
# *COVID-19 related effects on early language development*

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# Introduction

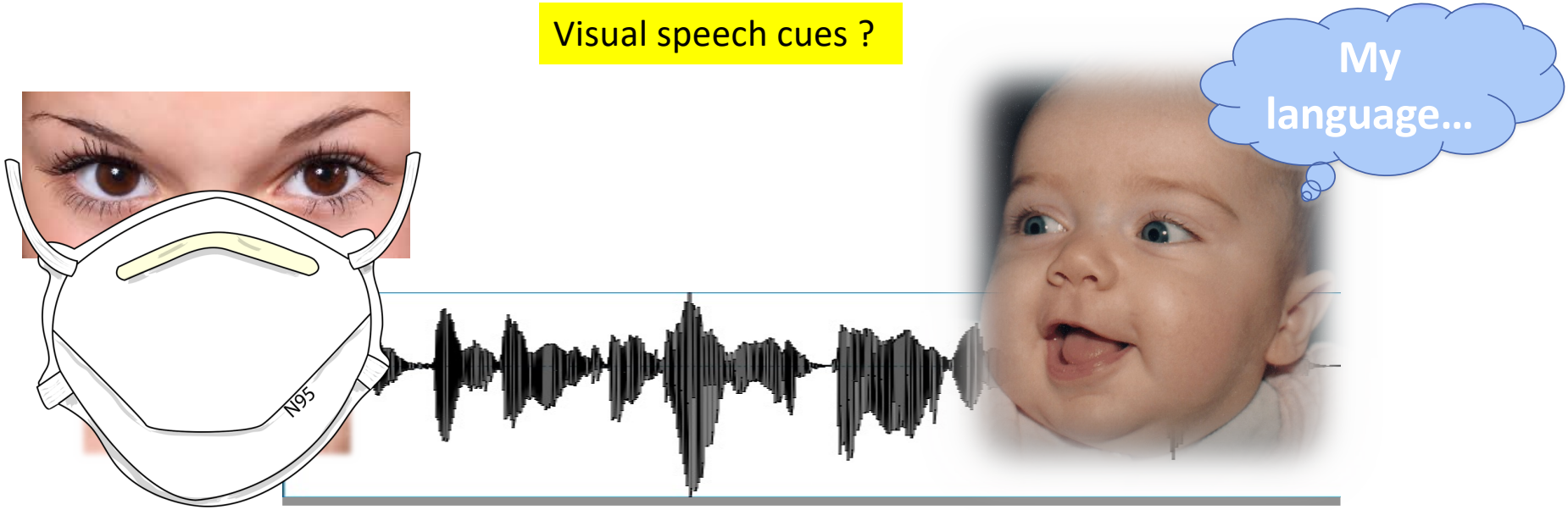
- **Language includes auditory and visual cues relevant to language learning**


e.g., Kuhl, 2014; Lewkowicz and Hansen-Tift, 2012; Sebastián-Gallés et al., 2012; Tomalski et al., 2013; Tsang et al., 2018; Choi et al., 2018; Morin-Lessard et al., 2019; Pejovic et al., 2019; Pons et al., 2019; Cruz et al., 2020; Sekiyama et al., 2021

# Introduction

- **COVID-19**

Visual speech cues ?



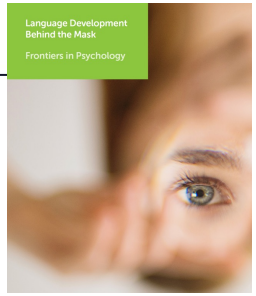
# Introduction

- **COVID-19**

Visual speech cues ?

Auditory speech cues ?


e.g., Bottalico et al., 2020; Rahne et al., 2021; Thibodeau et al., 2021; Cruz et al., 2022; Pycha et al., 2022

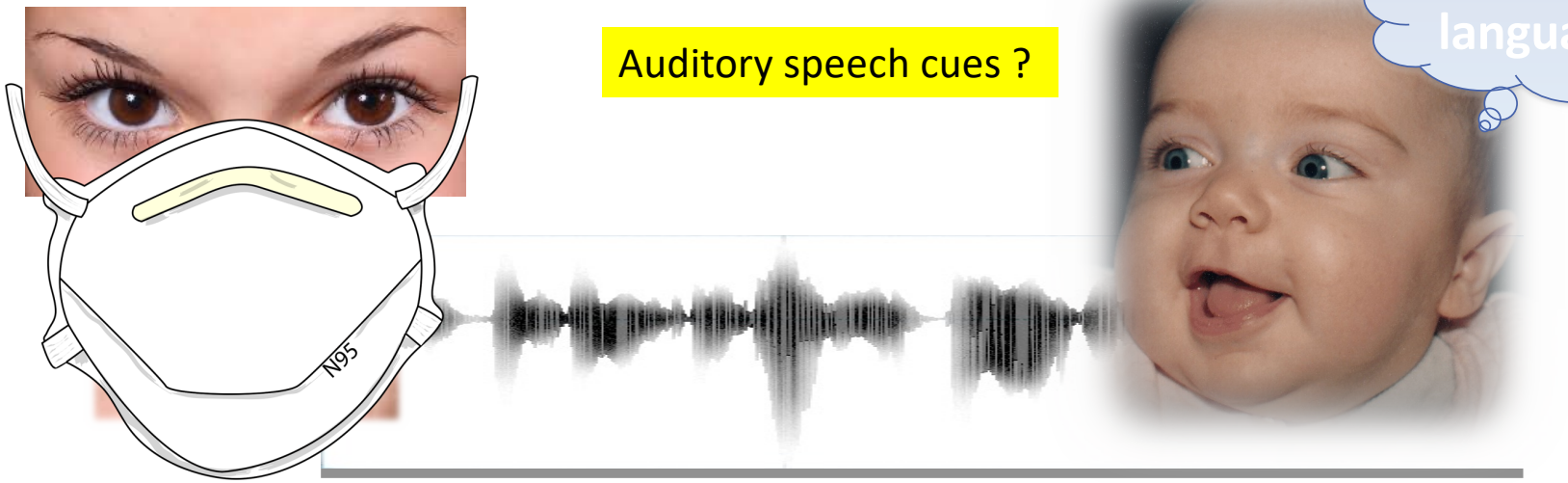



# Introduction

- **COVID-19**

Visual speech cues ?

Auditory speech cues ?




Affect early speech processing!

e.g., Singh et al., 2021; Orena et al., 2022; Lalonde et al., 2022

# Introduction

- **COVID-19**


Visual speech cues ?

Auditory speech cues ?

Everyday communication/ interaction


Affect early speech processing!

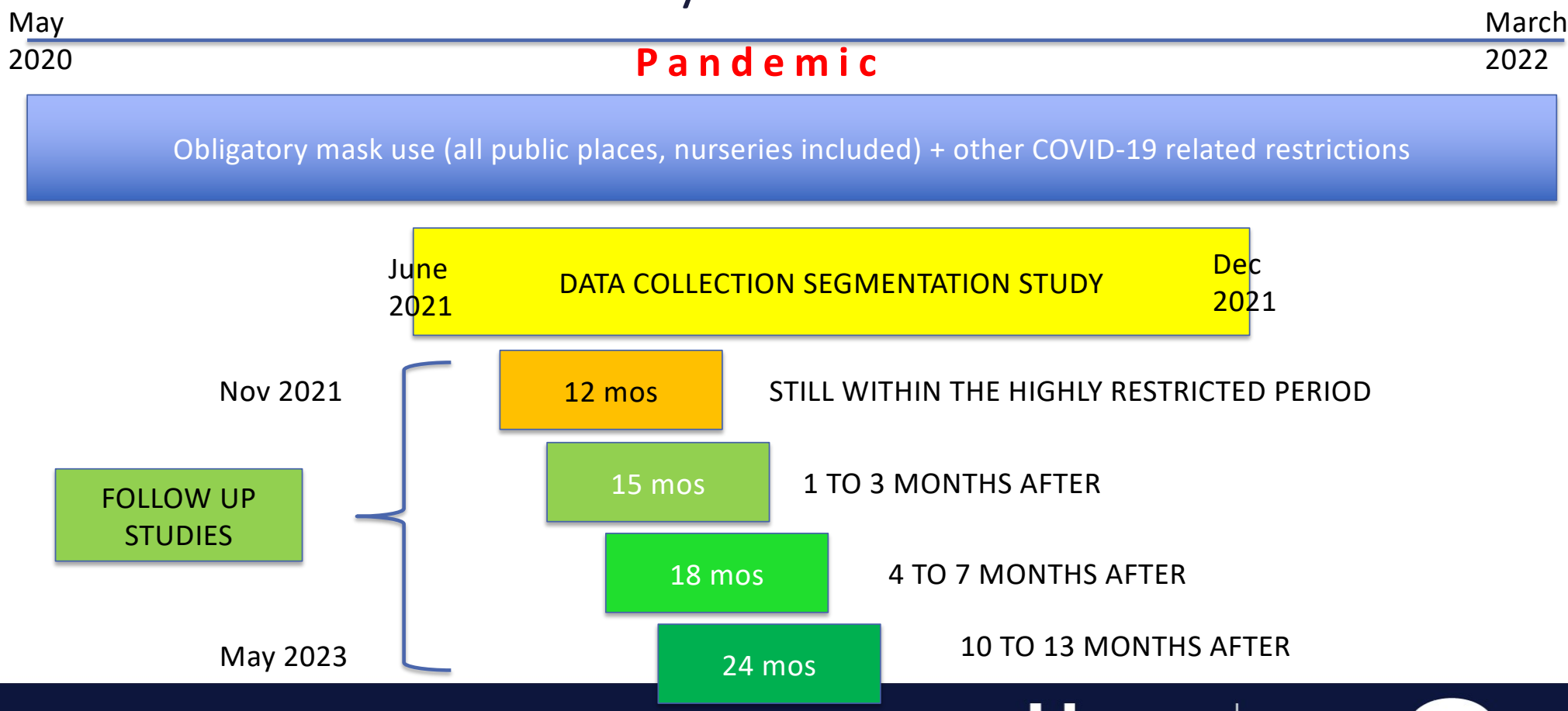
Effects on language development, cognitive development

e.g., Davies et al., 2021; Deoni et al., 2021; Kartushina et al., 2022

# Introduction

- **Developmental research needs to understand whether and when these potential effects take place in early development**
- **This longitudinal study addresses this question**
  1. Comparing **word segmentation abilities** in **7-9-month-old** infants born during the pandemic (in presence or not of a face mask) with earlier segmentation data collected in 2016-2017 (Butler & Frota, 2018)
  2. Examining their **later** language development (between **12 and 24 months** of age) in a series of follow up studies

# Study timeline



# 1. Word segmentation

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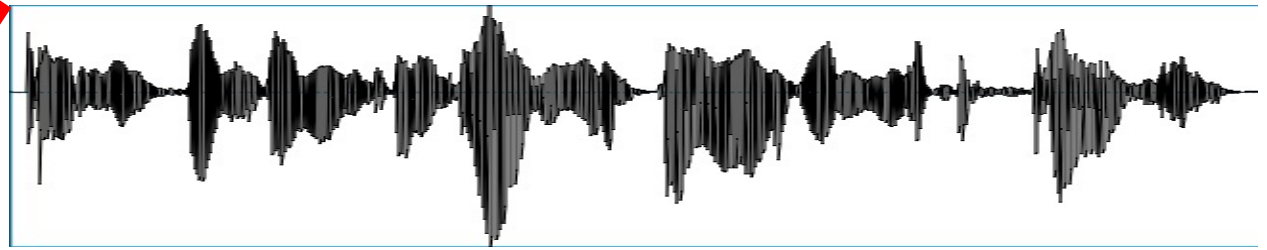
CHALLENGE !



- **Word segmentation: crucial milestone for language development** (Singh et al., 2012; Bergmann and Cristia, 2016; Kidd et al., 2018; Hoareau et al., 2019, Frota et al., 2020).
- **It might be supported by audiovisual information** (de la Cruz-Pavía et al., 2019; Tan and Burnham, 2019)

# 1. Word segmentation: COVID-19 study

**Summary**

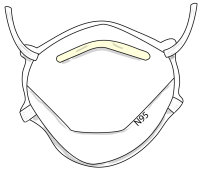
1. COVID-19 related changes hinder early word segmentation abilities
   - Presence/absence of the face mask
   - No segmentation was found at 7-9 months, not even at the prosodic edge

2. Effect of continued exposure to altered speech cues together with (other) COVID-related changes > Difference between pre-pandemic data and the data collected during the pandemic

**Auditory Experiment (AUD)**

**Audiovisual Experiment (AV)**

WITHOUT WITH



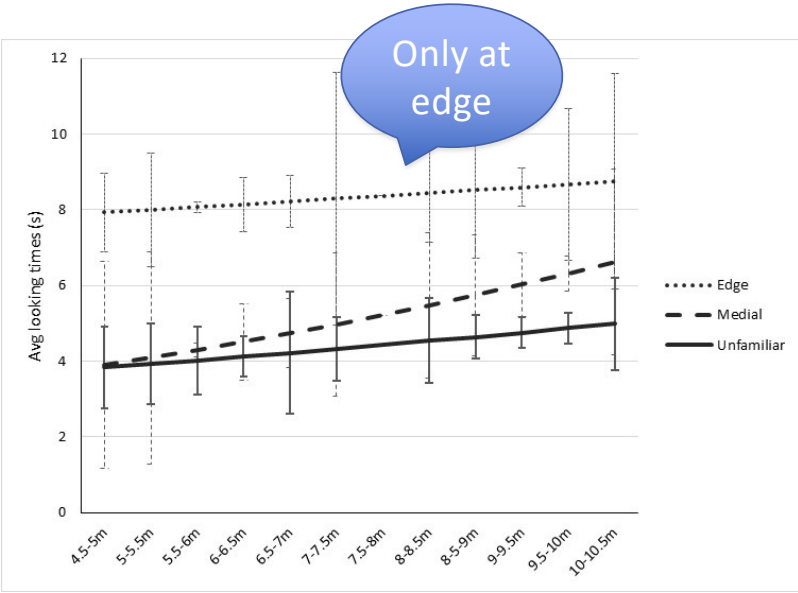
7–9-month-old infants

✓ Segmentation at prosodic edge

# 1. Word segmentation: COVID-19 study

- **Followed Butler & Frota (2018), B&F**

- Emerging word segmentation abilities in European Portuguese learning infants from 4 to 10 months of age
- Auditory task using a visual familiarization paradigm




Butler & Frota (2018) *Journal of Child Language*

Frota et al., 2022, *Frontiers in Psychology*

# Method- Participants

- 77 infants from monolingual EP homes recruited in the Lisbon area

  Full-term, no familial risks for language impairment, no health-related issues

  Face mask exposure (in-lab) questionnaire, language exposure parental questionnaire (Molnar et al., 2014), EP-CDI short form, CSBS checklist

**Auditory Experiment (AUD): 37 infants**

- With-mask condition: 18 infants (mean age, 8.4 months; range, 7 months, 17 days – 9 months, 22 days; 10 females)
- Without-mask condition: 19 infants (mean age, 8.5 months, range, 7 months, 5 days – 9 months, 7 days; 8 females)

No differences in age, mask exposure, nº of people infant interacted with, CDI, or CSBS

**Audiovisual Experiment (AV): 40 infants**

- With-mask condition: 20 infants (mean age, 8.1 months; range, 7 months, 4 days to 9 months, 7 days; 9 females)
- Without-mask condition: 20 infants (mean age, 8.2 months, range, 7 months, 6 days to 9 months, 11 days; 8 females)

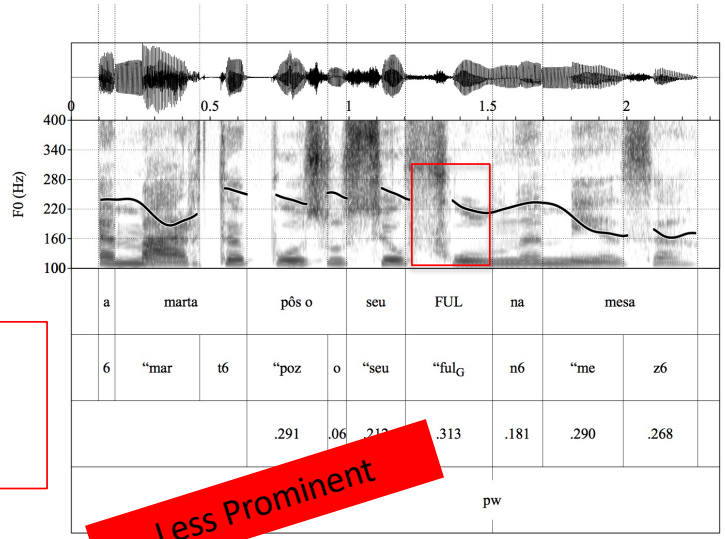
No differences in age, mask exposure, nº of people infant interacted with, CDI, or CSBS

# Method - Materials

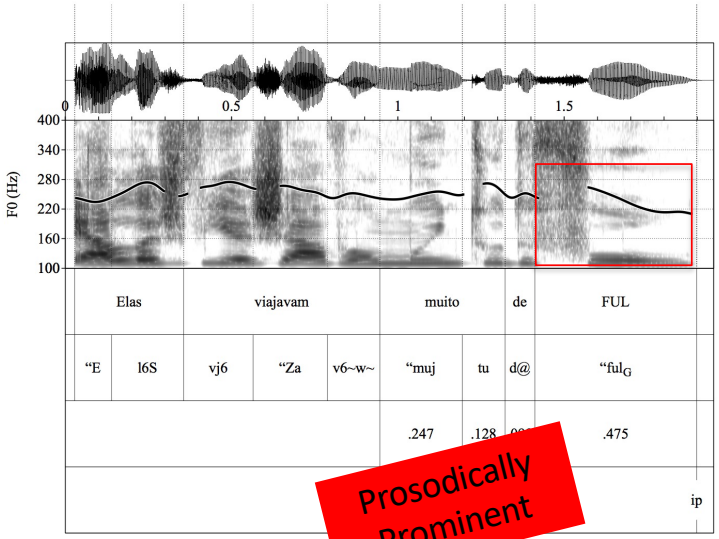
- **Materials (= B&F, 2018 + Mask condition, recorded by the same female speaker):**

  4 monosyllabic pseudo words (CVC/CVG)

  2 passages constructed for each word, one for **medial** and one for **edge** condition




Less Prominent




Prosodically Prominent

Internal to the Intonational Phrase (IP)

Final Intonational Phrase edge (=sentence)

# Method- Materials

- **Audiovisual Experiment (AV): Audiovisual stimuli**

Video recordings (professional JVC camera, model GY-HM11E, in .mov format, a 4:3 aspect ratio, 25 fps) occurring simultaneously with the recordings of the auditory stimuli.

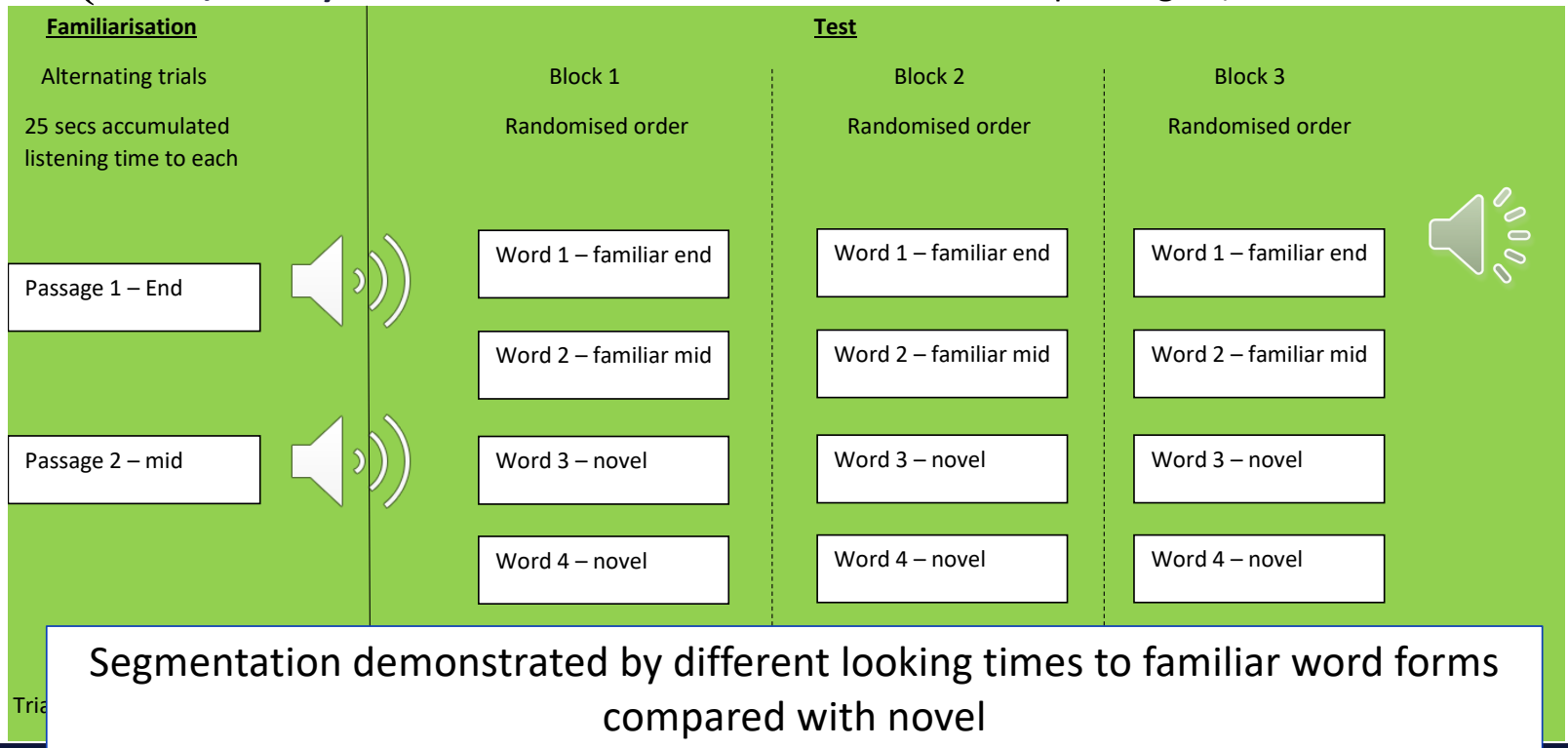
The speaker was instructed to speak in an infant-friendly manner. No other instructions were given.

Frota et al., 2022, *Frontiers in Psychology*

# Method - Procedure

Familiarized with passages; Tested with words

**Procedure (= B&F, 2018):** Modified version of the visual habituation paradigm (Altvater-Mackensen & Mani, 2013)



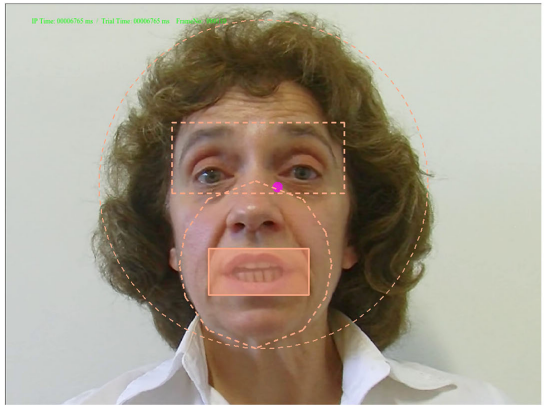

Segmentation demonstrated by different looking times to familiar word forms compared with novel

# Method - Procedure

- **Audiovisual Experiment (AV):**

Same procedure as in the Auditory experiment, except that
- **stimuli in the familiarization phase were audiovisually presented**

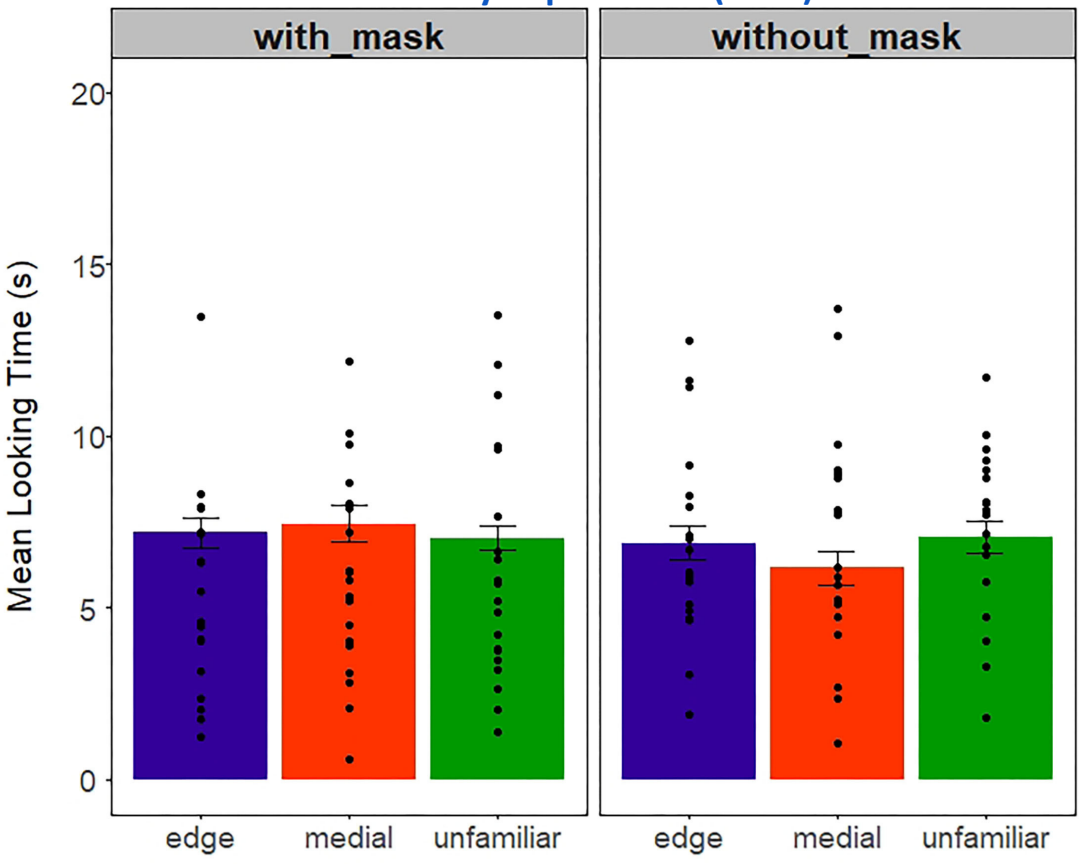
Infants' looking data were collected using an EyeLink 1000 Plus eye tracker



Frota et al., 2022, *Frontiers in Psychology*

# Results

**Auditory Experiment (AUD)**

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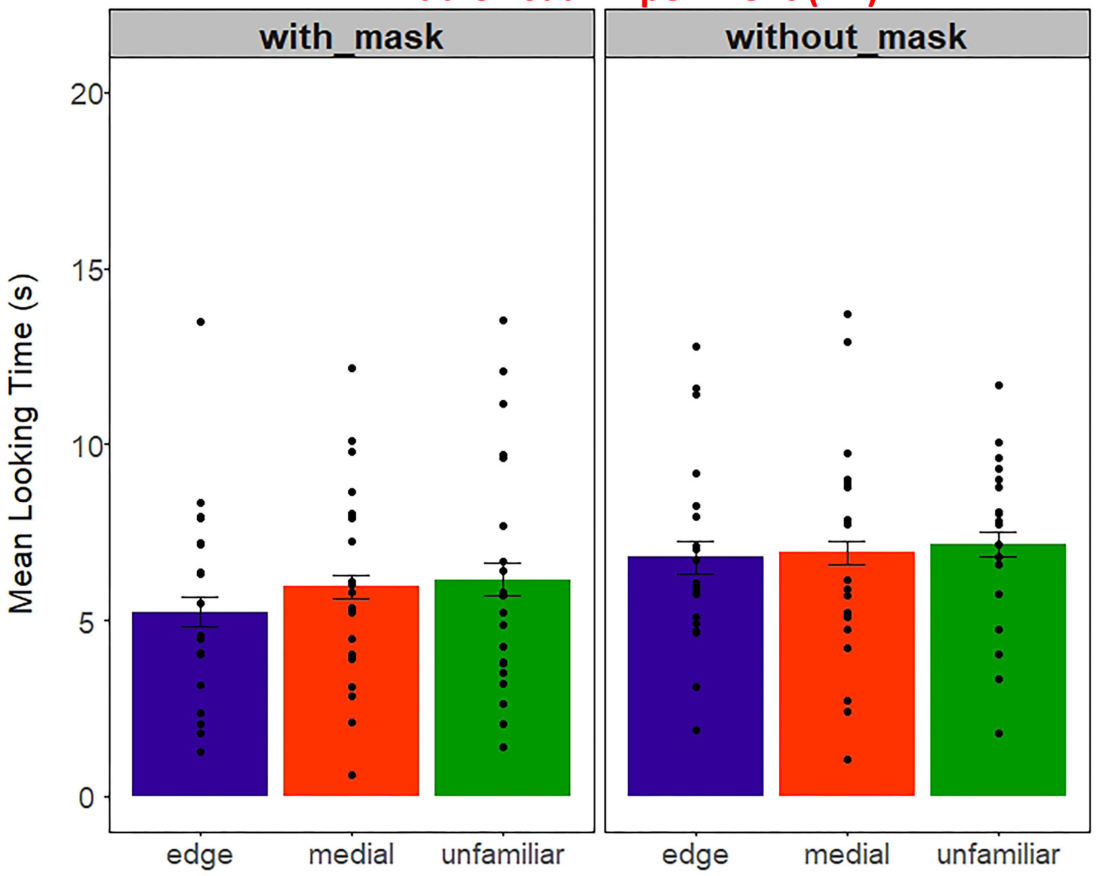

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# Results

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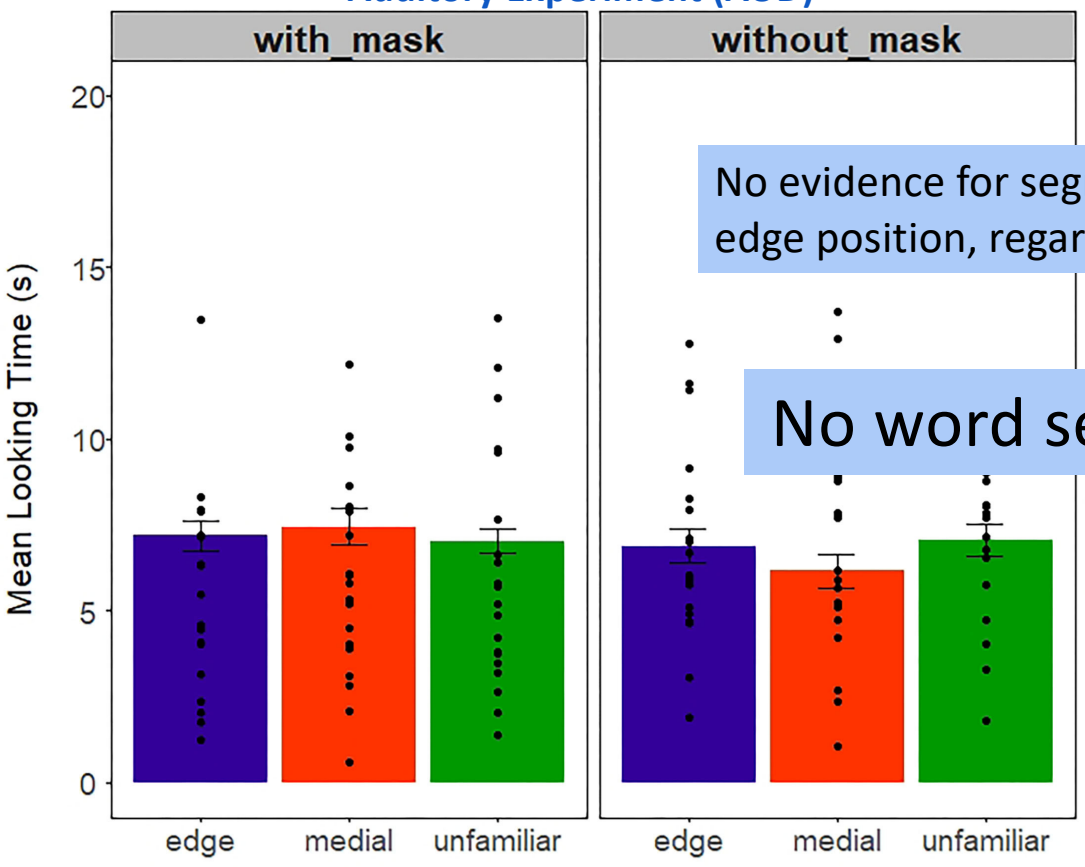


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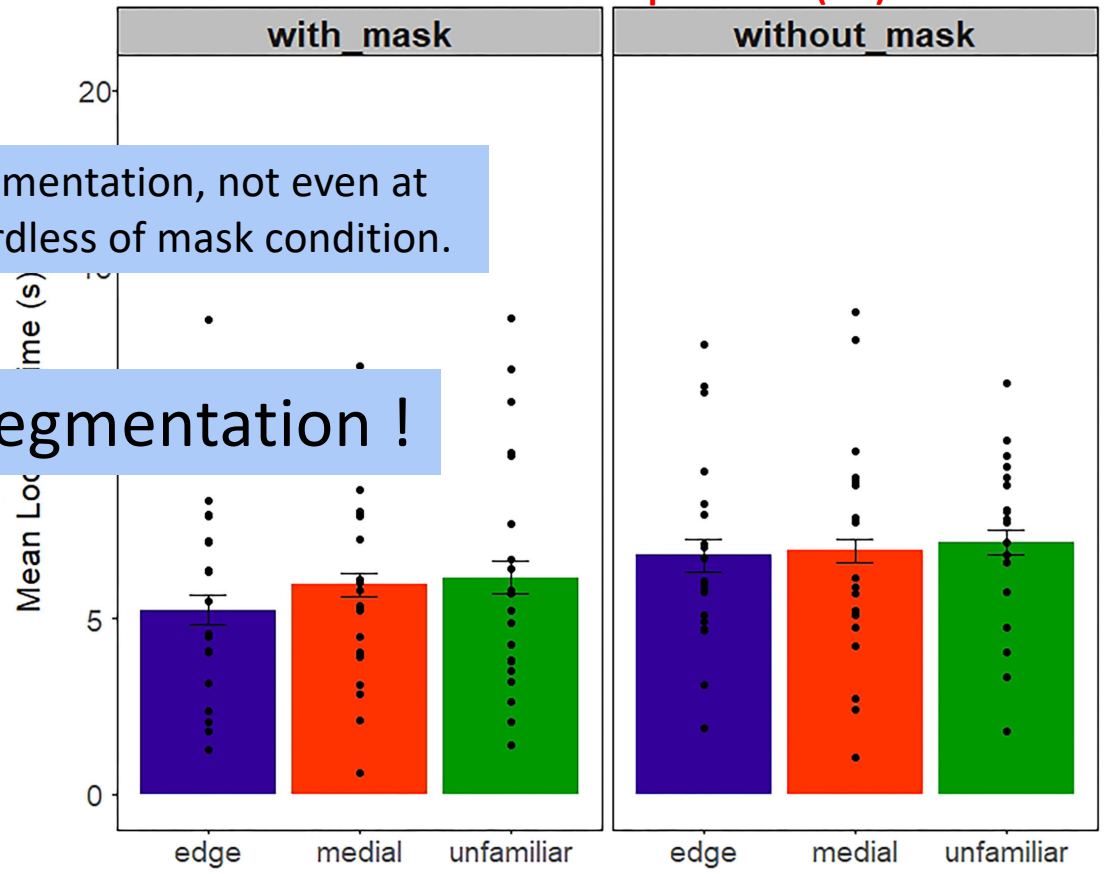
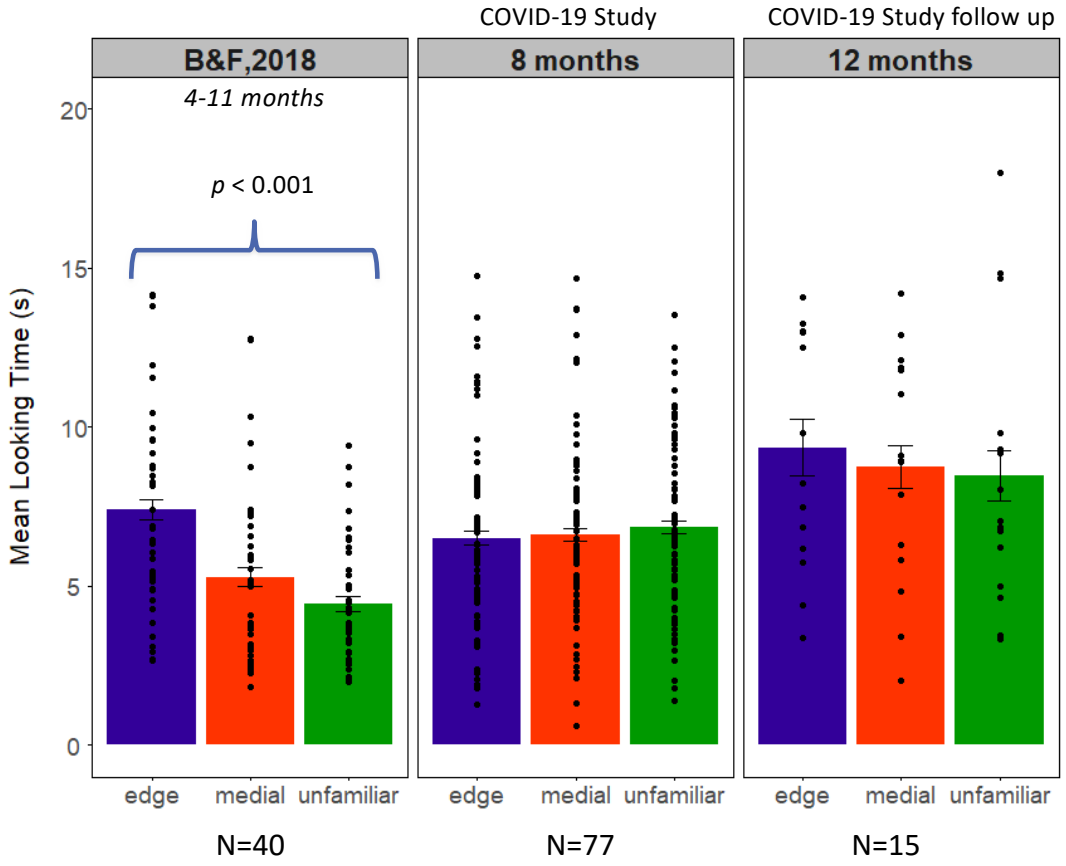



No evidence for segmentation, not even at edge position, regardless of mask condition.

No word segmentation !

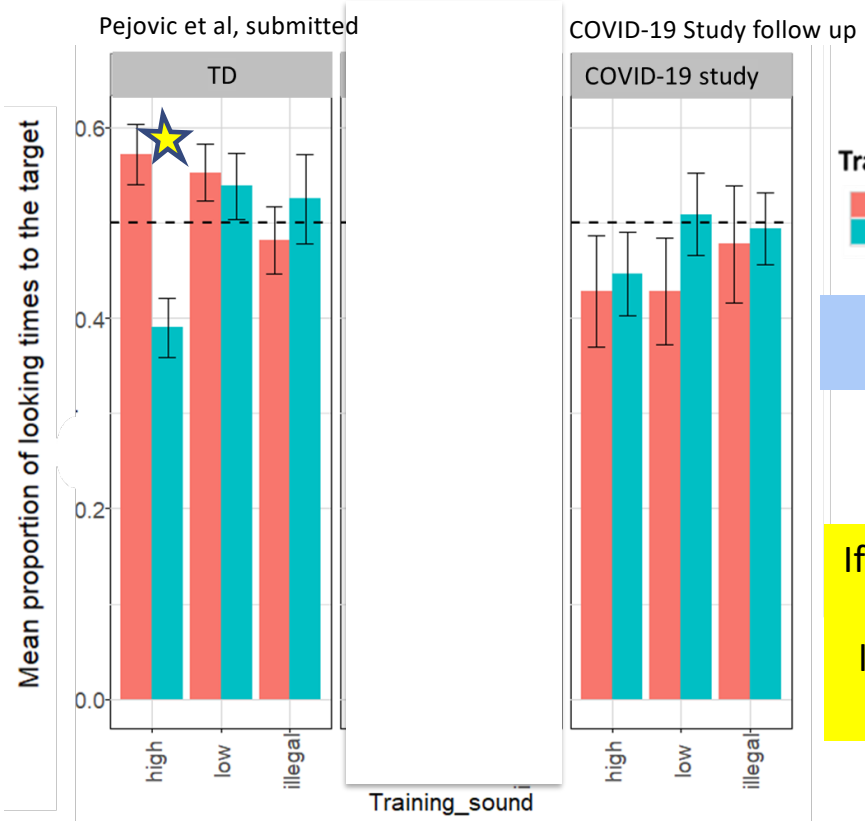
# Results




No word segmentation !

# Results

Sensivitity to phonotactic patterns in word learning, measured with eye-tracking (Frota et al., 2021, Pejovic et al., submitted)



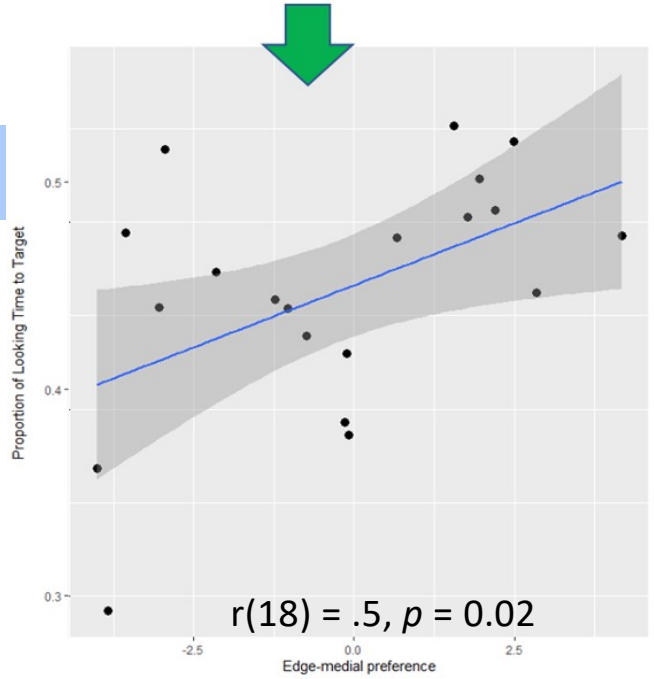

N=31, mean age 20.4

N=20, mean age 20.4

No word learning !

If preferred edge over medial (i.e., better at edge), then better at looking at the target in the word learning task

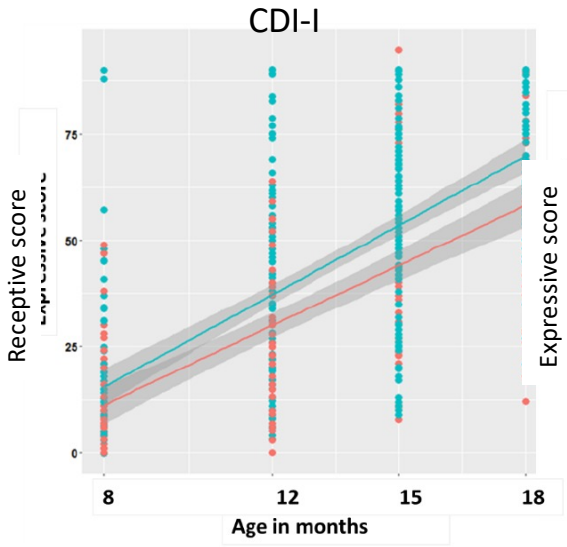
Segmentation at 7-9 months and Word learning

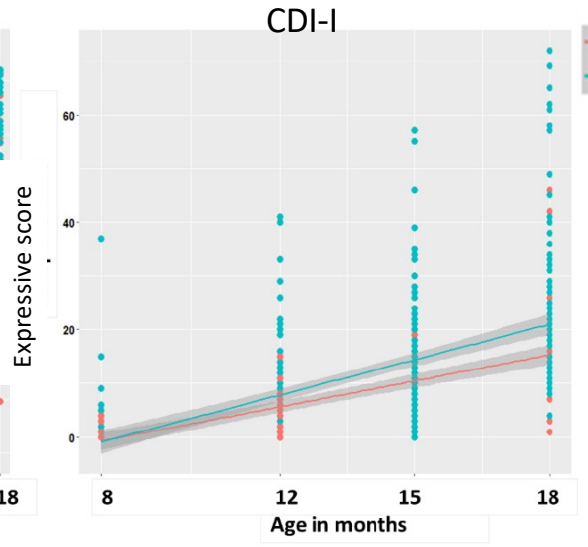


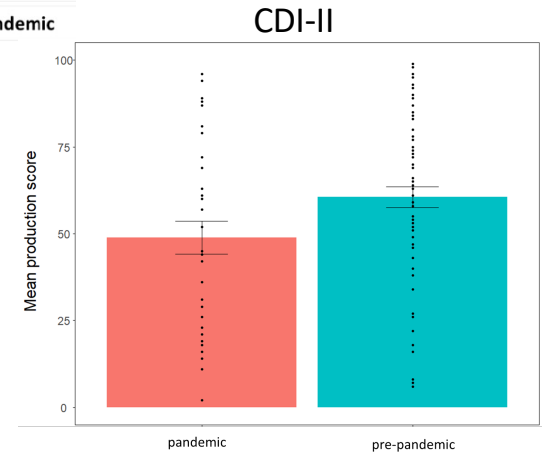
2. Later language development: **Vocabulary development** (CDI measures) *Frota, Pejovic et al., in progress*

# Results

Despite gains in vocabulary development with age, no convergence yet by 24 months




Infants from the COVID-19 study have **lower expressive vocabulary scores** than same age infants from the CDI-I norming study (p<.001, Z=-2.9, *r* = .23)

They scored **lower both for receptive** (p=.02, Z=-2.24, *r* = .18) **and expressive vocabulary** (p=.03, Z=-2.1, *r* = .18) than same age infants from the CDI-I norming study

They scored **lower both for receptive** (p=.01, Z=-2.55, *r* = .26) **and expressive vocabulary** (p=.06, Z=-1.84, *r* = .19) than same age infants from the CDI-I norming study

Infants from the COVID-19 study scored **lower for expressive vocabulary** scores (p=.04, Z=-2.0, *r* =.2) than same age infants from the CDI-II norming study

12 months
N= 32, 11-13 mos, mean=12.6

15 months
N = 39, 14-16 mos, mean=15.3

18 months
N = 33, 17-19 mos, mean=18.2

24 months
N = 36, 24-25 mos, mean=24.2

# Discussion

1. Frota et al., (2022): No evidence for segmentation (not even at the prosodic edge)
   - Presence/absence of the face mask
   - Auditory only /audiovisual speech cues

   - Audiovisual impact of face-masked speech was stronger than the auditory impact (some evidence towards a developing advantage of utterance-edge position without mask – see the published paper)

2. Follow up studies found a (prolonged) effect of exposure to altered speech cues and (other) COVID-related changes > Difference between pre-pandemic data and our findings

   - **Segmentation abilities are delayed in infants from the COVID-19 study (12 months);**
   - **At 20 months, they fail to use word learning mechanisms previously found at same age toddlers**
   - **Delays in vocabulary development are still apparent at 24 months of age (CDI)**

# Discussion

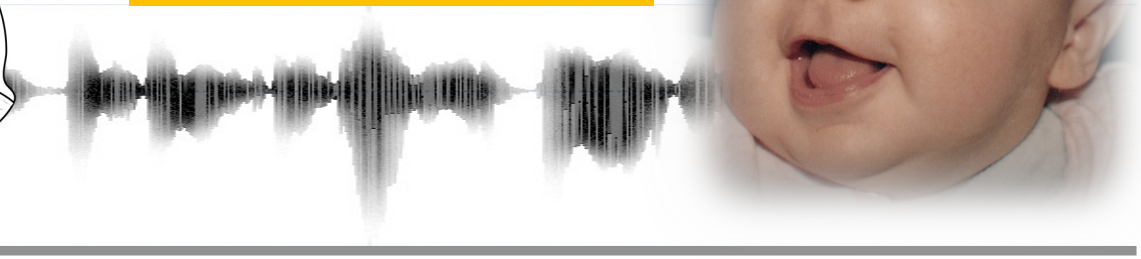

Visual speech cues

+

Auditory speech cues

+

Everyday communication/ interaction




Affect early speech processing!

Effects on language development

Our results suggest an overall effect of the pandemic on early segmentation abilities and **later language development**, with significant delay patterns that persist until 24 months of age.

# Early Word Segmentation Behind the Mask

ORIGINAL RESEARCH
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Jovana Pejovic

## Obrigada!
## Thank you!



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