Do Olhar ao Cérebro: marcadores precoces no desenvolvimento da linguagem

Eyes and Brain: Early markers of Language development

http://ww3.fl.ul.pt/LaboratorioFonetica/babylab/EBELa/
Ethics Statement: Ethical approval obtained from Comissão de Ética do Hospital de Santa Maria and from Comissão de Ética da Administração Regional de Saúde de Lisboa e Vale do Tejo; Written informed consent obtained from parents or legal guardians of all participants according to the principles explained in the Declaration of Helsinki
Goals

Research on early markers of language development using both standard behavioral measures and ERP measures

- Infant’s task in learning a language: a stronger commitment to the native language as development proceeds

- Markers of early acquisition
  - Predictors of later abilities
    - Normal development (faster, later)
    - Language impairment (SLI, ASD)

- Domain: general/language specific?

- What the early markers for European Portuguese are
- How they correlate and at which timepoint with later language skills

[1, 2, 3]
Goals: Prospective study in 4 domains

- Stress discrimination
- Phonetic discrimination
- Pitch discrimination
- Phonetic discrimination
- Word learning

5/6 6/7 8/9 12 (18) 19/20 (24) (30)

CSBS_DP Infant Toddler Checklist (adapted to EP, norming study planned) [4]

Portuguese Communicative Development Inventory (CDI) – Short forms (8-18; 16-30) [5]

WHY looking for early markers in these 4 domains?
Goals: Prospective study in 4 domains

CSBS_DP Infant Toddler Checklist (adapted to EP, norming study planned) [4]

Portuguese Communicative Development Inventory (CDI) – Short forms (8-18; 16-30) [5]

Eyes ET
Brain ERP

WHY using Eye-tracking and ERPs?
Goals: Prospective study in 4 domains

5/6, 6/7, 8/9, 12, (18), 19/20, (24), (30)

Stress discrimination, Phonetic discrimination, Pitch discrimination, Phonetic discrimination, Word learning

CSBS_DP Infant Toddler Checklist (adapted to EP, norming study planned) [4]

Portuguese Communicative Development Inventory (CDI) – Short forms (8-18; 16-30) [5]

“Because it is non-invasive and does not require advanced motor responses or language, eye tracking is particularly important for the study of young children and infants.” “...eye tracking can reveal important features of the complex picture of autism.” [6]
Goals: Prospective study in 4 domains

CSBS_DP Infant Toddler Checklist (adapted to EP, norming study planned) [4]

Portuguese Communicative Development Inventory (CDI) – Short forms (8-18; 16-30) [5]

“Noninvasive safe brain technologies have now been proven feasible for use with children starting at birth.” “...linguistic development from infants’ earliest responses... is reflected in infants’ language abilities in the second and third year of life” [1]
Goals: Prospective study in 4 domains

Stress discrimination

Word stress as a strong cue for knowing where the words are in continuous speech, in some languages (e.g., English, German) > speech segmentation task

Performance predicts language later language skills (e.g., expressive vocabulary)

Performance as a marker of risk for later language impairment (SLI)

[7], [8]
**Goals: Prospective study in 4 domains**

- **Eyes ET**
- **Brain ERP**

**Stress discrimination**

Word stress as a strong cue for knowing where the words are in the continuous speech, in some languages (e.g., English, German) > speech segmentation task

**Performance predicts language later language skills** (e.g., expressive vocabulary)

**Performance as a marker of risk for later language impairment (SLI)**

5/6 6/7 8/9 12 (18) 19/20 (24) (30)

Altered looking patterns across facial parts [6], [16]

[7], [8]
Phonetic discrimination develops from a general to a language-specific stage. The latter is crucial to segment words, and proceed with learning, and thus predicts later language skills (ASD, SLI) [1], [2], [9].

The diagram illustrates different sounds, progressing from native sounds to words, phrases, and beyond. This progression is key to understanding how phonetic discrimination evolves and its implications for language development.
Goals: Prospective study in 4 domains

Phonetic discrimination develops from a general to a language-specific stage.

The latter is crucial to segment words, and proceed with learning, and thus predicts later language skills (ASD, SLI).

[1], [2], [9]
Goals: Prospective study in 4 domains

Intonation Phrase boundaries are crucial for both lexical and syntactic segmentation

Given infants’ early sensitivity to pitch, this field suggests promising results as predictive markers

Às meninas] deram bonecas]
As meninas deram bonecas]

Word segmentation next to boundaries + phrasing

5/6 6/7 8/9 12 (18) 19/20 (24) (30)
Goals: Prospective study in 4 domains

**Eyes**
**ET**
**Brain**
**ERP**

The words the infant learns guide him/her in later language development (of the lexicon, phonology and syntax).

The beginnings of sound-meaning associations correlate with other markers of development and signal risk for impairment (ASD).

 satu > Rafu >>*nhagu // sopa

How native sound combinations impact on infants’ word learning

[1], [12], [13]
Eyes and Brain: Participants

- Participants
  - 2 groups: typically developing (TD) and at risk group (ARG)
  - Criteria for inclusion/exclusion: ARG ([14], [15])
    Genetic risk (one first degree family member with ASD or SLI)
    Other risk factors: sex (male), low birth weight (< 2500g), low 5’ APGAR score, premature birth (<37)
    Screening tool (CSBS-DP)
- N for each task 30 infants (30 x 4 x 2 x 2 = 480)
- Adult group (ERP tasks – no adult data)
Eyes and Brain: Participants

- **Participants**
  - 2 groups: typically developing (TD) and at risk group (ARG)

**Network of public and private institutions collaborating with EBELa**

- Hospitals: HSM-CHLN
- Health centers
- Nursery schools
- APPDA, Diferenças
- Other private associations
- ......
Eyes and Brain: Expected trends at a glance

Research on early markers of language development: prospective study

4 domains

- Phonetic discrimination NN (6,12mos)
- Stress discrimination (5-6mos)
- Pitch processing (8-9mos)
- Word learning (19-20mos)

Eye-tracking

- Anticipatory looking
- Visual fixation

ERPs

- MMN, N250-550, P150-250
- MMN
- CPS
- N400

EP-CDI – measure of later language outcomes

NO/LOW RISK FOR ASD/SLI (TD) vs. HIGH RISK GROUP (ARG)

12, 18, 24, 30
Eyes and Brain: Predictions & Outcomes

Research on early markers of language development: prospective study

1. Overall poor language abilities in ARG when compared to TD
2. **Early markers as predictors of later language abilities:** The eye movement and neural responses as the potential early markers/predictors; The CDI scores and the final Griffiths score as the language development measures to be predicted
3. Good discrimination of nonnative contrasts will *correlate negatively* with later language abilities.
4. Good discrimination of native contrasts will show a *positive correlation*
5. Cases with formal diagnosis on independent grounds would provide a robust estimate of how effective the previously identified early markers of risk can be as an early diagnostic tool
6. Proposal of a set of early markers of risk as decisive step in the promotion of more effective methods of assessment, prevention and intervention with strong individual, familial and social benefits
Instruções

Para palavras que a criança compreende mas ainda não diz, assine a primeira coluna (Compreende). Para palavras que a criança compreende mas também diz, assine a segunda coluna (Compreende e diz). Se a criança usa uma forma diferente de dizer a palavra, assinale-a na mesma (ex: 'nana' para banana). No caso de palavras que podem ter uma forma masculina e feminina, ou singular e plural (ex: bonito, bonita, bonitos, bonitas), responda considerando qualquer uma das formas. Inclua ainda as formas com -inho/a (ex: boticinha, boticinhas, boticinhas). Considere também as várias formas do mesmo verbo (ex: dar, cid, dava).

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As crianças compreendem mais palavras do que dizem. Neste questionário, estamos interessados em saber as palavras que o/ela usa ou/ou não diz. Por favor, assinale as palavras que ouviu a criança dizer. Se a criança diz a palavra de uma maneira diferente, assinale-a no mesmo (ex: 'nana' para banana). No caso de palavras que podem ter uma forma masculina e feminina, ou singular e plural (ex: bonito, bonita, bonitos, bonitas), responda considerando qualquer uma das formas, bem como as formas com -inho/a (ex: boticinha, botinhas, botinhas). Considere também as várias formas do mesmo verbo (ex: dar, cid, dava).
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