# More Than Just Words: The Impact of Environment on Children's Language Growth

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# Language environment to support language development

## Quantity & quality of language

(Hart & Risley, 1995; Hirsh-Pasek et al., 2015; Tamis-LeMonda,et al, 2014).

## Conversational turns

(eg. Gratier et al., 2015; Levinson, 2016)

## Maternal (parental) responsivity

(eg. Tamis-Lemonda, et al, 2006; Rowe et al., 2005; Rowe, 2012)

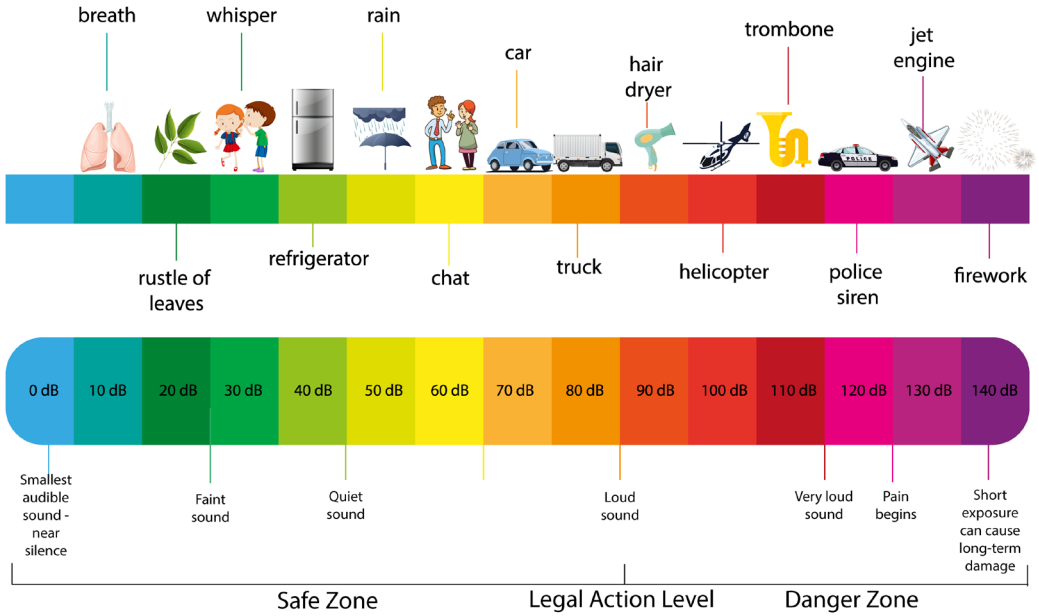
# Children are raised in noisy environments

# Auditory environments

**+ 15 dB SNR**

**ASHA recommendation**

(American Speech-Language Hearing Association, 2005)




**Signal to noise ratio** (SNR)
Signal (Language)
should be 15 dB (decibels)
above the surrounding noise

# Auditory environments

**+ 15 dB SNR**

**ASHA recommendation**

(American Speech-Language Hearing Association, 2005)

**+ 2 dB / + 11 dB SNR**

(e.g., Larsen & Blair, 2008)

**~ 8 dB SNR**

(e.g., Benitez-Barrera, Grantham, & Hornsby, 2020)

**Signal to noise ratio** (SNR)
Signal (Language)
should be 15 dB (decibels)
above the surrounding noise

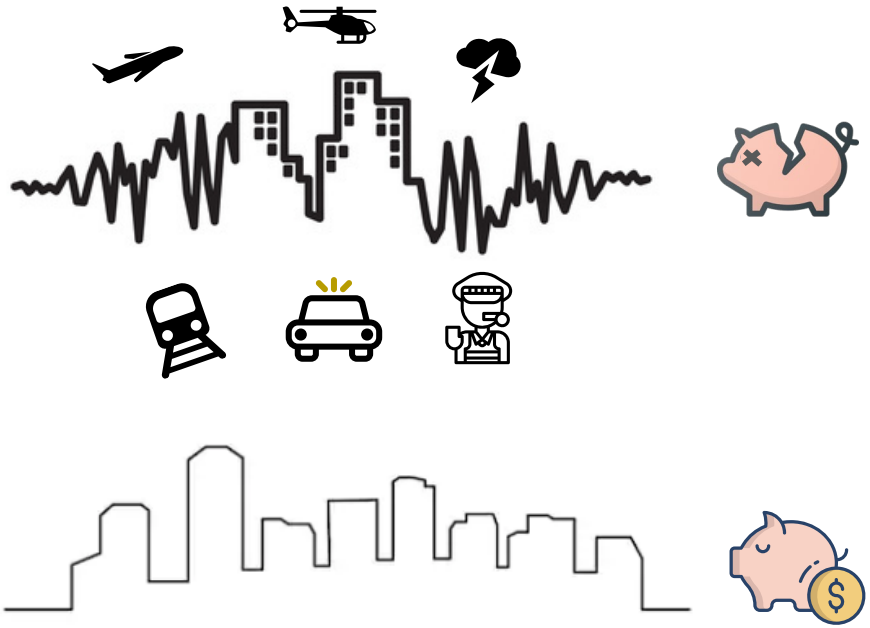
**< 15 dB recommendation**

# Noise is a problem for learning

| Listening effort and fatigue | Inability to concentrate | Poor word learning | Access to language |
|---|---|---|---|
| (e.g., Picou, Ricketts & Hornsby, 2013) | (e.g., Clark & Sörqvist, 2012) | (e.g., McMillan &Saffran, 2016) | (Jamieson, Kranjc, Yu & Hodgetts, 2004; McMillan & Saffran, 2018) |

# Noise exposure is higher in low income homes

## External noise



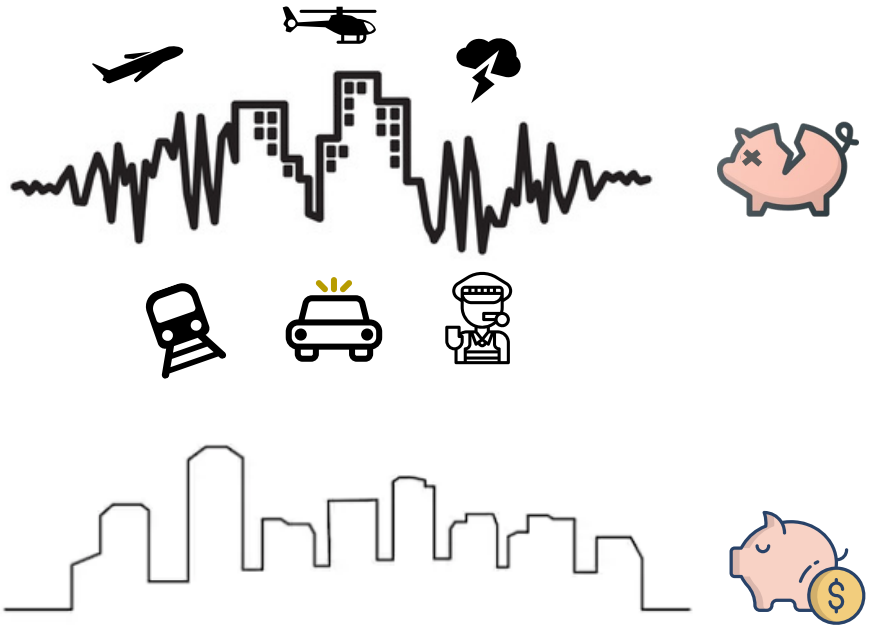
## Internal Noise

# Television and language development

- Based on parent report of TV viewing, increased viewing is correlated to worse language development (Byeon & Hong, 2015; Lin, et al 2015; Masur, et al 2016; Lavigne et al. 2015; Ribner, et al, 2017; Tomopoulos et al., 2010; Zimmerman & Christakis, 2005 but see Schmidt, et al, 2009)
- Why?
  - More noise: Signal to noise ratio
  - Parent interactions:
    - More TV = lower quantity and quality of language (Lavigne et al. 2015) and fewer conversational turns (Cyck & De Anda 2021; Ambrose, Van Dam &Moeller, 2014)
    - Techniference (Corkin et al. 2021; Krogh et al. 2021)
- American Academy of Pediatrics recommendations
  - Video chat is exempt
  - Potential educational benefits in bilingual homes (Beck et al 2015)
    - In preschool kids can learn from TV, when co-viewing (eg., Richet, Robb, Fender, Wartella, 2010)
    - 4- 5- year-old English speakers learned Welsh through TV (e.g., Willams & Thomas, 2017) .

# Noise exposure is higher in low income homes

## External noise



## Internal Noise

# Chronic noise could be a problem for development

## Hearing Loss

(e.g, Harrison, 2008)

## Neural disorganization & impaired learning (animal studies)

(e.g, Cheng et al., 2018; Sun et al., 2011)

## Parental Stress

(e.g, Troller-Renfer et al., 2022; Magill-Evans & Harrison, 2010)

# Current question: Does a childhood in a noisy household effect language development?

| Auditory environment | Language environment | Parental response to noise |
| --- | --- | --- |
|  |  |  |
|  |  |  |

# Environment

LENA: Digital Language Processor


| Auditory environment | Language environment | Parental response to noise |
|---|---|---|
| Noise<br>overlap speech<br>distant speech<br>outside noise<br>TV/media | Adult word count<br>Conversational turns | Signal to noise<br>(Benita Barrera & Hornsby & Wesley, 2020)<br>adjusting language to account for noise<br>**Parental Responsivity** |

# Measure of child language

QUIL: ES – Language screener
in English and Spanish


- Vocabulary: what words do children already know?
- Syntax: what do children know about putting words together
- Process: How skilled are children at learning new language?
- Combined scores: with and across languages

# Current study: Is childhood household noise related to language development?

Language environment

Auditory environment

Parental Response to noise

Brain Structure and function

Maternal Stress

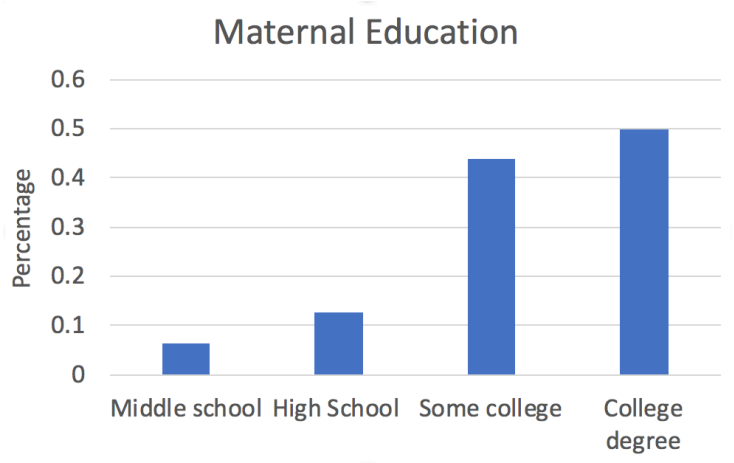
# Current study: Is childhood household noise related to language development?

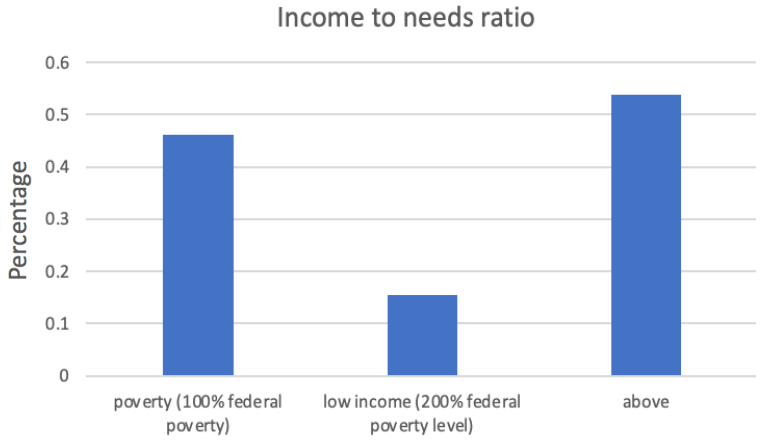
- Children (ages 3-5 years) from primarily Spanish-speaking homes across a range of SES
- Why?
  - Multigenerational
  - Diversity in SES
  - Bilingualism

# Results so far

- 16 Families
- To date:
  - LENA data
  - Spanish and English language measures (QUILS)
- Future directions
  - Transcribing LENA
  - Parental stress
  - EEG

# Demographics (SES)



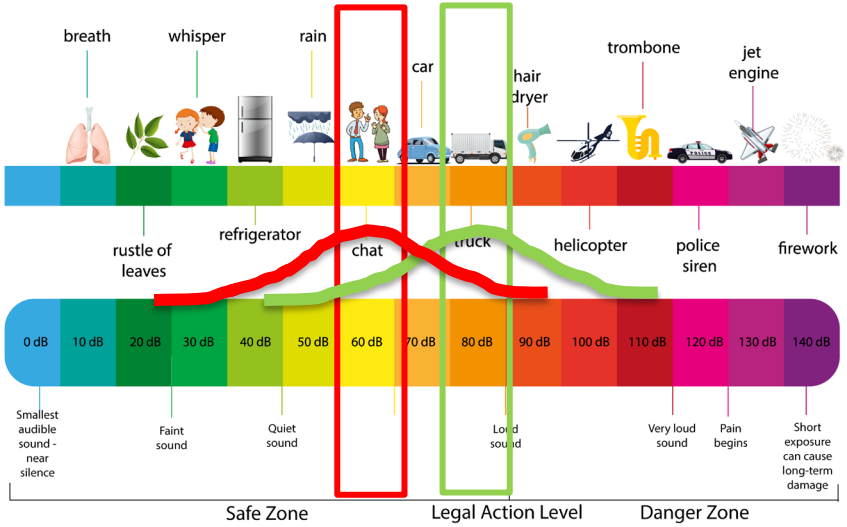

- ~80 % of mothers at least some college
- Mean annual income = $61,000
- On average 5 people living in the home (Range: 3 to 9)
- >50% low income or at poverty

# Noise in the environment

## Noise

66.83 dB (SD = 2.36 dB)

range 61.9 -71.32 dB




## Signal to Noise Ratio

4.35 dB (SD = 2.04 dB)

range 1.02 -8.9 dB

**< + 15 dB recommendation**

# TV in the environment

**~2 hours/day approx.**

**~30 mins – 4 hours**

TV percent

11.9% (SD = 5%)

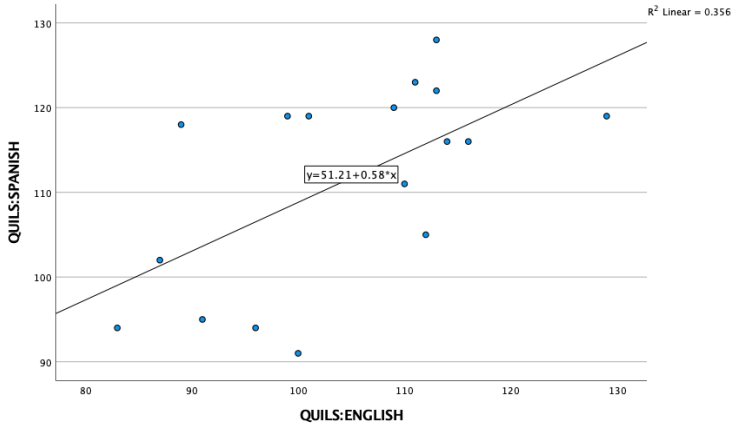
range 3%-21%

Similar to other studies with children
Cycyk & De Anda (2021)

# Results: Child Language

- Spanish

| | Mean | SD | Min | Max |
|---|---|---|---|---|
| **Combined** | **110.0.9** | **11.66** | **91** | **128** |
| Vocabulary | 116 | 11.59 | 96 | 134 |
| Syntax | 106 | 11.59 | 84 | 125 |
| Processing | 113.8 | 13.35 | 81 | 131 |




- English

| | Mean | SD | Min | Max |
|---|---|---|---|---|
| **Combined** | **104.29** | **12.35** | **83** | **129** |
| Vocabulary | 110.88 | 9.89 | 95 | 133 |
| Syntax | 102.24 | 16.26 | 74 | 123 |
| Processing | 106.82 | 16.8 | 77 | 135 |

r = .597, p = 0.011

# What predicts language abilities?

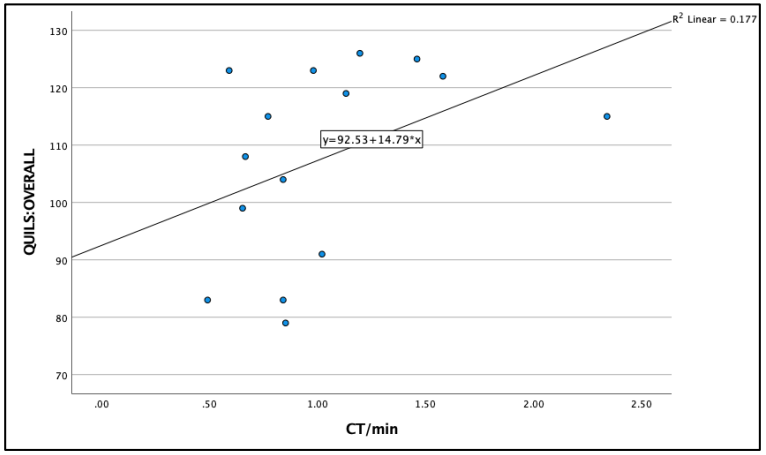
Adult Words

Conversational Turns → Language (Spanish & English)

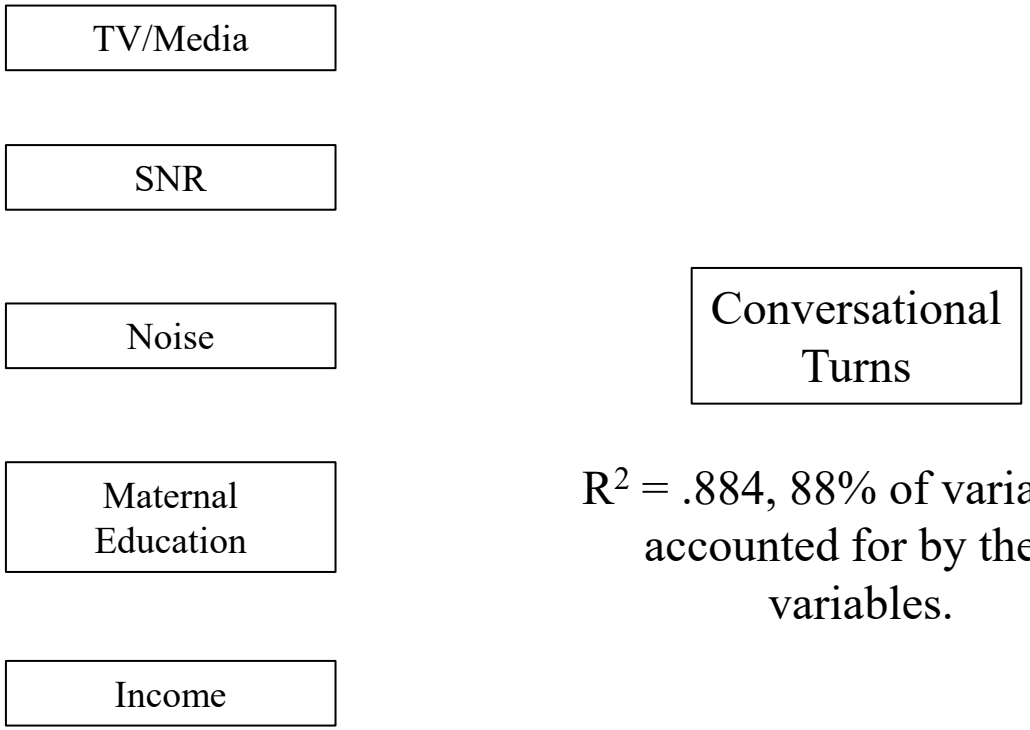
$r$=.452, $p$ = 0.04

Noise

SNRs



# What predicts conversational turns?




$R^2$ = .884, 88% of variability accounted for by these variables.

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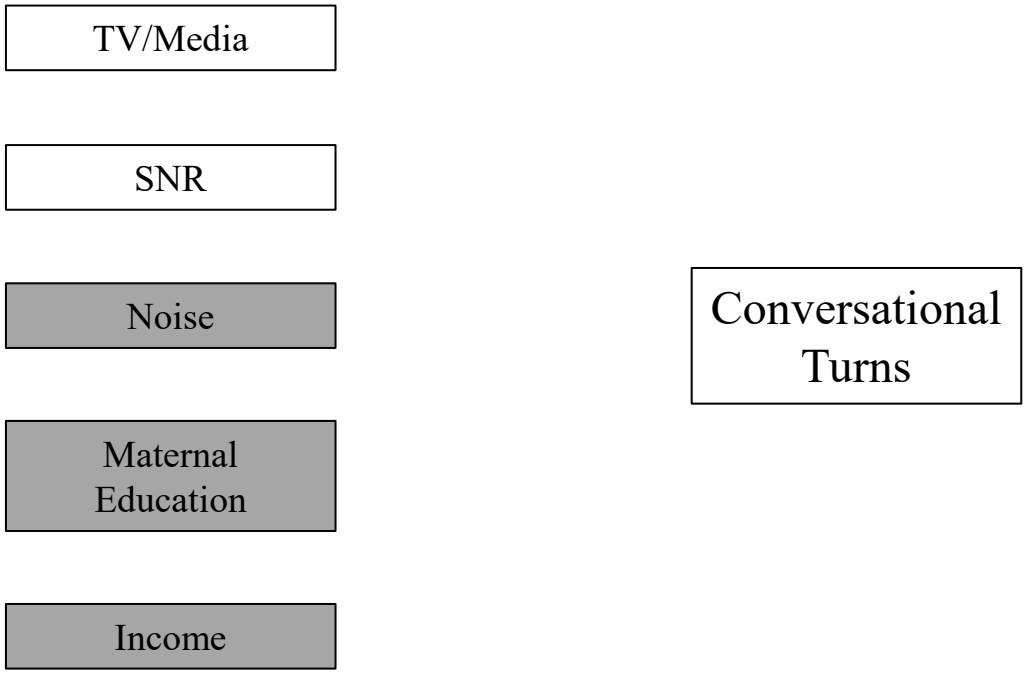

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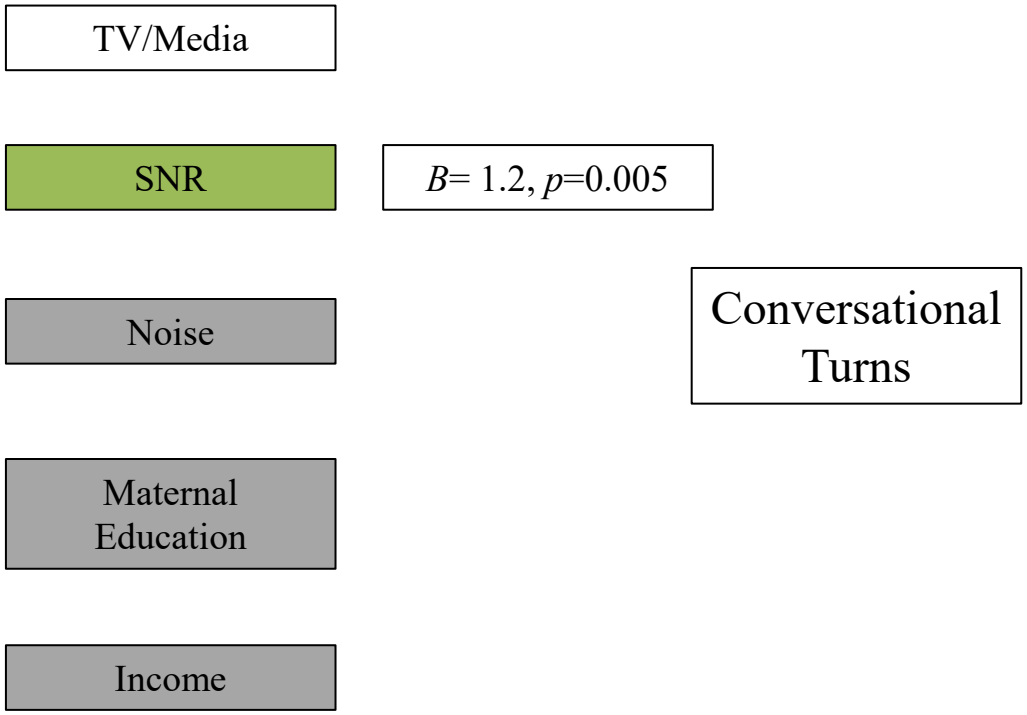

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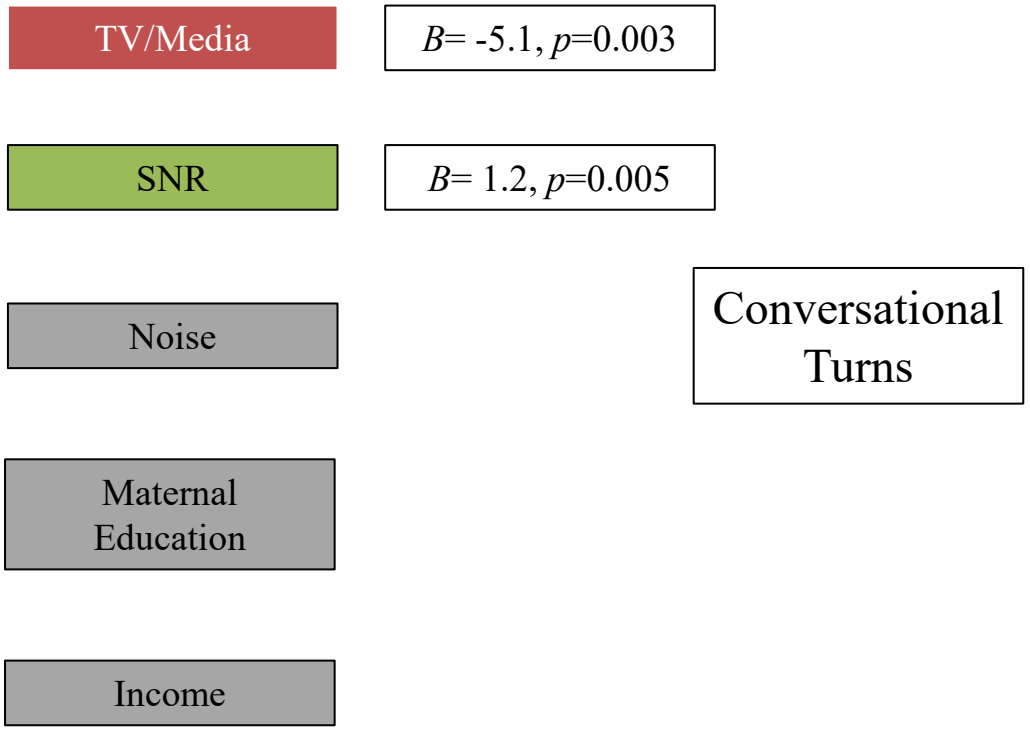
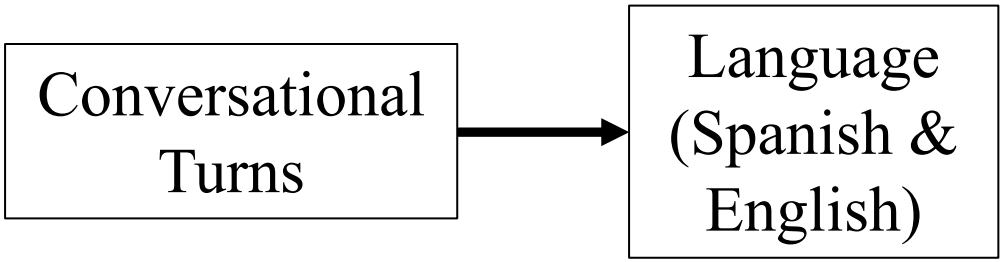


# How does the environment influence this?



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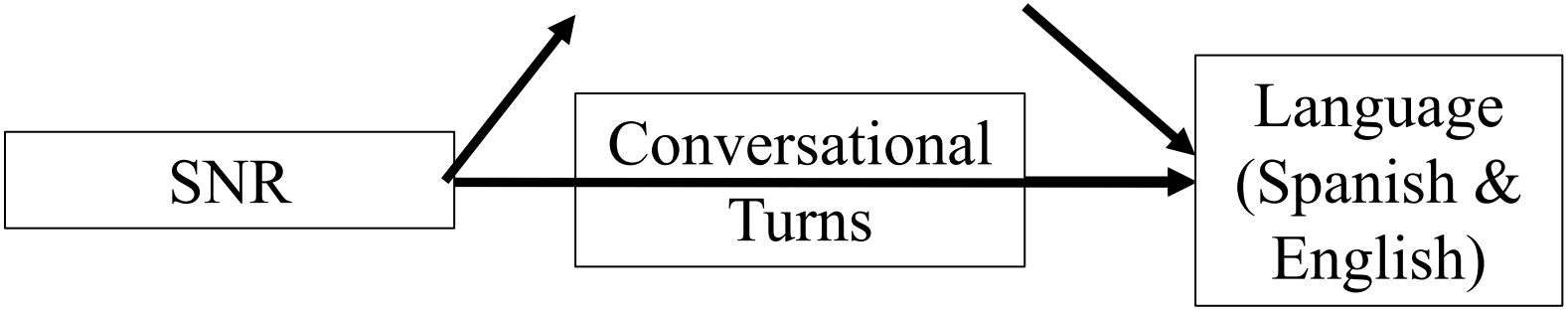

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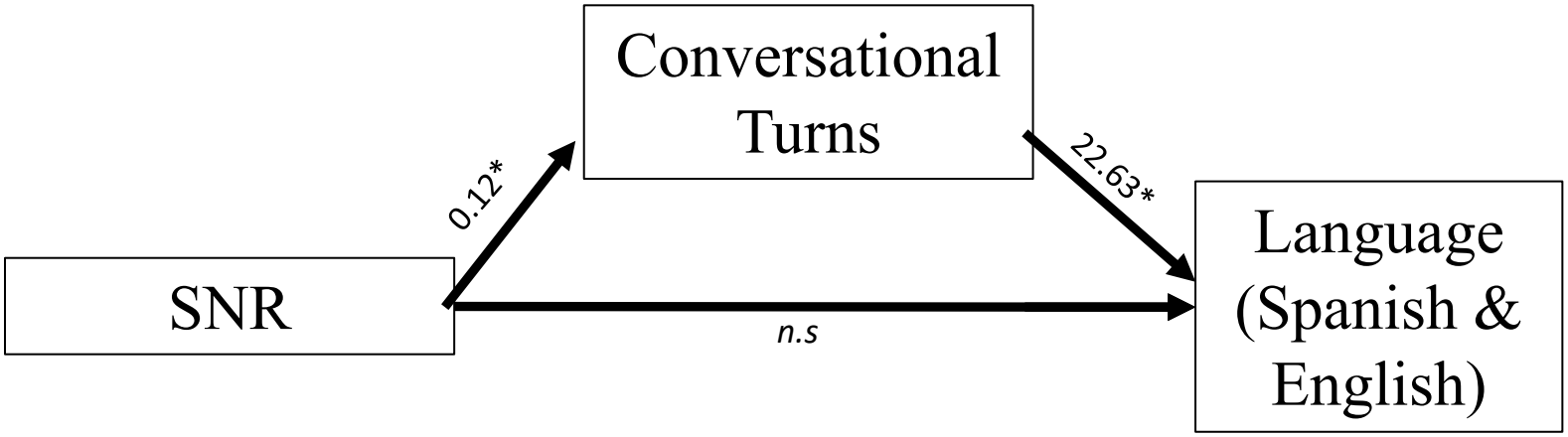
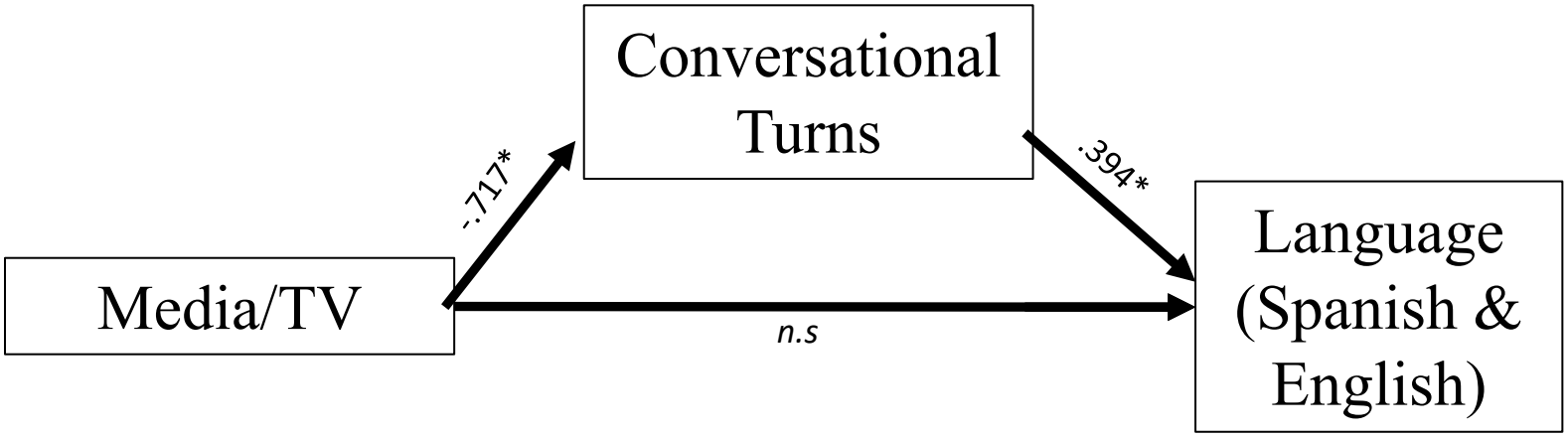



**Adult-child interaction** – conversational turns
**Parental Responsivity** – signal to noise ratio
What matters to language development is not the noise, but how the parents adjust their language to account for the noise

# How does the environment influence this?




Supports and expands on previous findings.
The reason TV negatively influences language development is conversational turns, not at all due to watching TV per se

# Conclusions: Environment Matters

- Language environment
  - Conversational turns
- Children live in *noisy* environments
  - Average SNR was + 4 dB (well below + 15 dB)
- When families adjust their language to account for noise, children's language is strong.
  - Coming closer
  - Speaker louder
- SNRs can be seen measure of parental responsivity

# Conclusions: TV

- TV effects language development because it is related to adult language (conversational turns)
  - Rates similar to other findings with similar populations

# Take home messages

- Noise matters. Overlooked related to language development.
- More responsive parents adjust their speech to the environment – benefits for language development
- TV takes away time from adult-child interactions – Detrimental for language development
- Advice to parents
  - Noise at these levels not necessarily problematic
  - Need to adjust to it
    - Reducing noise or
    - Increasing speech levels
    - Quiet times
- Way more research is necessary.

# Thank you!

- Families and children who take part
- Funders
  - ASHA
  - National Science Foundation
  - UTD School of Behavioral and Brain Sciences
- Students and collaborators