Universidade de Lisboa
Lisbon BabyLab - FLUL/CLUL
LaPSo-ISCTE, FPCE-UP, HSM-CHLN

Do Olhar ao Cérebro: marcadores precoces no desenvolvimento da linguagem

Eyes and Brain: Early markers of Language development

EBELa

http://ww3.fl.ul.pt/LaboratorioFonetica/babylab/EBELa/

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Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

EBELa: EXCL/MHC-LIN/0688/2012

Universidade de Lisboa
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CADin, 12 Jan 2015

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Eyes and Brain: Early markers of Language development

EBELa

http://labfon.letras.ulisboa.pt/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

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EBELa: EXCL/MHC-LIN/0688/2012

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

What the early markers for European Portuguese are

How they correlate and at which timepoint with later language skills

Markers of early acquisition

Domain general/ language specific?

Predictors of later abilities

Normal development (faster, later)

Language impairment (SLI, ASD)

[1, 2, 3]

Goals: Prospective study in 4 domains

Eyes ET + Brain ERP

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

Stress discrimination

Phonetic discrimination

Pitch discrimination

Phonetic discrimination

Word learning

WHY looking for early markers in these 4 domains?

Reports

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

Griffiths scales

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

Goals: Prospective study in 4 domains

Eyes ET + Brain ERP

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

Stress discrimination

Phonetic discrimination

Pitch discrimination

Phonetic discrimination

Word learning

WHY using Eye-tracking and ERPs?

Reports

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

Griffiths scales

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

Goals: Prospective study in 4 domains

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

Stress discrimination

Phonetic discrimination

Pitch discrimination

Phonetic discrimination

Word learning

"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]

Reports

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

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

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Stress discrimination

Phonetic discrimination

Pitch discrimination

Phonetic discrimination

Word learning

"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]

Reports

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

Griffiths scales

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

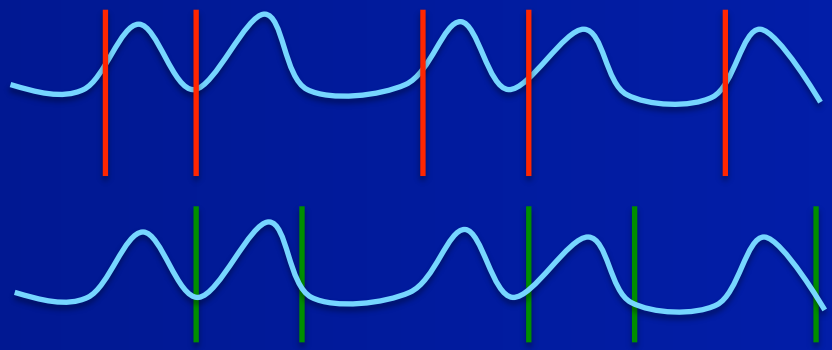
Goals: Prospective study in 4 domains

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

Eyes ET
+
Brain ERP

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

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

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)

[7], [8]

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

Goals: Prospective study in 4 domains

Eyes ET + Brain ERP

5/6 6/7 8/9 12

Phonetic discrimination

Phonetic discrimination

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q G		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	N		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

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]

Native sounds > words > phrases >…

Goals: Prospective study in 4 domains

Eyes ET + Brain ERP

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

Phonetic discrimination

Phonetic discrimination

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]

Standards Deviant Deviant

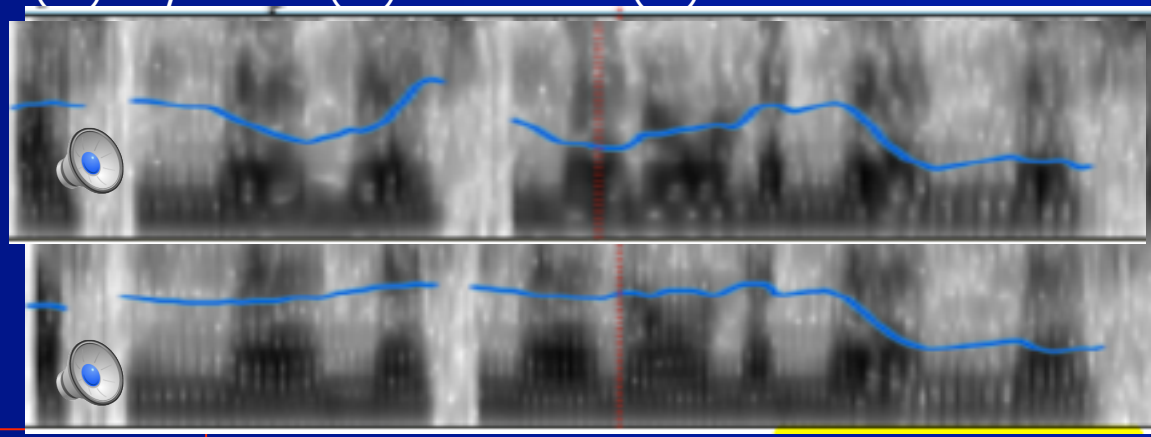
da da da da da ba da da da da da da da da ...

Goals: Prospective study in 4 domains

Eyes ET + Brain ERP

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

Pitch discrimination



Intonation Phrase boundaries are crucial for both lexical and syntactic segmentation

[10], [11]

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

Goals: Prospective study in 4 domains

Eyes ET
+
Brain ERP

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

Word learning

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)

[1], [12], [13]

satu > Rafu >>*nhagu // sopa

How native sound combinations impact on infants' word learning

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	Eye-tracking		ERPs		EP-CDI – measure of later language outcomes
Phonetic discrimination NN (6,12mos)	-	Anticipatory looking	- / +	MMN, N250-550, P150-250	12, 18, 24, 30
Stress discrimination (5-6mos)	+	Anticipatory looking	+	MMN	+
Pitch processing (8-9mos)	+	Visual fixation	+	CPS	+
Word learning (19-20mos)	+	Visual fixation	+	N400	+

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

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

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Lisbon Baby Lab

CDI para o Português Europeu – Forma reduzida: Nível I

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http://www.fl.ul.pt/laboratoriofonetica/babylab/pt/CDI_Portugues_Europeu.html

Nome da criança ____________________ Sexo F o M o

Data de nascimento _____/_____/_____ Data de hoje ________________

Instruções

Para palavras que a criança compreende mas ainda não diz, assinale a primeira coluna (Compreende). Para palavras que a criança compreende mas também diz, assinale 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, bonito, bonitos, bonitas), responda considerando qualquer uma das formas. Inclua ainda as formas com -inho/a (ex.: bonitinho, bonitinha, bonitinhos, bonitinhas). Considere também as várias formas do mesmo verbo (ex.: dar, dá, deu).

	Compreende	Compreende e diz		Compreende	Compreende e diz		Compreende	Compreende e diz
ai	o	o	biberão	o	o	cai/cair	o	o
ão (som do animal)	o	o	colher	o	o	canta/cantar	o	o
brrum-brrum	o	o	copo	o	o	dá/dar	o	o
piu-piu (som do animal)	o	o	escova	o	o	espera/esperar	o	o
cão	o	o	garfo	o	o	gosta/gostar	o	o
galinha	o	o	luz	o	o	pára/parar	o	o
gato	o	o	manta	o	o	puxa/puxar	o	o
leão	o	o	cadeira	o	o	ri/rir	o	o
pato	o	o	cama	o	o	salta/saltar	o	o
rato	o	o	cozinha	o	o	tira/tirar	o	o
carro	o	o	mesa	o	o	toma/tomar	o	o
triciclo	o	o	televisão	o	o	azul	o	o
bola	o	o	água	o	o	bom	o	o
boneco	o	o	árvore	o	o	bonito	o	o
livro	o	o	casa	o	o	depressa	o	o
banana	o	o	chuva	o	o	fofo	o	o
bolo	o	o	flor	o	o	grande	o	o
leite	o	o	lua	o	o	já está	o	o
pão	o	o	pedra	o	o	mau/má	o	o
papa	o	o	rua	o	o	hoje	o	o
sopa	o	o	avó/vovó	o	o	noite	o	o
chapéu	o	o	bebé	o	o	este	o	o
fralda	o	o	mãe/mamã	o	o	meu/minha	o	o
meia(s)	o	o	menina	o	o	mim	o	o
sapato(s)	o	o	banho	o	o	onde	o	o
cabeça	o	o	chichi	o	o	quem	o	o
cabelo	o	o	colo	o	o	ali	o	o
dentes	o	o	cucu	o	o	fora	o	o
olho(s)	o	o	não	o	o	algum	o	o
pé	o	o	olá	o	o	mais	o	o

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Lisbon BabyLab

CDI para o Português Europeu – Forma reduzida: Nível II

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http://www.fl.ul.pt/laboratoriofonetica/babylab/pt/CDI_Portugues_Europeu.html

Nome da criança ____________________ Sexo F o M o

Data de nascimento _____/_____/_____ Data de hoje ________________

Instruções

As crianças compreendem mais palavras do que dizem. Neste questionário, estamos interessados em saber as palavras que o/a seu/sua filho/a DIZ. Por favor, assinale as palavras que ouviu a criança dizer. Se ela diz a palavra de uma maneira diferente, 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, bonito, bonitos, bonitas), responda considerando qualquer uma das formas, bem como as formas com -inho/a (ex.: bonitinho, bonitinha, bonitinhos, bonitinhas). Considere também as várias formas do verbo (ex.: dar, dá, deu).

ai	o	caixa	o	dá/dar	o
mé-mé	o	computador	o	finge/fingir	o
miau	o	garfo	o	gosta/gostar	o
pumba	o	luz	o	pensa/pensar	o
tau-tau	o	óculos	o	põe/pôr	o
cão	o	tapete	o	quer/querer	o
cavalo	o	toalha	o	salta/saltar	o
gato	o	cadeira	o	vê/ver	o
pato	o	cama	o	azul	o
rã	o	escada(s)	o	bom	o
urso	o	frigorífico	o	bonito	o
barco	o	quarto	o	depressa	o
carro	o	árvore	o	fofo	o
helicóptero	o	baloiço	o	frio	o
bola	o	céu	o	já está	o
brinquedo	o	chuva	o	maior	o
livro	o	sol	o	pequeno	o
água	o	circo	o	depois	o
banana	o	escola	o	dia	o
bolacha	o	amigo	o	hoje	o
carne	o	mãe/mamã	o	isto	o
iogurte	o	professor	o	mim	o
pão	o	banho	o	nosso	o
queijo	o	não	o	tu	o
sumo	o	obrigado(a)	o	onde	o
casaco	o	olá	o	aqui	o
chapéu	o	por favor	o	dentro	o
meia(s)	o	acaba/acabar	o	em cima	o
sapato(s)	o	brinca/brincar	o	muito	o
mão	o	cabe/caber	o	nenhum	o
olho(s)	o	cai/cair	o	sou/são/é	o
perna	o	compra/comprar	o	porque	o
unha(s)	o	corre/correr	o	palavras terminadas em -zinho (ex.: leãozinho)	o

A sua criança começou a combinar palavras, como por exemplo, 'bola amarela', 'quero pintar' ou 'menino voa'?
Não o Às vezes o Muitas vezes o

RESEARCH TEAM

Lisbon BabyLab: Membros da equipa

Em cima, da esq. para a dir.: Joseph Butler, Simão Cortês, Cátia Severino, Ertugrul Uysal. Em baixo, da esq. para a dir.: Profª Marina Vigário (Investigadora Responsável EBELa), Susana Correia, Nuno Matos, Marisa Cruz, Profª Sónia Frota (Directora do Laboratório e Lisbon BabyLab)

Lisbon BabyLab, CLUL

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Instituto Universitário de Lisboa

Obrigada

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