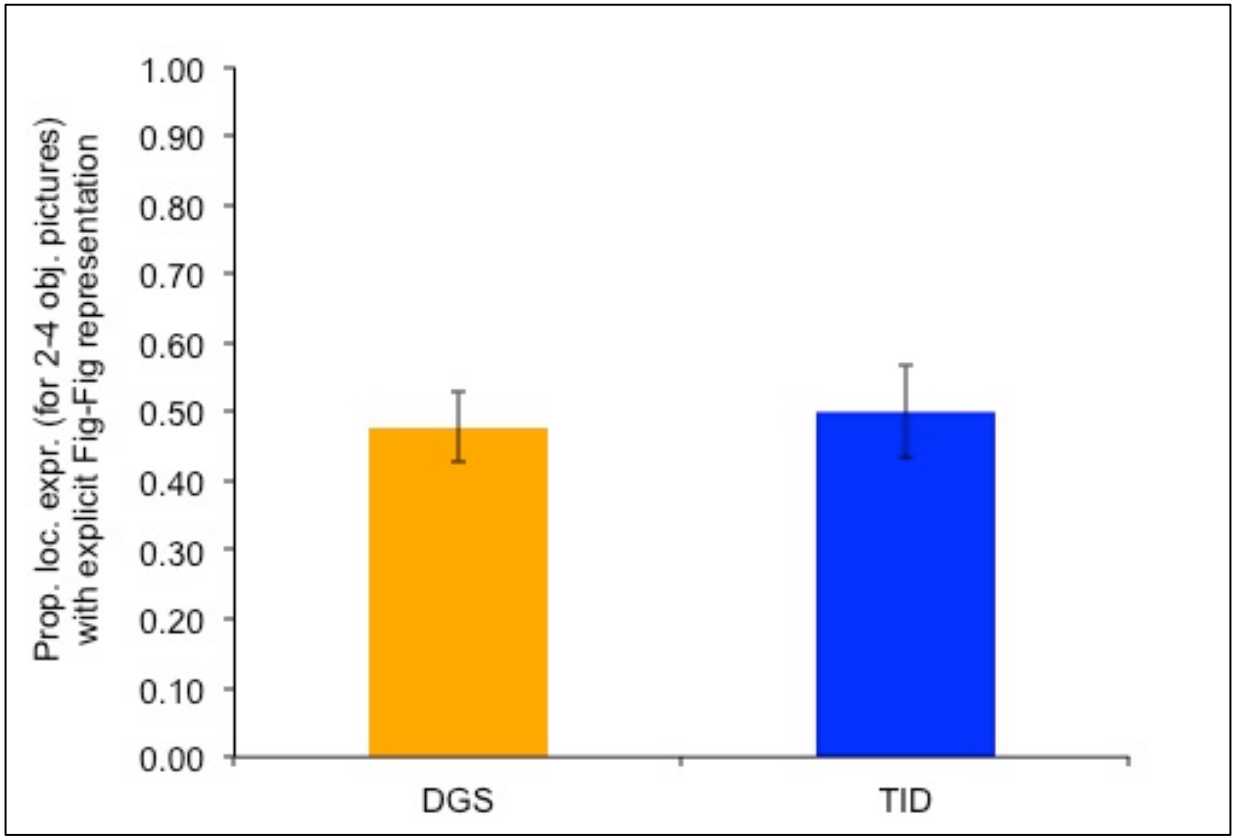
TABLE

CUP



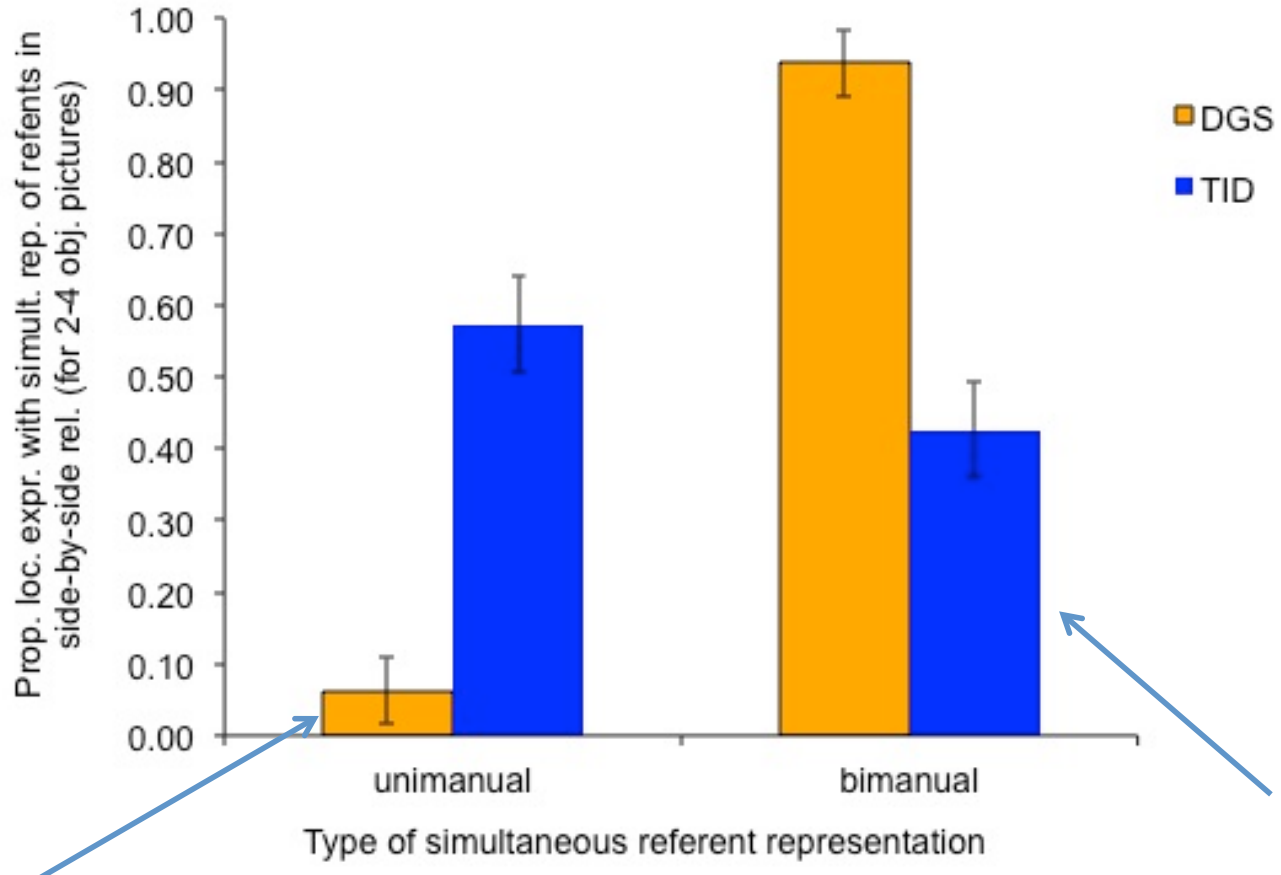
cup-(on-table)

Simultaneous referent representation:
Figure-Figure (*next-to* relationships), 2-4 figures



TİD

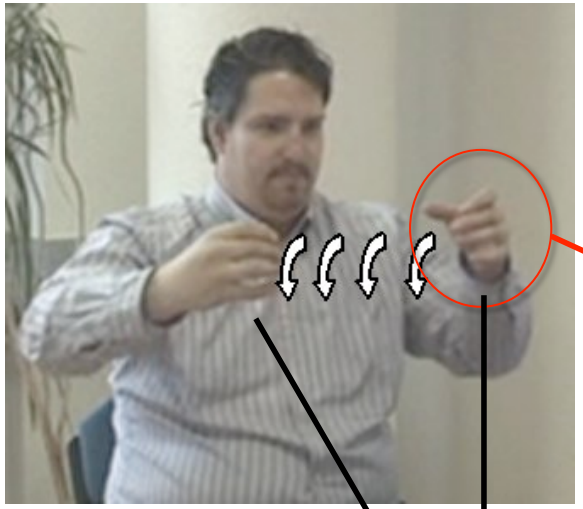
What did simultaneous referent representation look like?



Only for *pens* (long, thin objects), i.e. plural classifier form

only for 2-Figure pictures

DGS bimanual form



Anchor hand:

Encodes the *next-to* relationship

Entity classifier handshape

Curved objects

Semantically specific about entity and about spatial relationship

TİD unimanual form

LH:
RH: CUP FOUR **CL(cup).locC1**

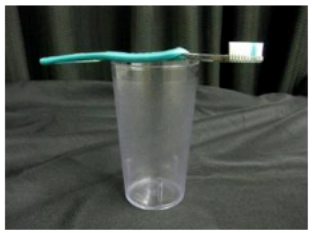
LH:
RH: **CL(cup).locC2** **CL(cup).locC3** **CL(cup).locC4** NEXT-TO-4-LoC

Summary

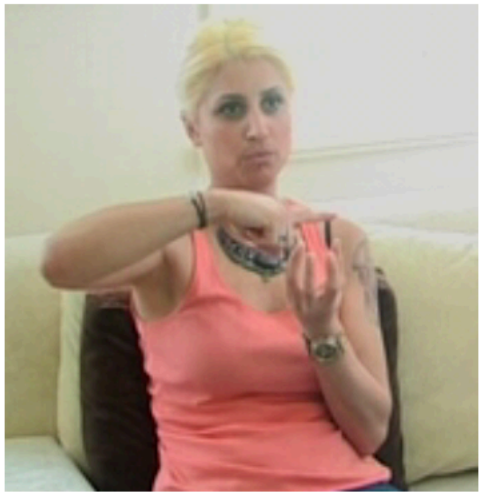
- Iconic affordances differentially shape spatial language in different sign languages
  - Iconic affordances not exploited in same way or to same degree
- Different preferences (noun sign vs. SASS) for same available devices
- Little use of simultaneity for direct representation of Figure-Ground *on* relationship
- Language-specific ways of encoding (highlighting) semantic feature *next-to*-ness

Why is simultaneity so rare for Figure-Ground *on* relationships?

- Typicality of spatial relationships may affect use of simultaneity to encode *on* relationships



TID

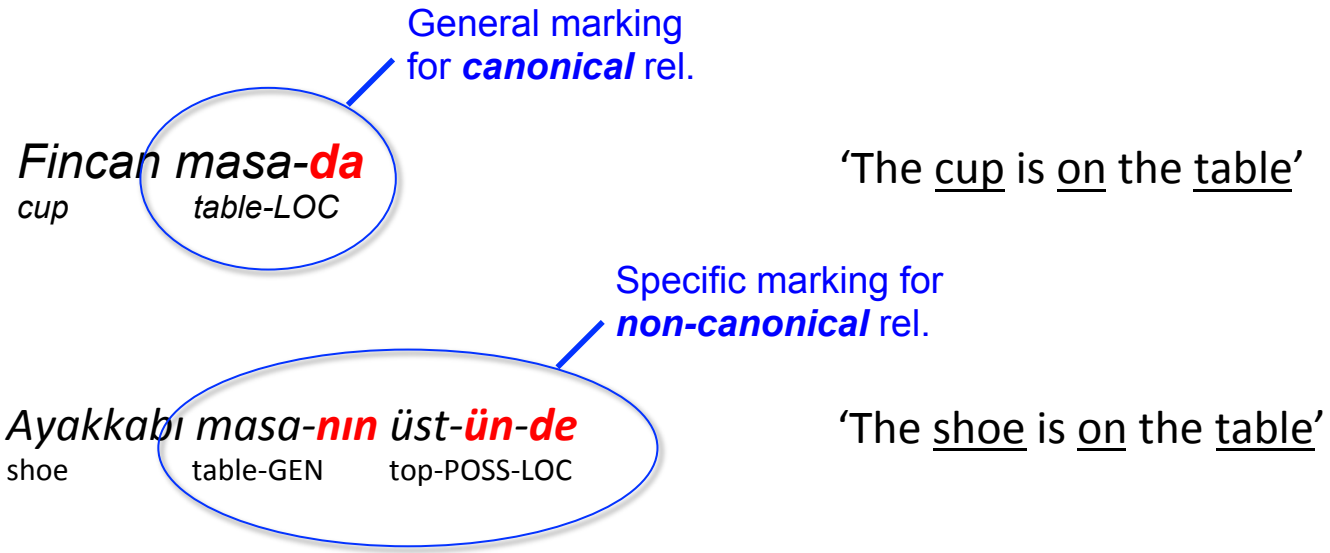


- Influence of semantic/pragmatic constraints on how iconic affordances are exploited

Why is simultaneity so rare for Figure-Ground *on* relationships?

- Similar to semantic/pragmatic constraints on encoding of spatial relationships in some spoken languages

E.g. Turkish:



Summary

- Iconic affordances differentially shape spatial language in different sign languages
- Iconic affordances not always exploited
- Language-specific ways of encoding semantic features of spatial relationship (SIDE-BY-SIDE-ness)

DGS

TID

Study 2:
Do the iconic and embodied affordances of the visual modality shape

- different sign languages in the same way?
- sign and gesture in the same way?

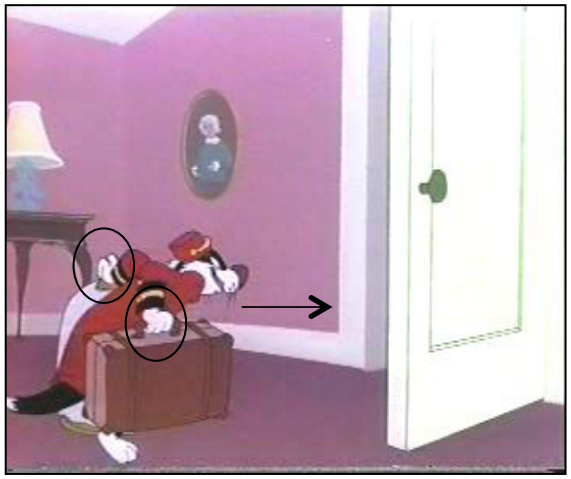
Event representation
(caused motion)

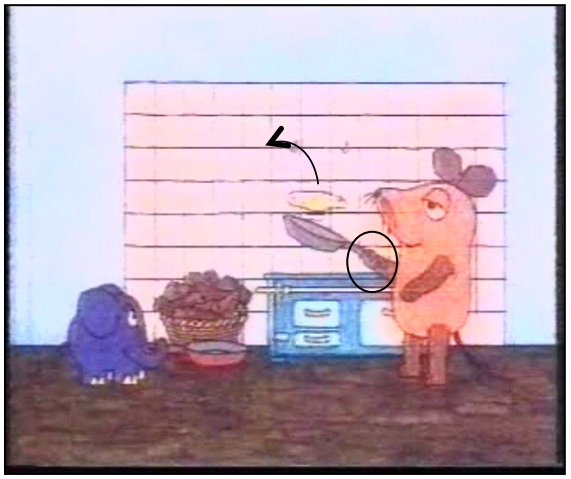
Perniss & Özyürek, in preparation

Data collection: Participants

- German Sign Language (DGS)
  - 12 signers (9 native, 3 early)
  - Data collected in Aachen and Essen, Germany
- Turkish Sign Language (TİD)
  - 12 signers (all native)
  - Data collected in Izmir, Turkey
- German
  - 12 native speakers
  - Data collected in Frankfurt (Oder)
- Turkish
  - 12 native speakers
  - Data collected in Istanbul, Turkey

Data collection: Event narration





- Cartoon clips from *Canary Row* and *Die Sendung mit der Maus*
- Focussed on 6 caused motion events, where motion caused by manual action (manner of handling)
- Clips were narrated to addressee, who then re-narrated

Questions

- Do the iconic and embodied affordances of the visual modality drive similarity of expression in this domain?
  - Between sign languages?
  - Between sign and gesture?
- How does difference in spoken languages impact?
  - Satellite-framed vs. verb-framed languages (Talmy 1985)
  - Influence of spoken language structure on gestural representation (Kita & Özyürek 2003)
  - Gesture as a substrate of sign language structure (Wilcox et al. 2010)

Coding and analysis

- Encoding in visual modality (sign and co-speech gesture)
  - **Both** action and motion components expressed
    - Separate forms (segmented)
    - Single form (conflated)
  - Only **one** component expressed (Action only or Motion only)

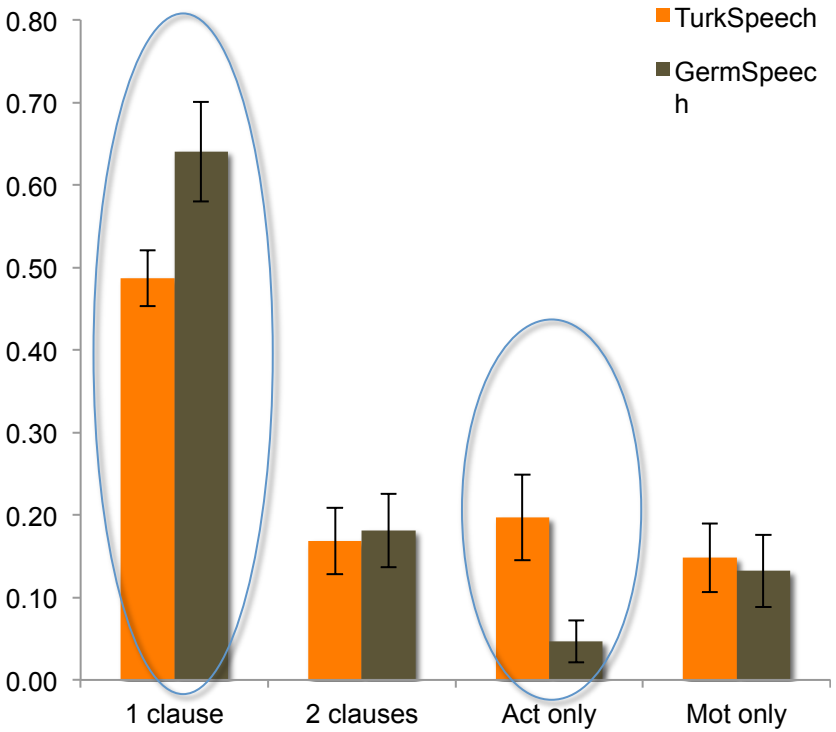
- Encoding in speech
  - **Both** action and motion components expressed
    - 2 clauses
    - 1 clause
  - Only **one** component expressed (Action only or Motion only)

Predictions

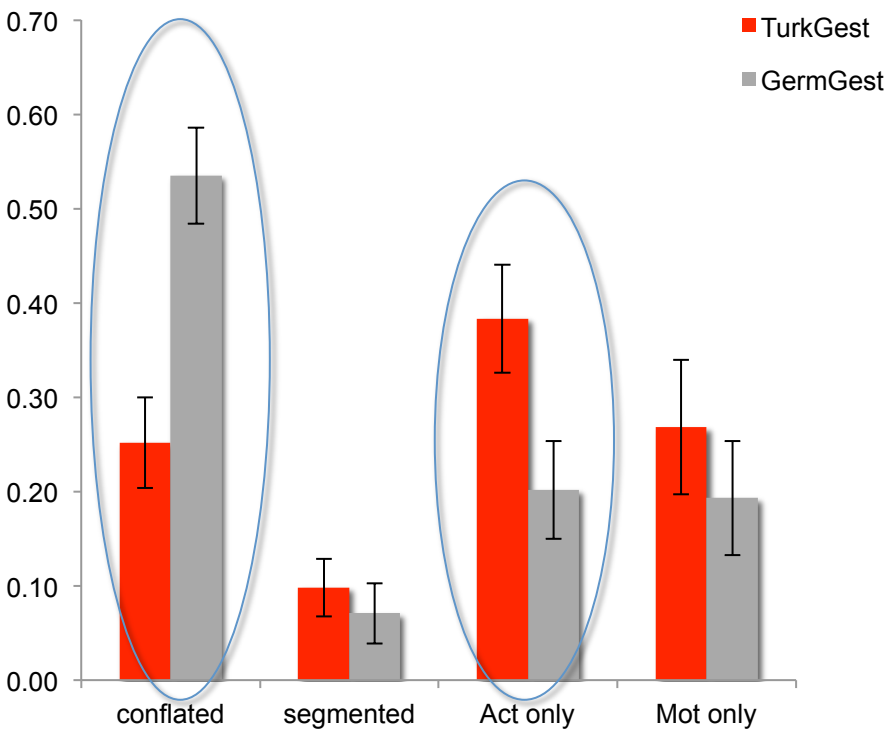
- **Spoken languages**
  - German is satellite-framed (like English; e.g. *to roll down*); Turkish is verb-framed (e.g. *to descend rolling*) (Talmy 1985)
  - ➢ Expect single clause expression of components in German; expect two clause expression in Turkish (Kita & Özyürek 2003)
- **Co-speech gesture**
  - Influenced by typological structure of speech (Kita & Özyürek 2003)
  - ➢ Expect conflation of components into single gesture in German co-sp. gesture; expect separate gestures in Turkish co-sp. gesture
- **Sign languages**
  - (Iconic) mappings must be clearly interpretable (Singleton et al. 1996) and shared spatial system predicts similarity in event packaging and linguistic structure (Benedicto & Brentari 2004; Schembri et al. 2005)
  - ➢ Expect separation of components in both German and Turkish sign languages

Results: Speech and Gesture

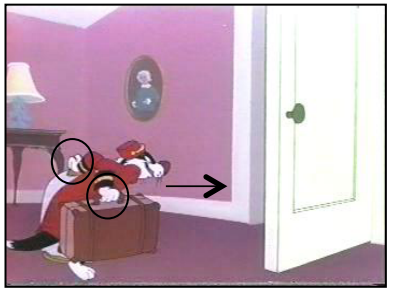
SPEECH



CO-SPEECH GESTURE



Examples: Differences in co-speech gesture



German co-speech gesture

Conflated action/motion representation

Turkish co-speech gesture

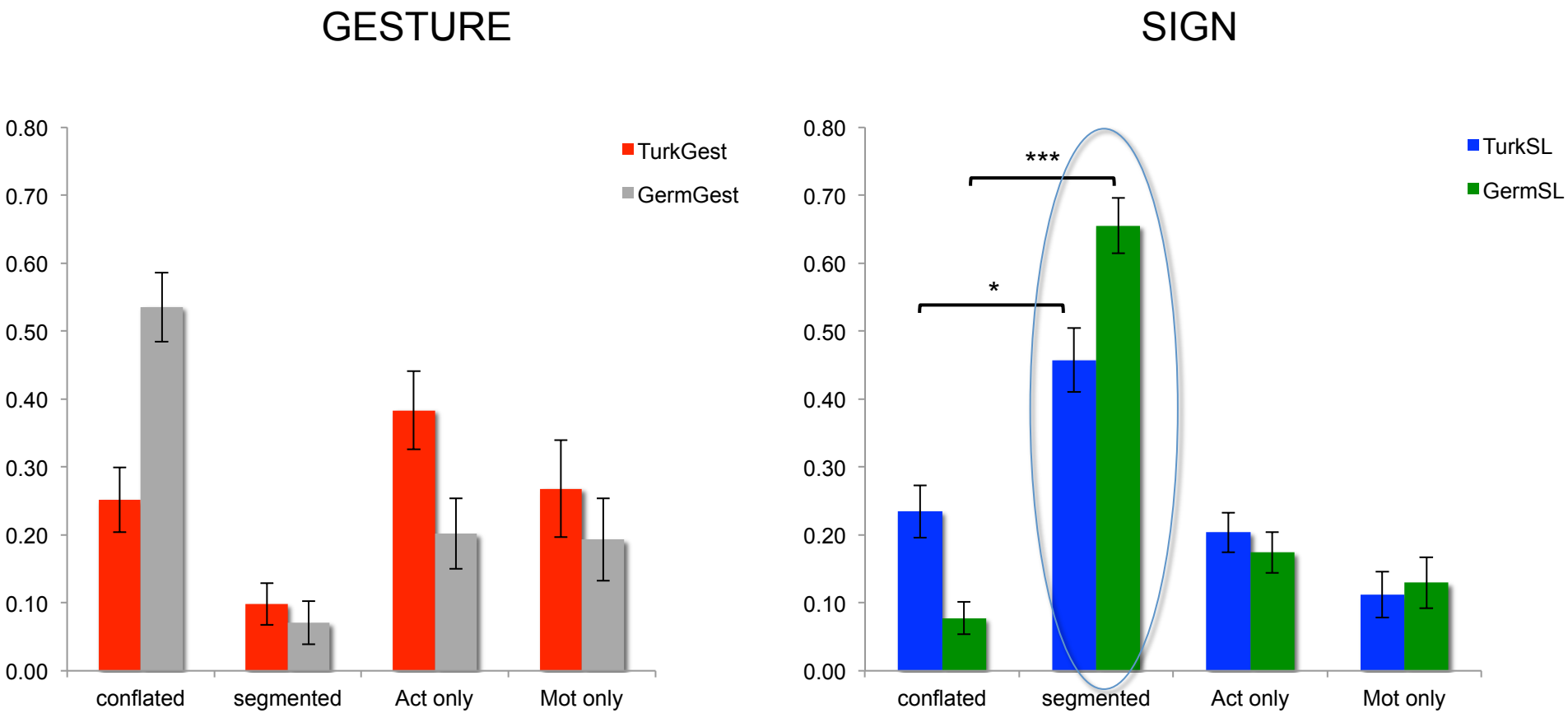
Action only representation

VIDEO EXAMPLES

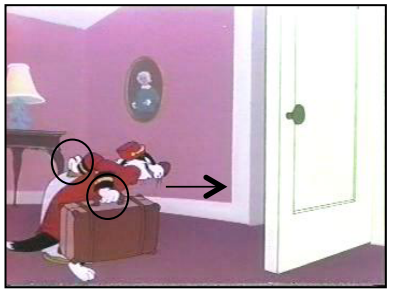
Speech: *und [nimmt die beiden Sachen mit]*
and takes the two things away-with

[heyecanlı bi şekilde alip onları], gidiyo, sonra [dışarı] çıkıyo.
excited in a way takes them, goes, then out exits

Results: Sign and gesture



Examples: Similarity between SLs



German SL

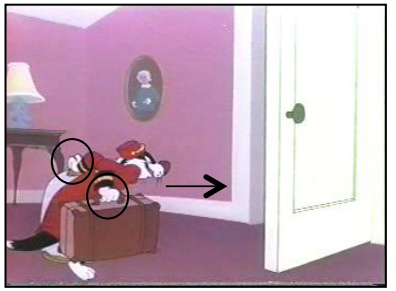
Segmented action/motion representation

Turkish SL

Segmented action/motion representation

VIDEO EXAMPLES

Examples: But also differences…



Turkish SL

Conflated action/motion representation

VIDEO EXAMPLE

Summary

- **Spoken languages**
  - German speech exhibits expected single clause pattern
  - Turkish speech exhibits variable encoding, unlike expected pattern (cf. Furman 2012), but still different from German
- **Co-speech gestures**
  - German co-sp. gesture conflation pattern follows speech pattern
  - Turkish co-sp. gesture encodings more likely to focus on just one component
- **Sign languages**
  - Overall similarity in encoding, and different from the surrounding co-sp. gestures (no evidence for gesture as substrate on this level)
  - Likely to represent both components, and in segmented way (consistent with expected constraints on iconic representation)
  - Possible typological variation in preference for conflation vs. segmentation pattern (beyond expected constraints on iconic representation)

Discussion

- Iconic and embodied affordances of the visual modality differentially modulated depending on whether the modality is used within a one-channel (sign) or a two-channel (gesture) system

- How does nature of one-channel vs. two-channel system shape expression?

Co-speech gesture: Two channels

- Spoken language communication spreads information across two channels – speech (vocal) and gesture (visual)
  - Speech is dominant channel and carries primary burden of semantic encoding
  - Gesture representations shaped by semantic and temporal matrix provided by speech
- Gestures iconic with aspects of the event, but need not be veridical representations (i.e. ambiguity is tolerated)
- Gestural representations influenced by linguistic packaging of event information in speech (cf. Interface Model, Kita & Özyürek 2003)
  - Gestures conflating action and motion predominantly co-occur with predicates like *rüberschwingen* (to swing across) or *rausnehmen* (to take out)

Sign: One channel

- Signed language communication uses one channel (visual) for expression
  - Visual channel assumes full duty of expression
  - Visual expression not constrained by alignment with another channel (speech)
- Iconic mappings (and reference in general) must be clearly interpretable (i.e. ambiguity not tolerated) (cf. Singleton et al. 1996)
  - Separation of action and motion components driven by one-channel visual language system
  - Motivates linguistic constraints, e.g. transitive/intransitive alternation of entity and handling classifier predicates (Benedicto & Brentari 2004)
- Independence of channel means individual iconic and embodied representations have time/freedom to unfold

Discussion

- Modality effects have been generally characterized as
  - Sign language vs. spoken language
  - Resulting from fact that sign language motion/action encoding is “gestural” in nature (due to shared affordances of the visual modality)

- Full understanding of modality effects requires
  - Comparison across different systems of expression – sign, speech, co-speech gesture
  - Understanding how representation is influenced by constraints on modality (visual vs. vocal; unimodal vs. bimodal system) and typology (linguistic patterns)

Understanding modality and typology effects

- Comparison across different systems of expression – sign, speech, co-speech gesture
- Understanding how representation is influenced by factors relating to modality and typology
  - Visual vs. vocal modality
  - Unimodal vs. bimodal system
  - Integration of linguistic and non-linguistic expression in visual system
  - Range of linguistic patterns
  - Influence of (language-specific) semantic/pragmatic constraints

Conclusion

- Iconic and embodied affordances of modality play strong role in shaping expression
  - Sign languages map space to space, form to form, body-part to body-part
- Sign languages may display more diversity in spatial language than has been previously assumed (and in a way more comparable with diversity found in spoken language)
  - Forms differing in semantic specificity
  - Language-specific forms
  - Different preferences in use of shared devices
- Maybe less diversity with embodied representation (where body movement needs to be interpreted)

Thanks for your attention!

University of Brighton

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