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Multimodal cue usage in beginning conversational dyadic exchanges across child development



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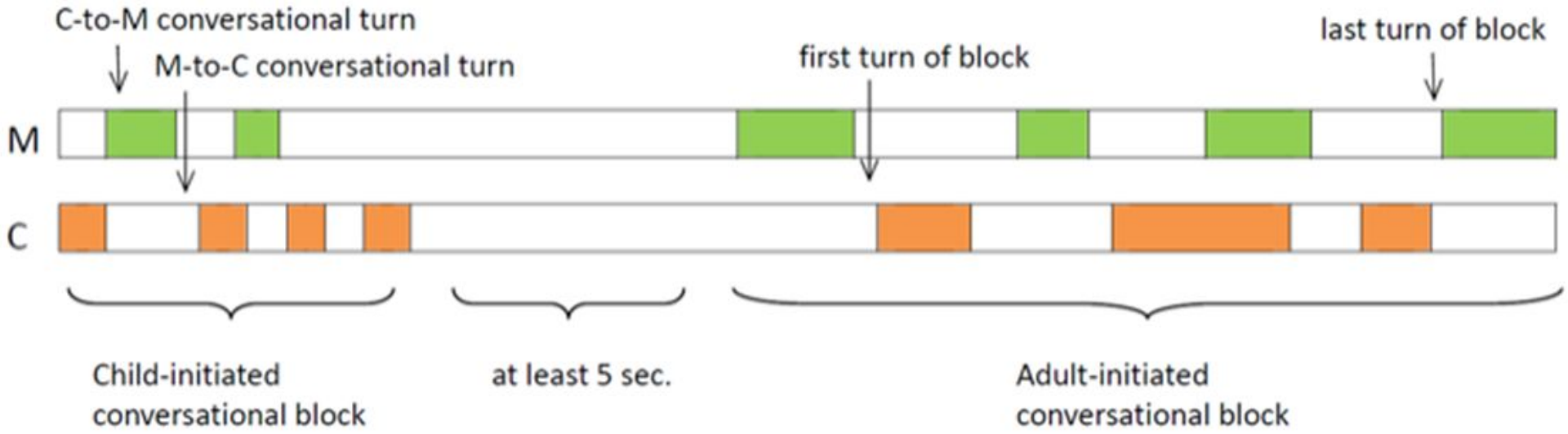
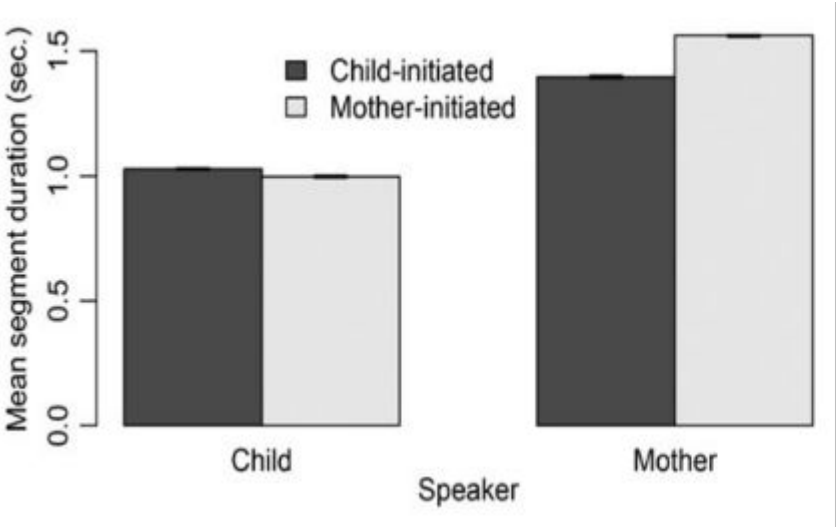
Background: Patterns in conversational interactions

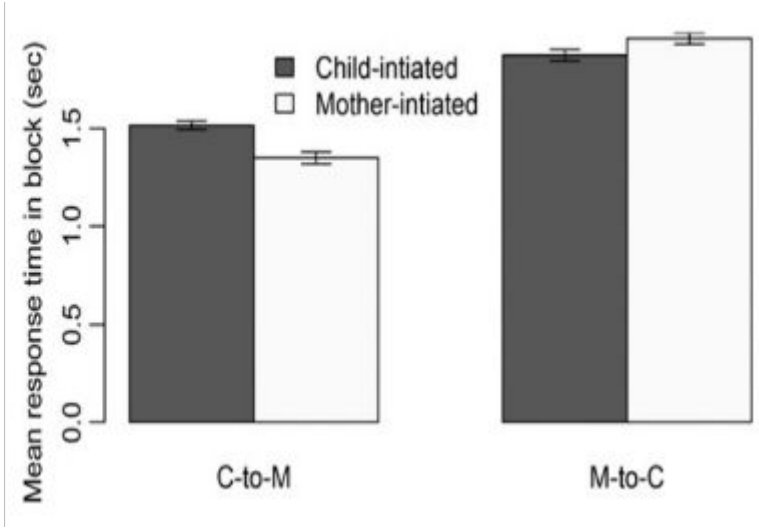
- Capturing children's linguistic environment using the LENA system.
- Automated analysis of the day-long recordings.



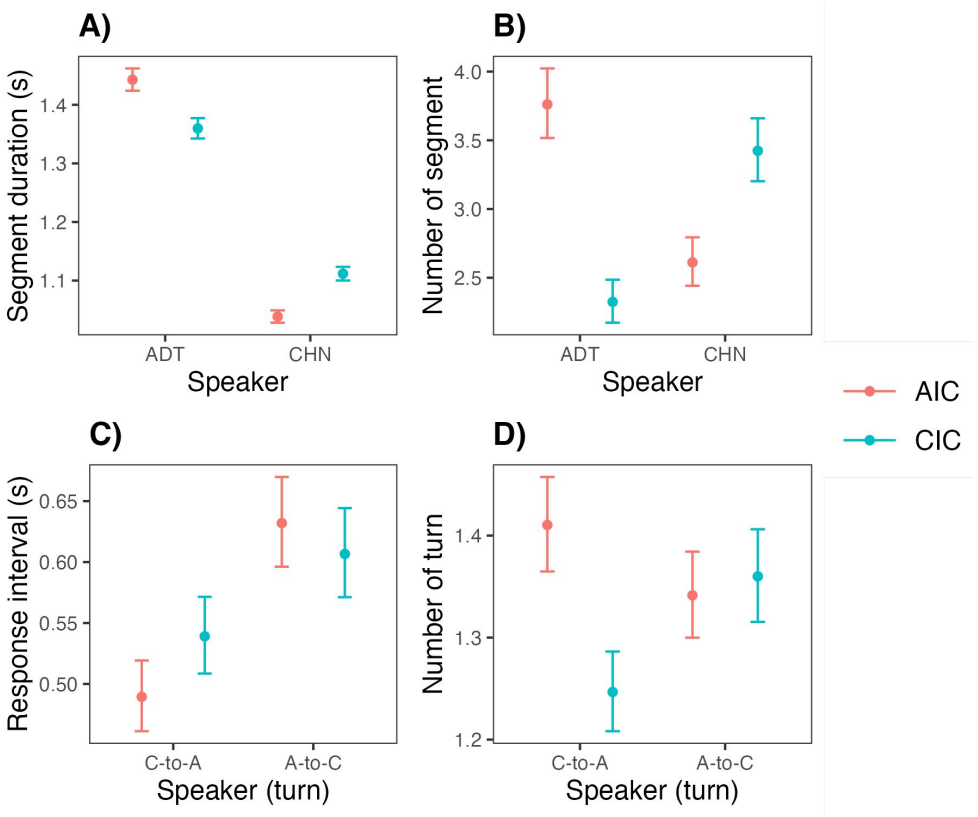
The initiator effect in English-speaking dyads (Ko et al., 2016)

- Mother-child dyads including toddlers aged 12 to 30 months
- Speakers are more active in their own-initiated block.
    - Greater segment duration and shorter response time in their own initiated conversation blocks.





The initiator effect in Korean-speaking dyads (Chai et al., in review)



- **Participants**: 228 daylong LENA recordings from 141 Korean adult-child dyads
- **Age range**: 7 to 30 months (M = 13.84, SD = 7.05 months)
- **Replication of the initiator effect**:
  - Significant interactions in Speaker:Block Type and Turn:Block Type.
  - **Heightened engagement** in **self-initiated** conversations by both the adult and the child.

...some thought-provoking questions

“Do we always initiate an interaction verbally?”

“If initiating the interaction with non-verbal cues, would the pattern vary according to child development?”

"What role do touch, gestures and facial expressions play in the early stages of language development?"

Social-interactionist theory (Lev Vygotsky; Jerome Bruner)

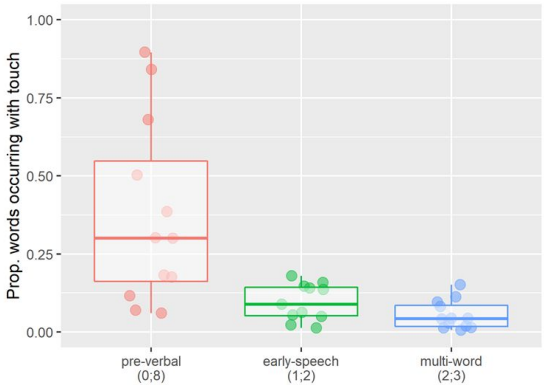
- Emphasizes the role of **direct contact** and **communication** with others in language learning
- The use of **multimodal** cues facilitates **language acquisition** in children
    - Combining **verbal** input with **visual and gestural** cues (Bruner, 1983)
    - Temporal synchrony in **verbal** and **gestural** communication during interactions (Gogate et al., 2000; Vigliocco et al., 2020).

The role of multimodal cues in language development

- **Eye gaze and joint attention**:
  - Crucial for language development in infants (Çetinçelik et al., 2021; Csibra, 2010; Gredebäck et al., 2010; Yu & Ballard, 2007)
  - Establishes joint attention, sharing focus on objects/events
- **Multimodal cues**:
  - Involve gaze, gestures, and visual, auditory, and tactile cues (Tomasello, 1988; Mundy & Newell, 2007;Abu-Zhaya et al., 2017; Ko et al., 2023)
  - Aid in learning abstract language rules and developing sustained attention

Multimodal cue usage in parents and children

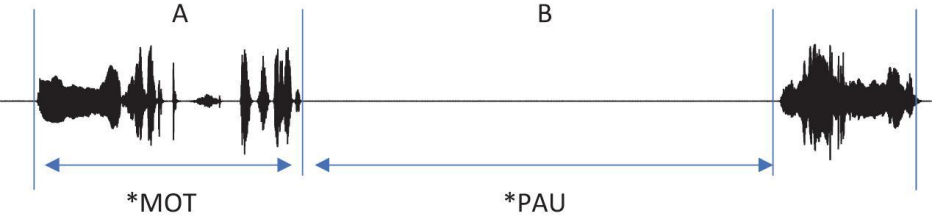
- **Caregiver support:**
  - Use of visual, auditory, and tactile cues, and adaptations to child development (Ko et al., 2013)
- **Children's use multimodal cues**:
  - Includes action and gesture "vocabulary," to communicate with caregivers (Caselli et al., 2012).
  - Children's multimodal behaviors, such as gestures and eye contact, **prompt** real-time **responses** from **parents** (Yurkovic et al., 2021).



Research questions

1. Do the mother-child dyads initiate conversational exchanges using multimodal, non-verbal cues, and if so, which specific cues are utilized?
2. Does the usage pattern of these multimodal cues change over the course of the child’s development?
3. Is there an initiator effect in the usage of multimodal cues?

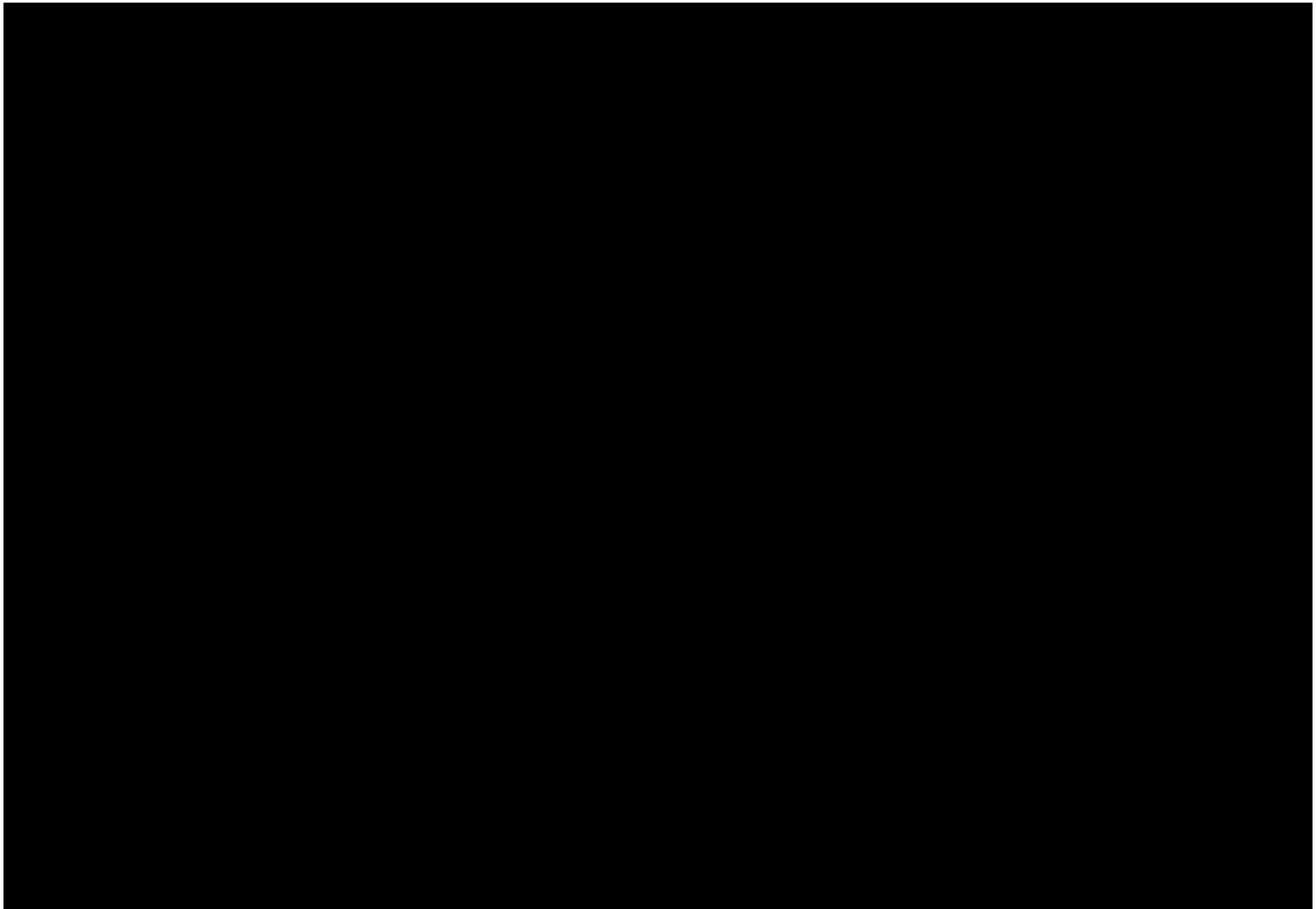
Ko Corpus (Ko et al., 2020)



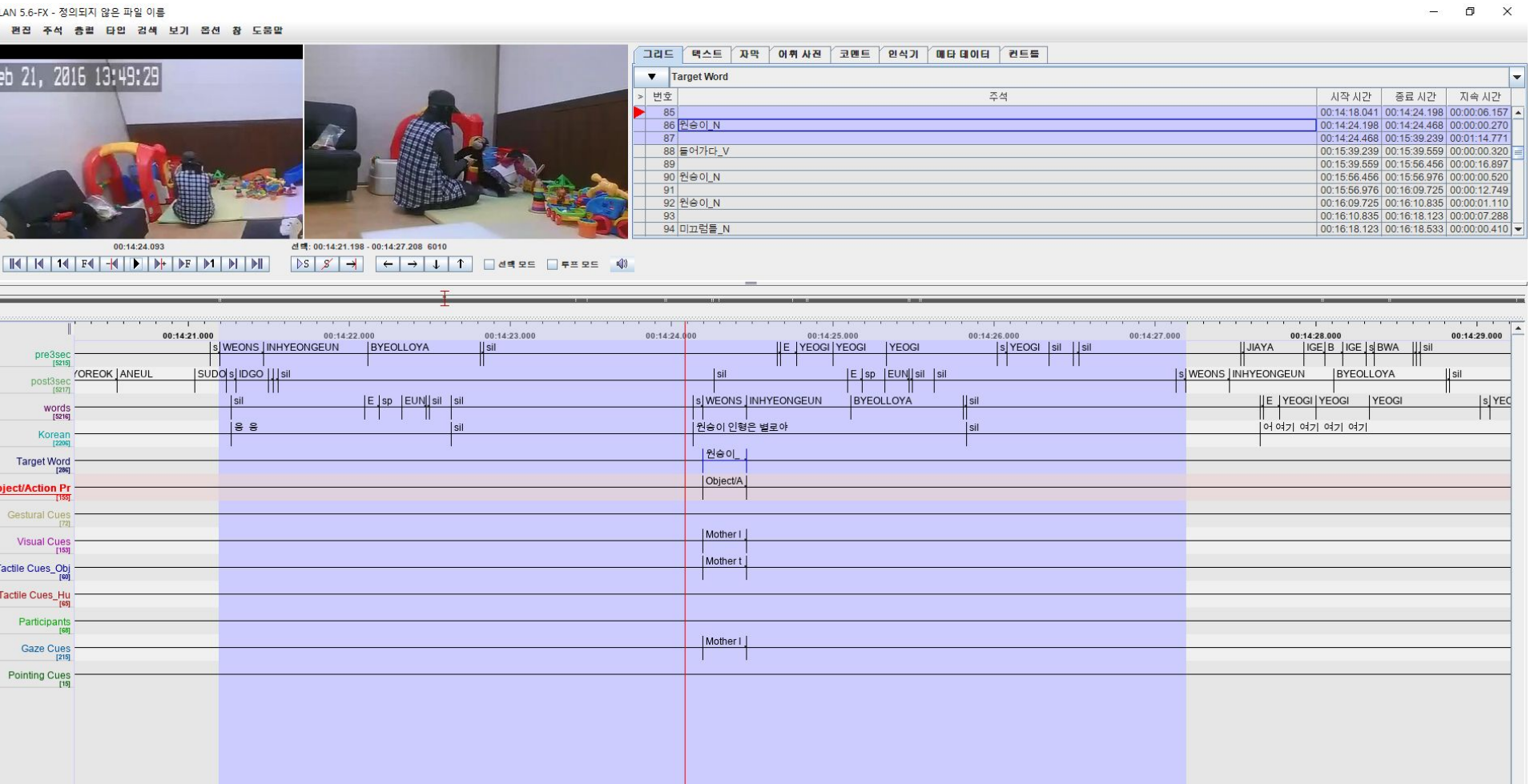
(a) 끌고 갈 거야?, not 끌고 갈거야?
kkulko kal keya?, not kkulko kalkeya?
Are you going to pull it?

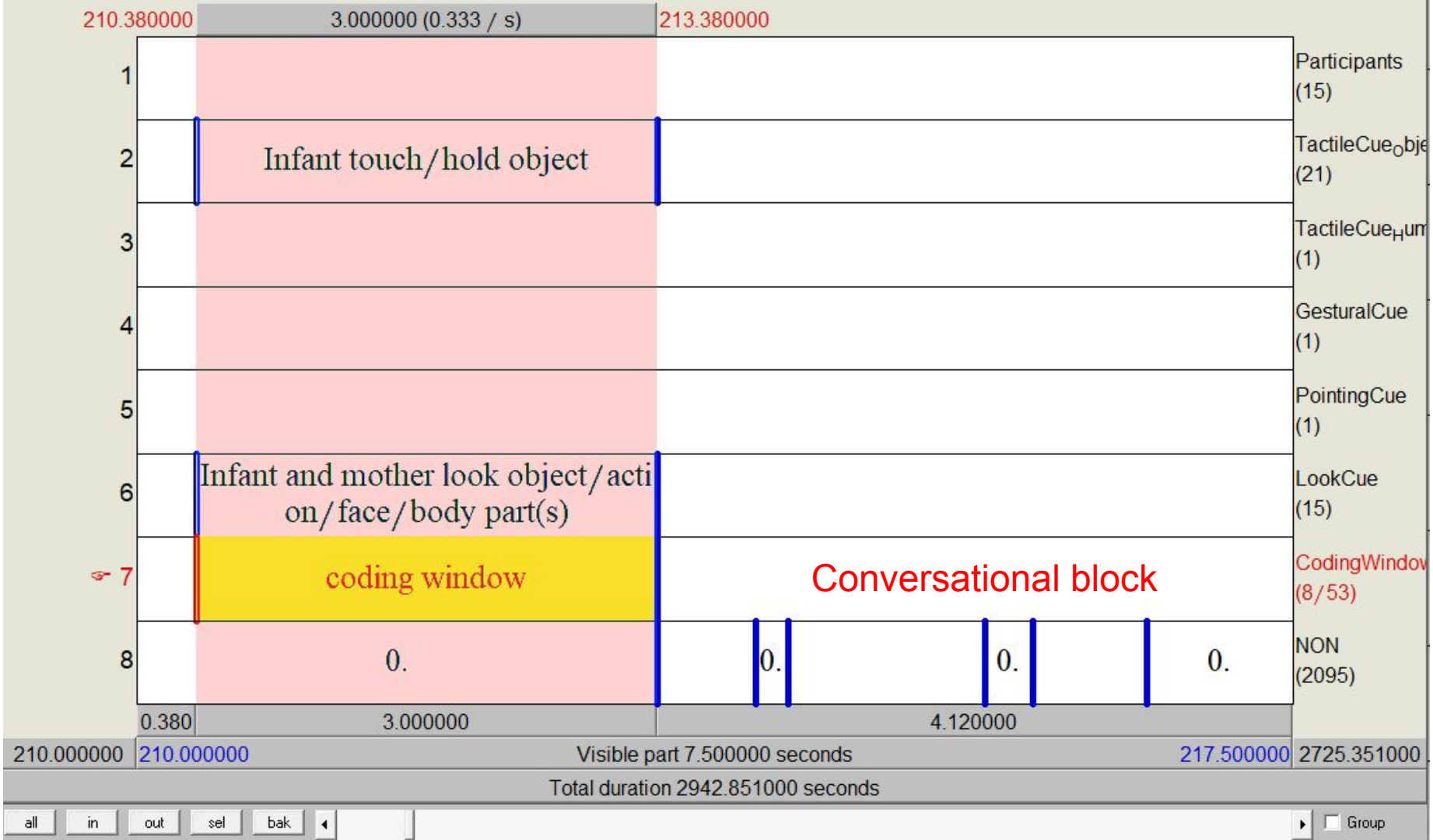
(b) 이리 와 봐. not 이리 와봐.
ili wa pwa. not ili wapwa.
Come over here.

- Audio-visual recordings of 35 naturalistic mother-child interactions in a mock apartment setting at SNU.
- Children aged between 8 and 27 months of age
- 40 minutes of free-play (CDS), and 10-minute phone



Annotation of video in ELAN




210.380000
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Participants
(15)
Infant touch/hold object
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(21)
TactileCue_Hum
(1)
GesturalCue
(1)
PointingCue
(1)
Infant and mother look object/acti
on/face/body part(s)
LookCue
(15)
coding window
Conversational block
CodingWindow
(8/53)
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NON
(2095)
0.380
3.000000
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217.500000
2725.351000
Total duration 2942.851000 seconds
all
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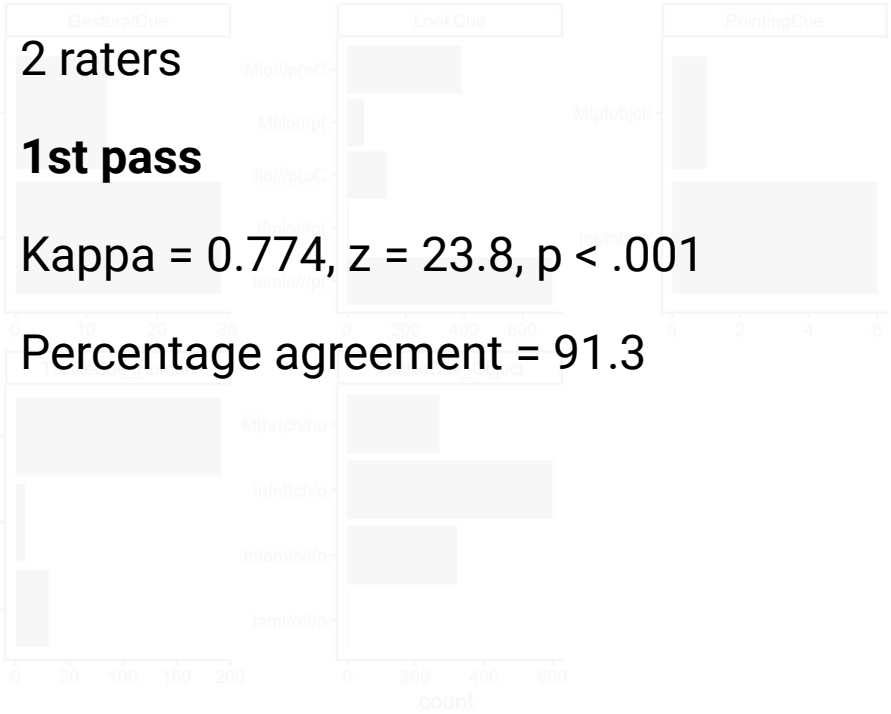
Group

id	cbid	t1.x	t2.x	CodingWindow	GesturalCue	LookCue
2	1	8.903	11.903	coding window	NA	Infant and mother look object/action/face/body part(s)
2	2	35.268	38.268	coding window	NA	Mother look object/action/face/body part(s) (initiator...
2	3	41.692	44.692	coding window	Mother gesture to object/action	Mother following infant look object/action/face/body p...
2	4	71.261	74.261	check coding window	NA	NA
2	5	82.01	85.01	coding window	NA	Infant and mother look object/action/face/body part(s)
2	6	112.603	115.603	check coding window	NA	NA
2	7	123.708	124.245	coding window	NA	Infant and mother look object/action/face/body part(s)

t1.y	t2.y	CHI	MOT
11.893	14.49	NA	이름아:@wp 놀러 봐, 이게 뭐야.
38.308	39.039	NA	이게 뭐야?
44.682	45.705	NA	뭐, 곰?
74.238	76.34	NA	이게 뭐야, 이름아, (..) 응?
84.998	86.997	NA	뭐, 또 뭐가 있어, 뭐가?
115.603	116.594	NA	쉬:@wp.
124.396	125.259	NA	기:린@wp.

	id	cbid	t1.x	t2.x	CodingWindow	GesturalCue	LookCue	NON	PointingCue	TactileCue_Human	TactileCue_Object	...1	t1.y	t2.y	CHI	MOT
1	2	1	8.903	11.903	coding window	NA	Infant and mother look object/action/face/body part(s)	NA	NA	Mother touch infant	NA	831	11.893	14.49	NA	이름아:@wp 놀러 봐, 이게 뭐야.
2	2	2	35.268	38.268	coding window	NA	Mother look object/action/face/body part(s) (initiator...	NA	NA	NA	Mother touch/hold object	832	38.308	39.039	NA	이게 뭐야?
3	2	3	41.692	44.692	coding window	Mother gesture to object/action	Mother following infant look object/action/face/body p...	NA	NA	NA	NA	833	44.682	45.705	NA	뭐, 곰?
4	2	4	71.261	74.261	check coding window	NA	NA	NA	NA	NA	NA	834	74.238	76.34	NA	이게 뭐야, 이름아, (..) 응?
5	2	5	82.01	85.01	coding window	NA	Infant and mother look object/action/face/body part(s)	NA	NA	NA	Infant touch/hold object	835	84.998	86.997	NA	뭐, 또 뭐가 있어, 뭐가?
6	2	6	112.603	115.603	check coding window	NA	NA	NA	NA	NA	NA	836	115.603	116.594	NA	쉬:@wp.
7	2	7	123.708	124.245	coding window	NA	Infant and mother look object/action/face/body part(s)	NA	NA	NA	Infant touch/hold object	837	124.396	125.259	NA	기:린@wp.
8	2	8	128.668	131.668	coding window	NA	Infant and mother look object/action/face/body part(s)	NA	NA	NA	Infant touch/hold object	838	131.659	132.863	NA	기:린@wp, 아이고.
9	2	9	157.87	160.87	coding window	NA	Infant and mother look object/action/face/body part(s)	NA	NA	NA	Mother touch/hold object	839	160.863	163.165	NA	이름이 엄마가 빠방:@o 갖다 줄까, 빠방:@o

Inter-rater reliability



2 raters

1st pass

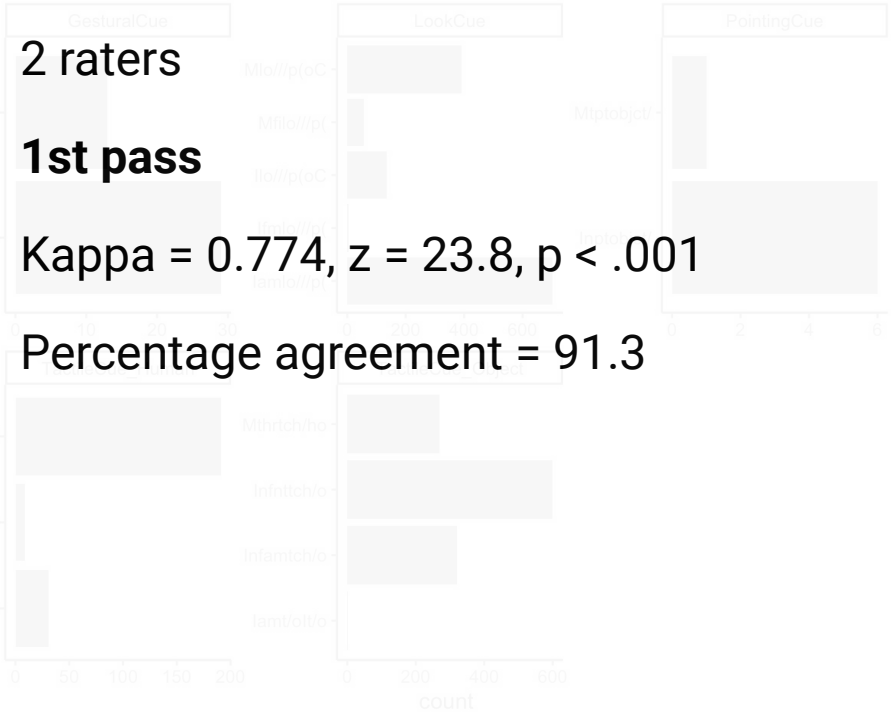
Kappa = 0.774, z = 23.8, p < .001

Percentage agreement = 91.3

Strength of Agreement (commonly accepted guidelines):

- < 0: Less than chance agreement.
- $0.01 - 0.20$: Slight agreement.
- $0.21 - 0.40$: Fair agreement.
- $0.41 - 0.60$: Moderate agreement.
- $0.61 - 0.80$: Substantial agreement.
- $0.81 - 1.00$: Almost perfect agreement.

Inter-rater reliability



2 raters

1st pass

Kappa = 0.774, z = 23.8, p < .001

Percentage agreement = 91.3

- One coder was producing a lot of codes
- Always moving, touching and looking at things
- Agreement between coders to focus on intention of action

Inter-rater reliability

2 raters

1st pass

Kappa = 0.774, z = 23.8, p < .001

Percentage agreement = 91.3

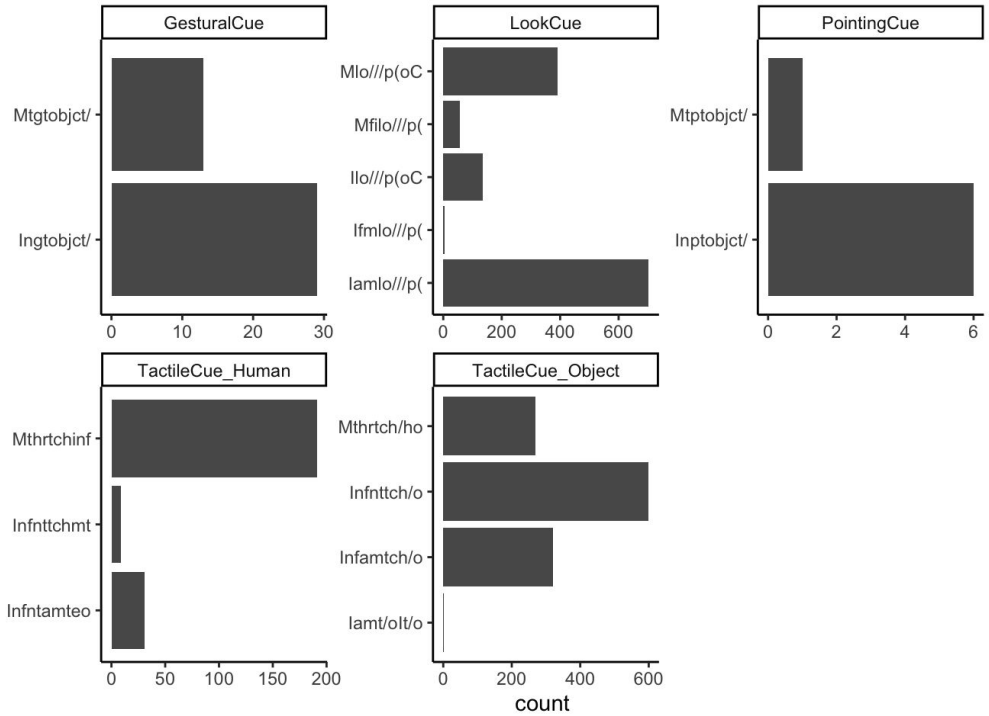
2nd pass

Kappa = 0.806, z = 24.8, p < .001

Percentage agreement = 92.7

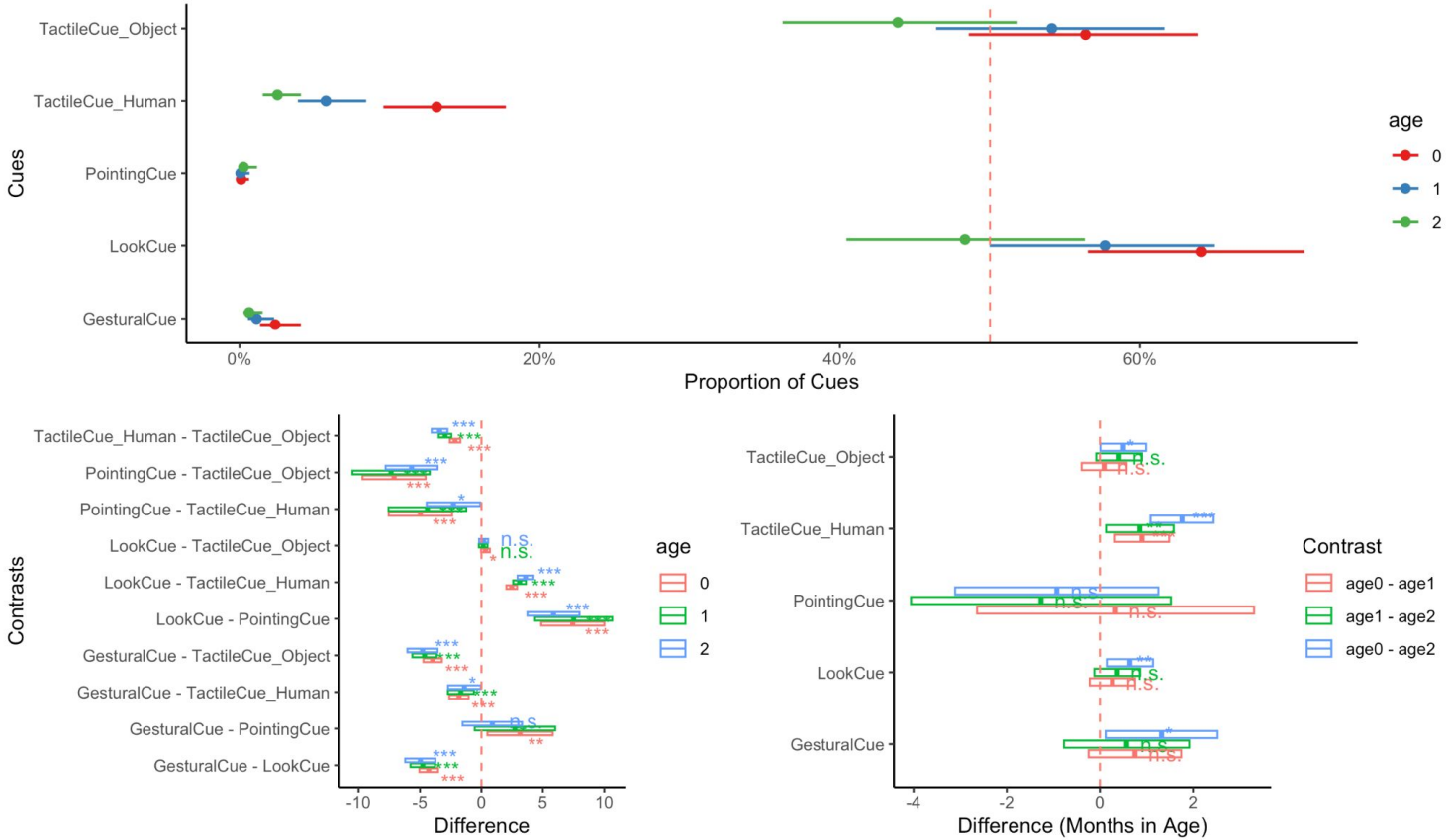
- One coder was producing a lot of codes
- Always moving, touching and looking at things
- Agreement between coders to focus on intention of action

Distribution of the non-verbal cues based on count

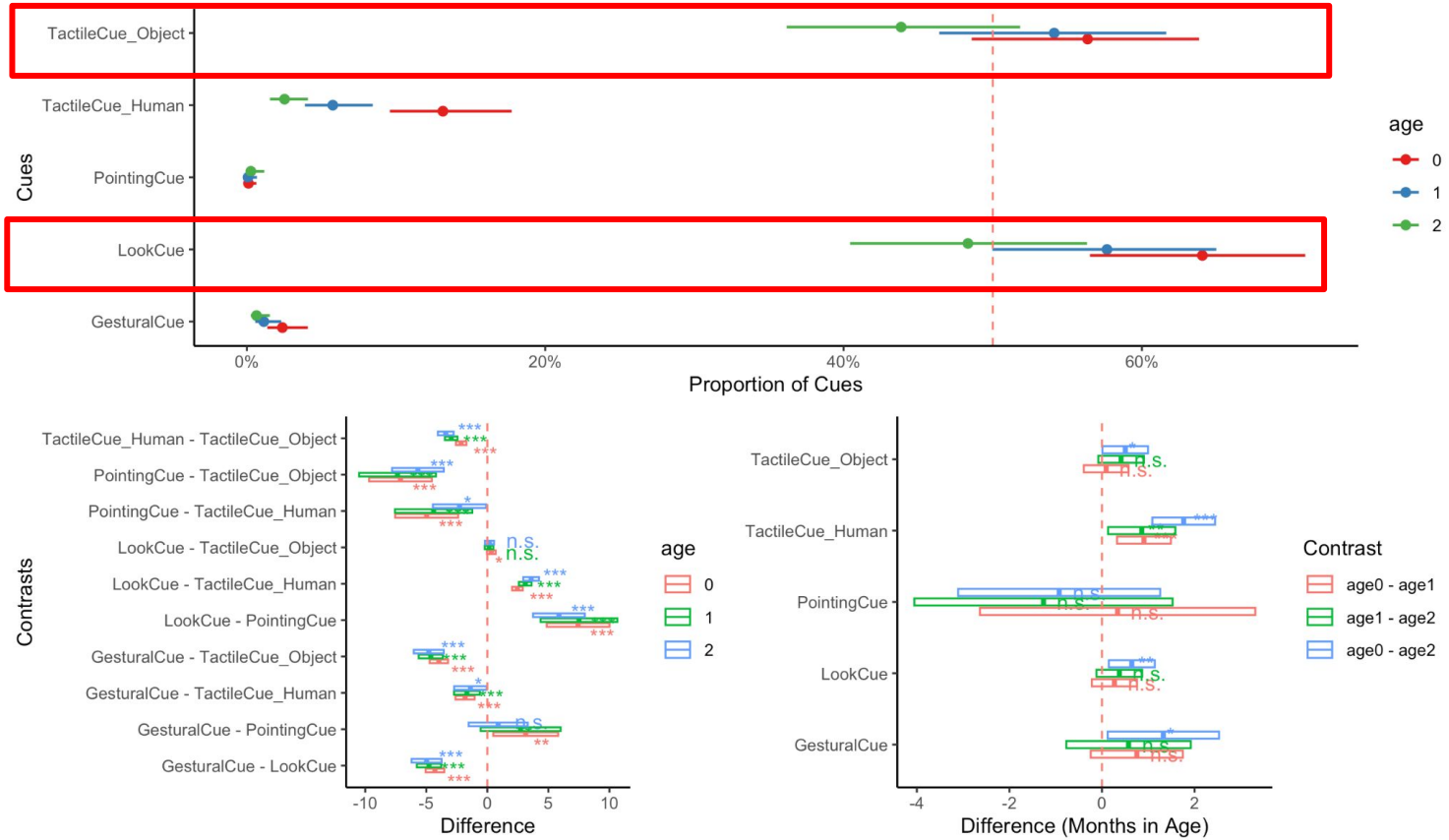


- Identified multimodal cues (look, tactile, gestural, pointing) within 3 seconds before conversational blocks.
- Allowed for multiple cues per window.

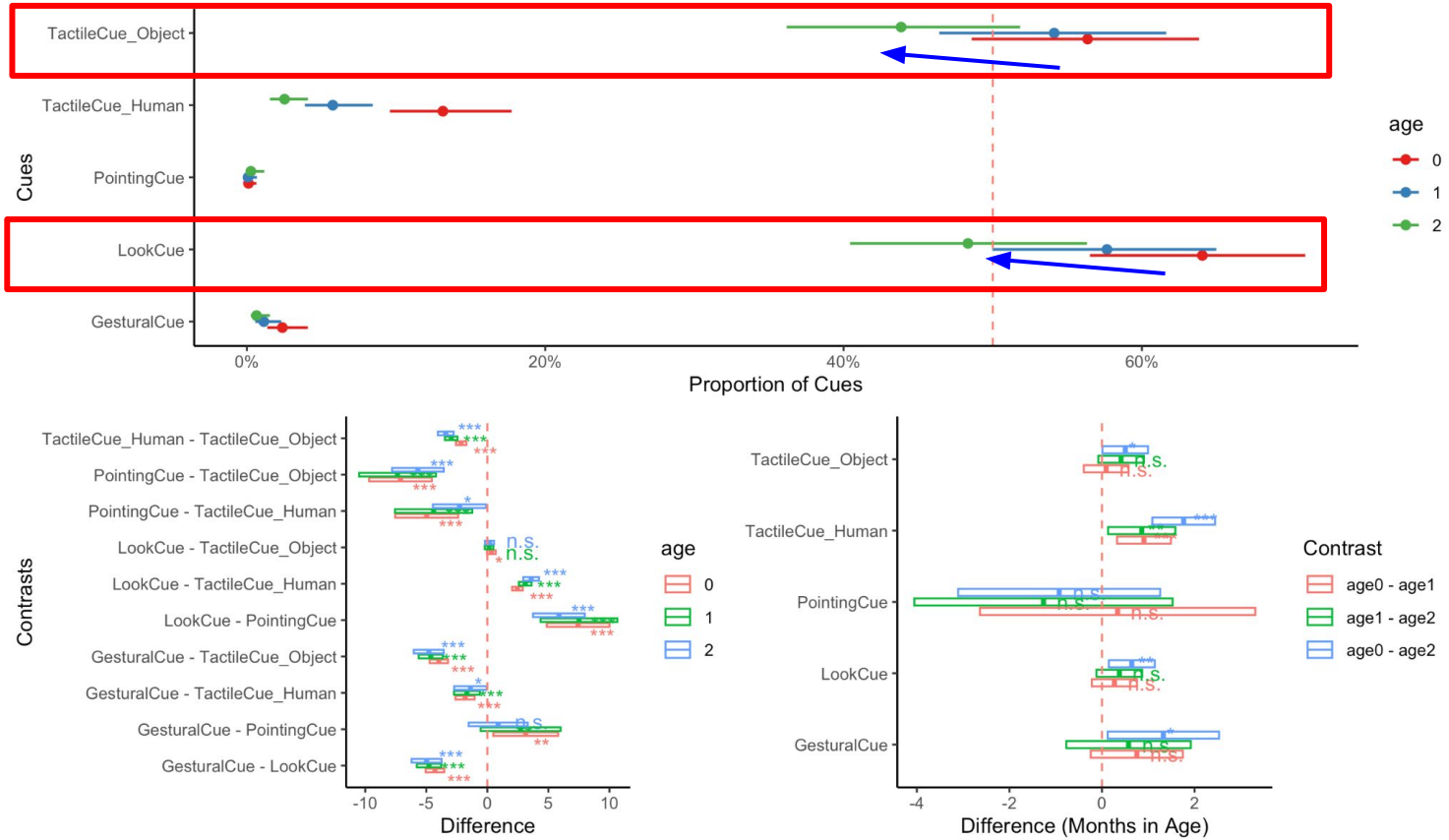
Prevalence of non-verbal cues preceding conversation blocks



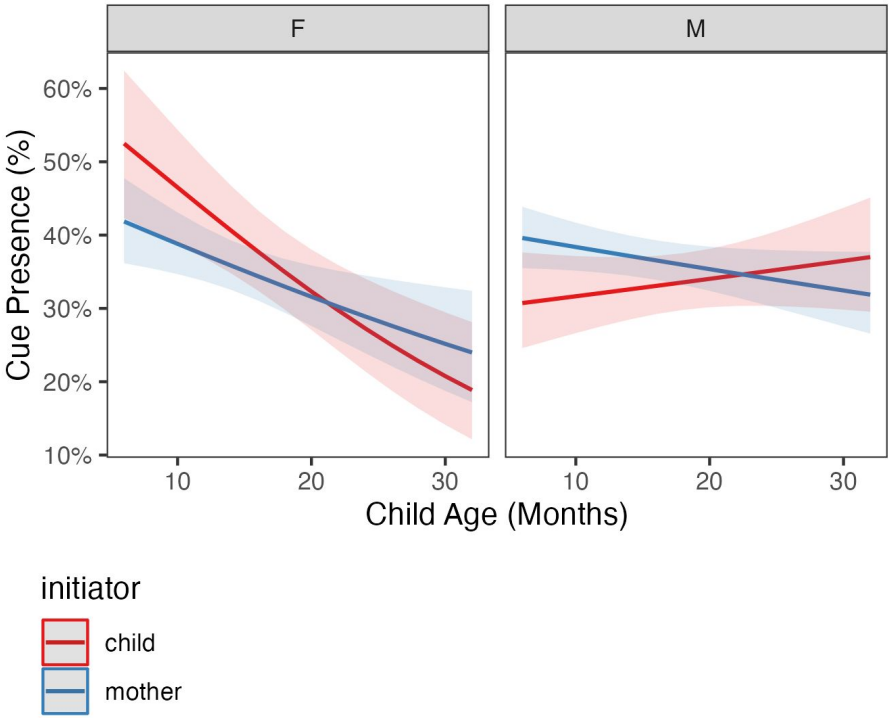
Prevalence of non-verbal cues preceding conversation islands



Prevalence of non-verbal cues preceding conversation islands

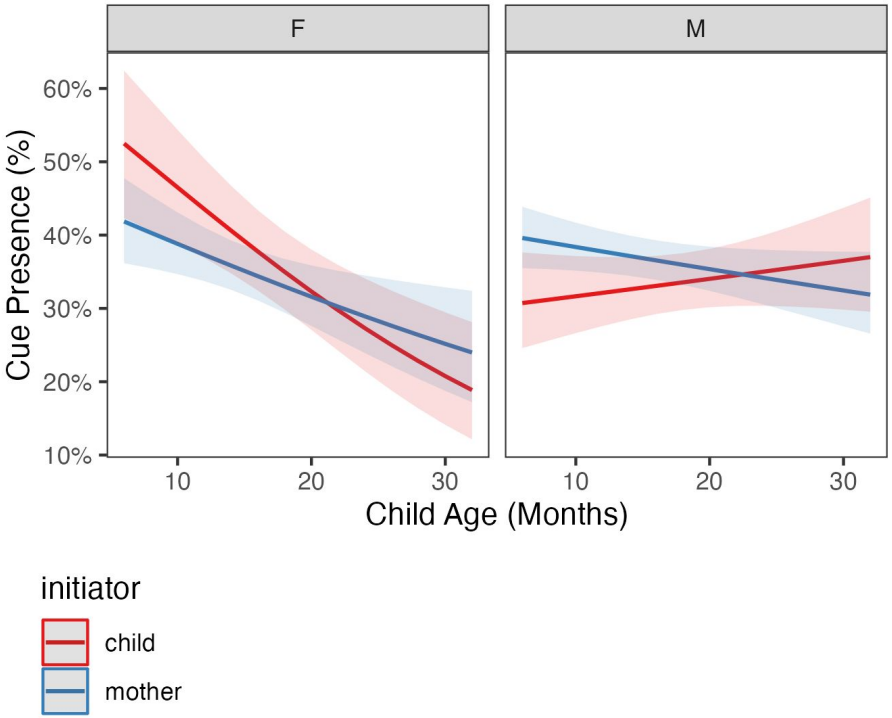


Results:
Initiator (mother, child) × Age (months) × Sex (girls, boys)



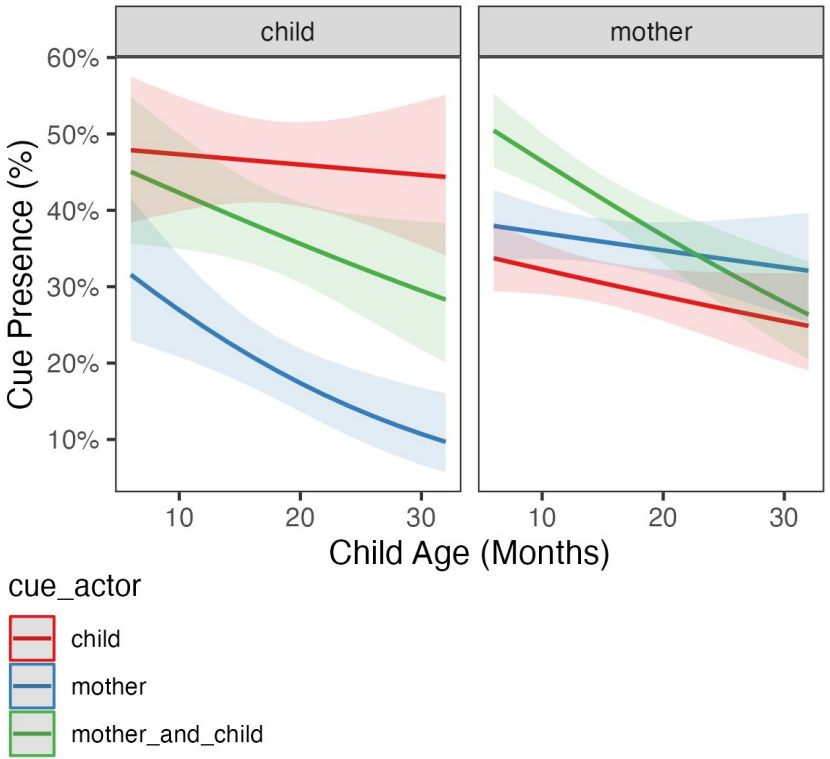
- Cue presence **decreases** with age in **mother-initiated** conversations for both group of children
- Cue presence **increases** with age for **boy-initiated** conversations

Results:
Initiator (mother, child) × Age (months) × Sex (girls, boys)



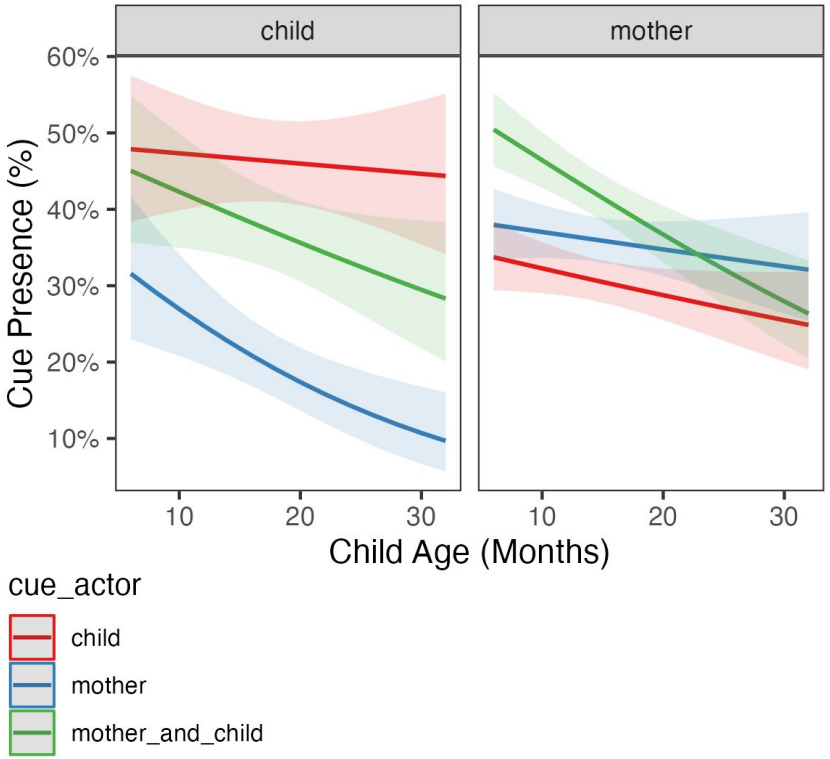
- **Sex differences** in cue presence change with age in **child-initiated** conversation

Results:
Initiator × Cue Actor × Age



- Both mother and child use **more non-verbal cues** preceding their **own-initiated** conversations
- Between **8 and 15 months**, **mother-initiated** conversations more likely to precede with **joint cues**

Results:
Initiator × Cue Actor × Age



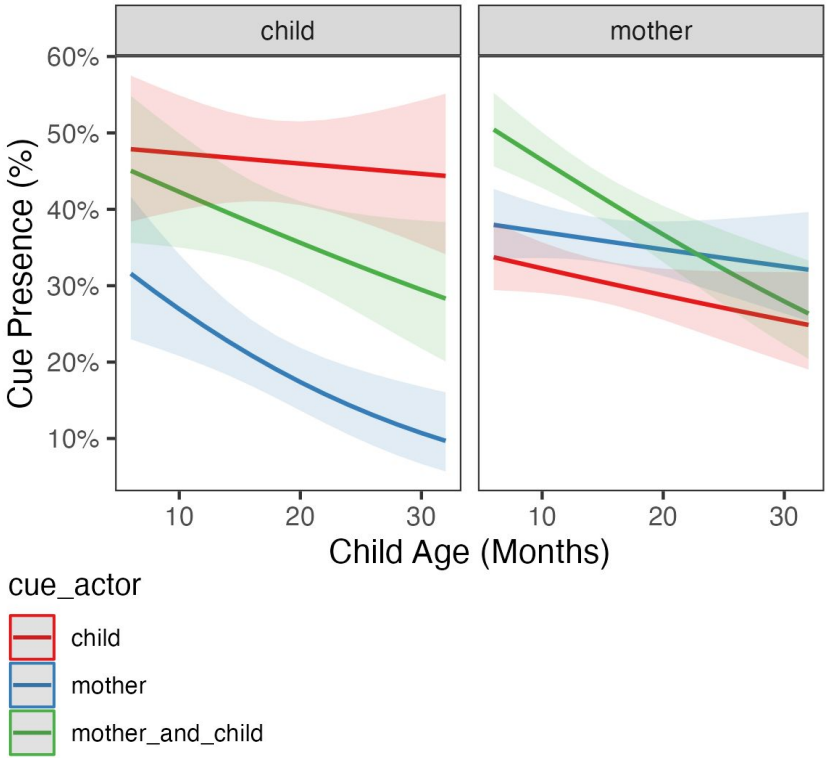
Child-initiated interactions:

- **Slow decrease** in cue presence of child across ages
- **Sharp decline** in mother and mother & child joint cues.

Mother-initiated interactions:

- **Decrease** in cue presence with child's age, **most steeply for mother & child joint cues**.

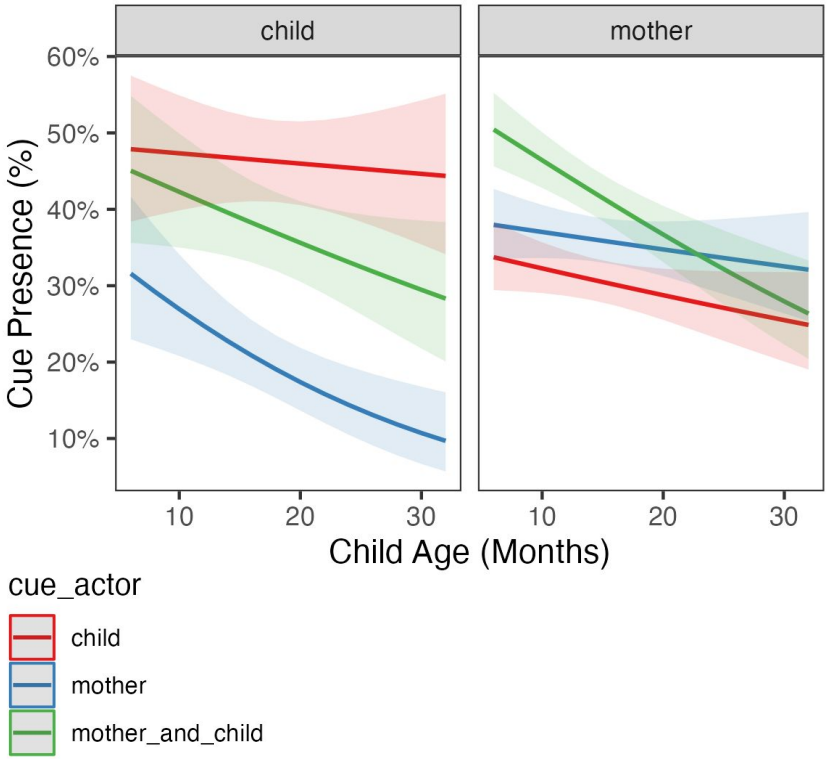
Results:
Initiator × Cue Actor × Age



Summary:

- Children and mothers use **more** multimodal cues when they **initiate** conversation.
- Cue presence demonstrates a **developmental** pattern, with varying degrees of decrease with age.
- **Mothers adjust** cue usage with child's **developmental** stage, not just based on **initiator** role.

Results:
Initiator × Cue Actor × Age ~~× Sex (girls, boys)~~



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Developmental Trajectory of Communication

- Prevalence of non-verbal cues preceding conversations
- Alignment with joint attention and multimodal interaction theories

Developmental Trajectory of Communication

- Decrease in non-verbal cues with age
- Mothers' strategy adaptation in line with children's communicative growth

Role of the Initiator

- Higher use of multimodal cues by initiators
- Strategic non-verbal communication to frame verbal exchanges
- Adaptive communication strategies in social interactions

Implications for Child Development

- Shift from non-verbal cues to verbal communication as a developmental milestone in initiation of conversations
- Indicative of communication skill milestones

Study Limitations and Future Research

- Need for further research on the impact of comprehension on cue usage
- Exploration of multimodal communication across diverse child populations

Acknowledgements

- We thank the families who participated in our study.
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Thank you.

Questions can be addressed to eonsuk@gmail.com.