The role of letter identity and letter position in Spanish developing readers: Evidence with skilled and dyslexic children

Joana Acha
Andone Sistiaga, Javier S. Sainz, Miguel Lázaro and Victor Illera

What does skilled reading mean

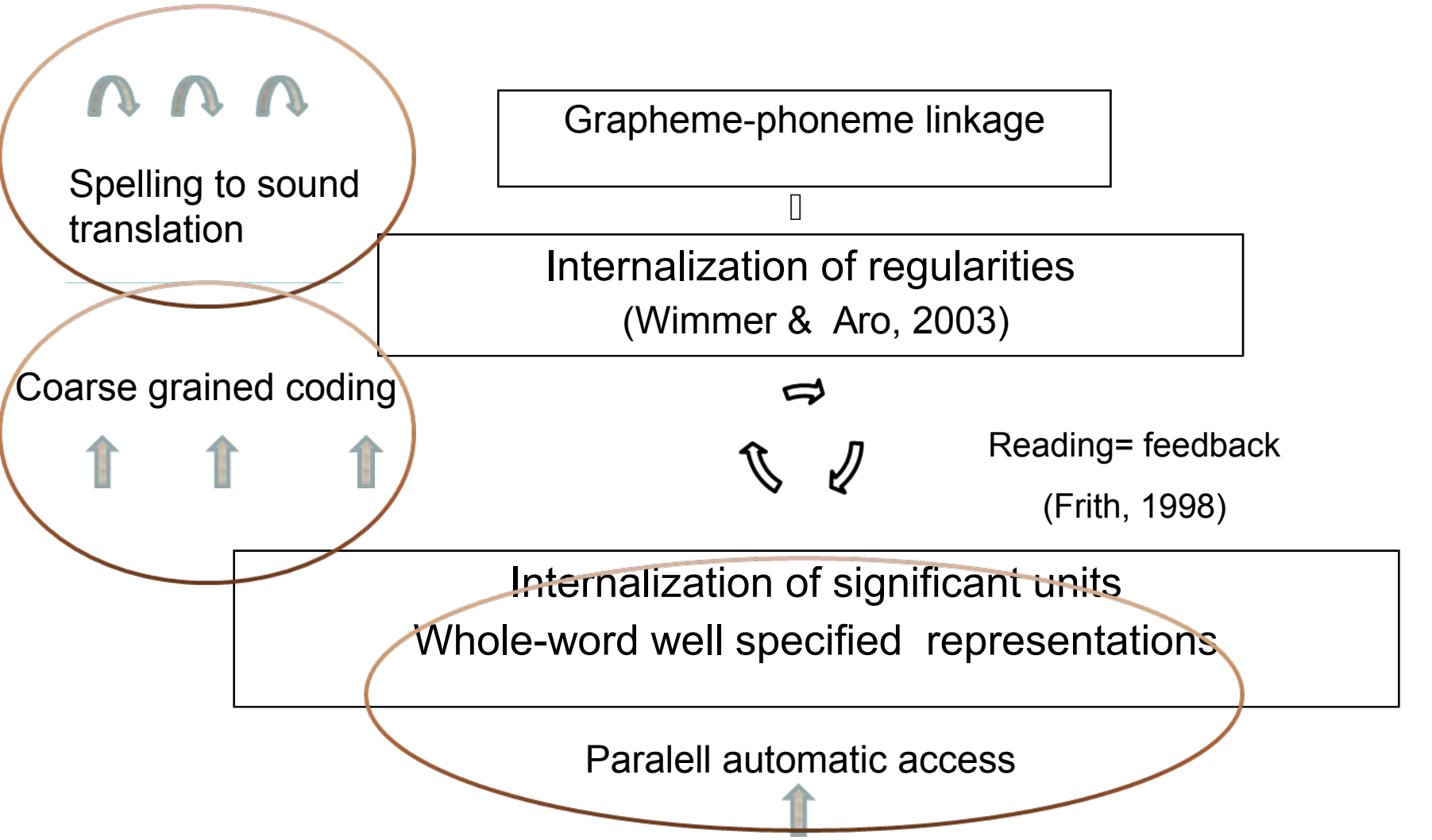
- Skilled reading implies identifying words **accurately** and **fast**

- This ability is grounded on the progressive **construction of orthographic representations**

How are these constructions built?

When do correct reading and automatic recognition converge?

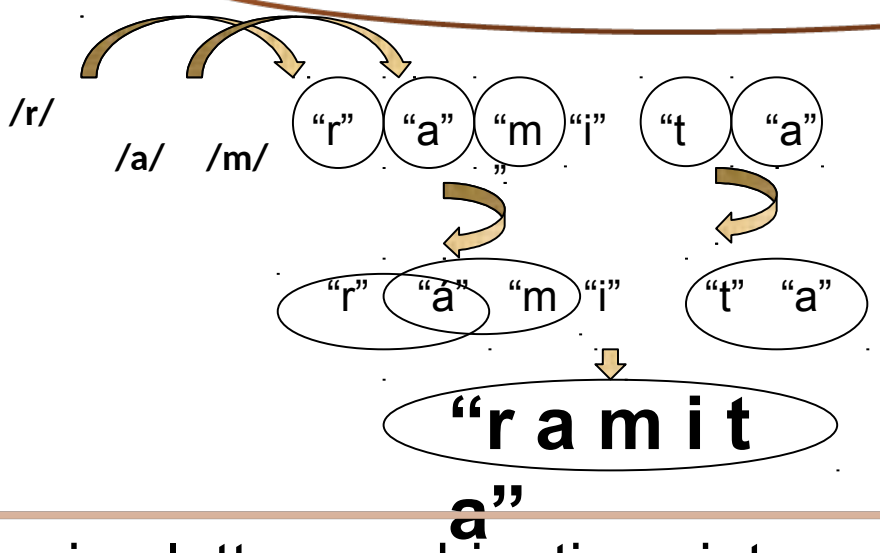
Construction of orthographic representations



Letter identity and letter position

Spelling to sound translation ⇨ children identify letters one by one

At this stage
letter identity is crucial for efficient reading



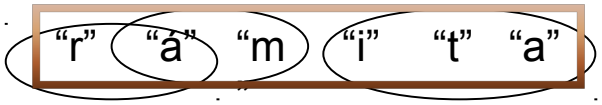
Co-occurring letter combinations internalized ⇨
component letters of orthographic chunks need to be well specified

At this stage
letter position becomes relevant

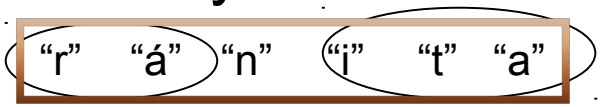
Efficent and automatic reading

- Construction of orthographic representations bias progresive and exhaustive letter identity and letter position coding

- Regularly encountered representations are better stored and retrieved faster



- These promote identification of new representations sharing letter combinatios ->
  and more exaustive representational system



Orthographic representations become more exhaustive

Form priming experiments

Lexical tuning hypothesis

dall
ball
lift

BALL

2nd 4th 6th grades

Castles, Davis & Lechter, 1999

rlay
lpay
meat

PLAY

3rd grade

5th grade

Castles, Davis , Cavalot & Forster, 2007

terme
efrme
gosnh

FERME

X 3rd grade

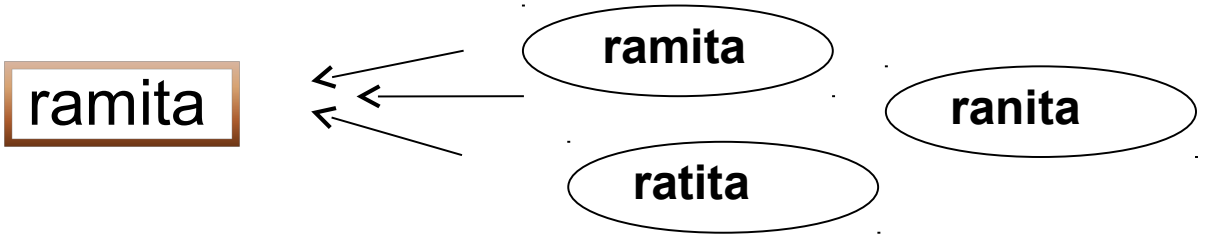
5th grade and dyslexics

skilled readers

Lété & Fayol, 2013

Receive influence from other similar representations

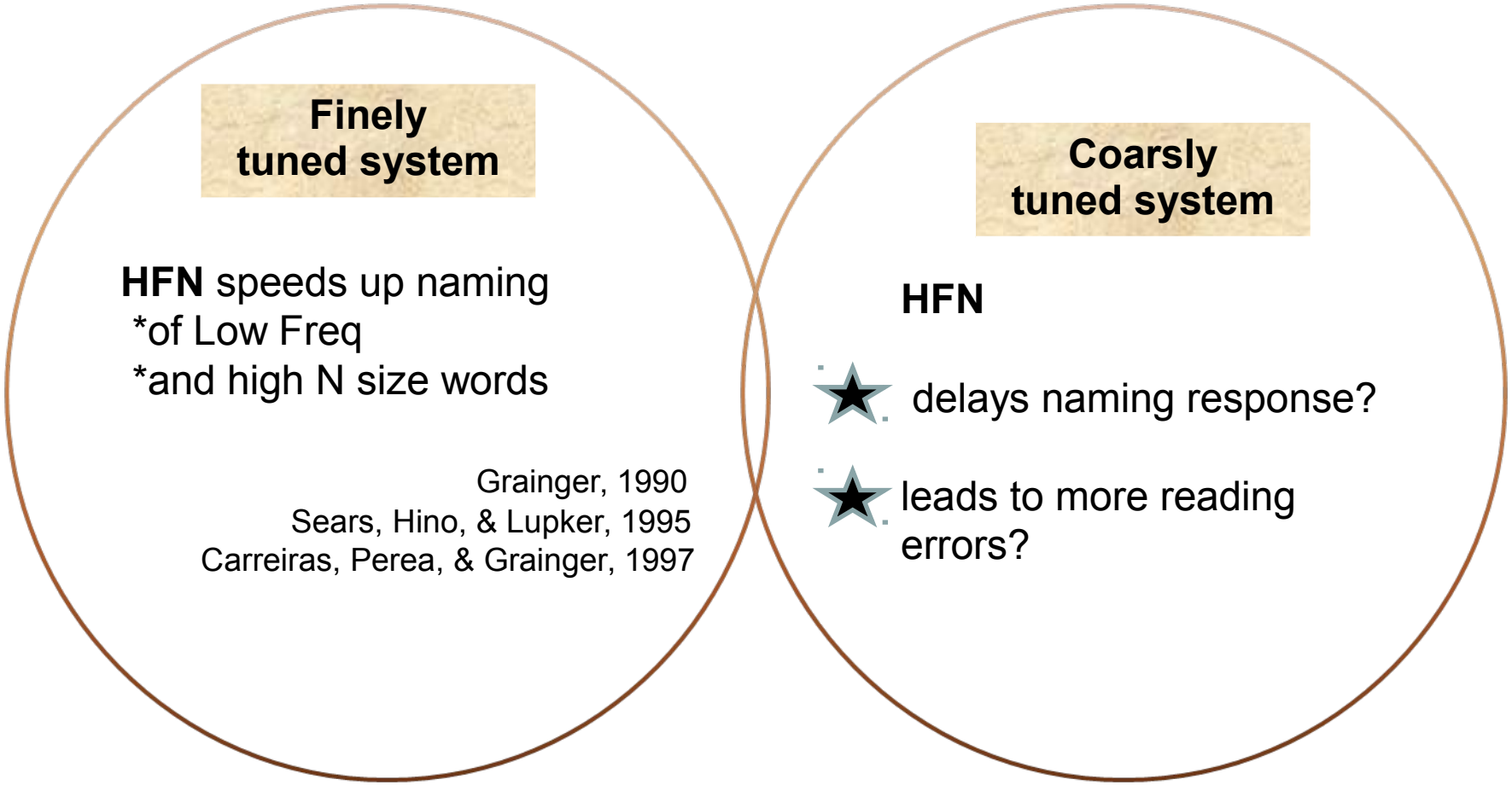
Experiments examining influence of **N size = SN**



LEXICAL DECISION	NAMING
N size facilitates decision in beginning readers ~ 1st to 3rd Duñabeitia et al., 2008 Laxon et al., 1988	Greater accuracy ~ Grade 1-3 *in pseudowords and low F. words Laxon et al., 1994, 2002
	★ lexicalization errors
N size does not influence performance->grade 1 to 5 Dufau et al., 2010	Null effects in words
	★ Detrimental effect of HFN in 2nd grade and dyslexics Marinus & de Jong, 2010

Receive influence of frequently seen whole-word representations

During the process of word construction, children should be senstive to frequently encountered whole-word forms = **HFN**s



Predictions

poorly tuned lexicon

beginning readers and dyslexics

Sublexical reading-> sequential spelling to sound mapping and activation of small shared representations -> negligible HFN effect

Paralell processing-> activation of whole-word representation during phonological assembly-> hesitations and corrections - misreading

finely tuned lexicon

skilled readers

Paralell processing-> high general activation and correct selection before phonological output starts-> facilitative effect - accuracy

Method

Sample

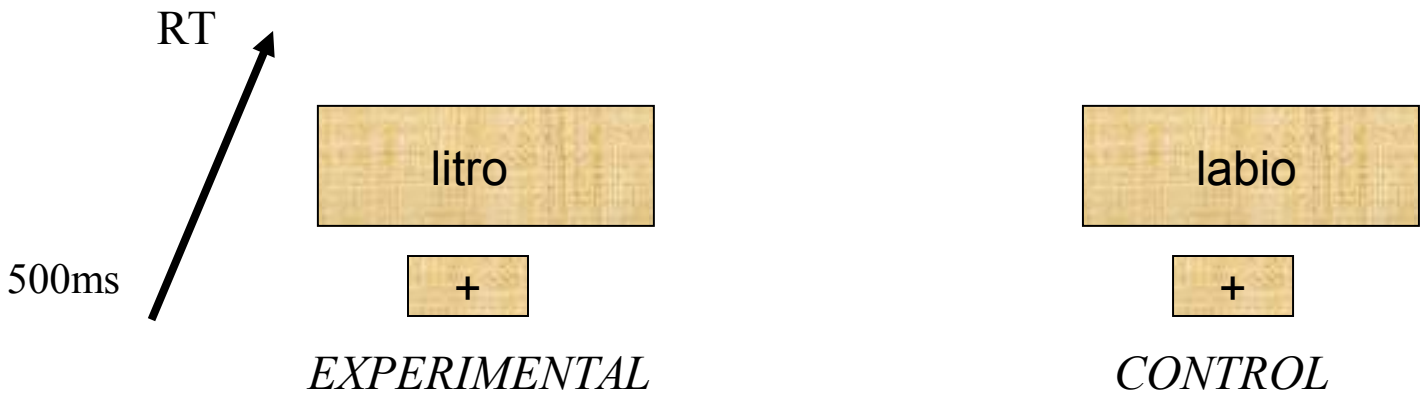
Chronological age years	Developing readers	Dyslexic readers
7.2 (2nd grade)	22	4
8.9 (4th grade)	22	4
11.1 (6th grade)	22	4

Word Stimuli

	32 words	32 words
SN	litro (libro)	labio
TN	cedro (cerdo)	cenar

	Experimental word						Control word					
	Frec	LEXIN	N	HFN	MbF	SYL	Frec	LEXIN	N	HFN	MbF	SYL
SN	8.3	7.9	5.9	2.6	2.6	10.8	9.1	11.3	4.3	0.1	2.5	10.8
TN	6.4	7.1	5.9	2.4	2.6	11.3	7.7	10.1	4.4	0.5	2.5	10.6

Task and procedure

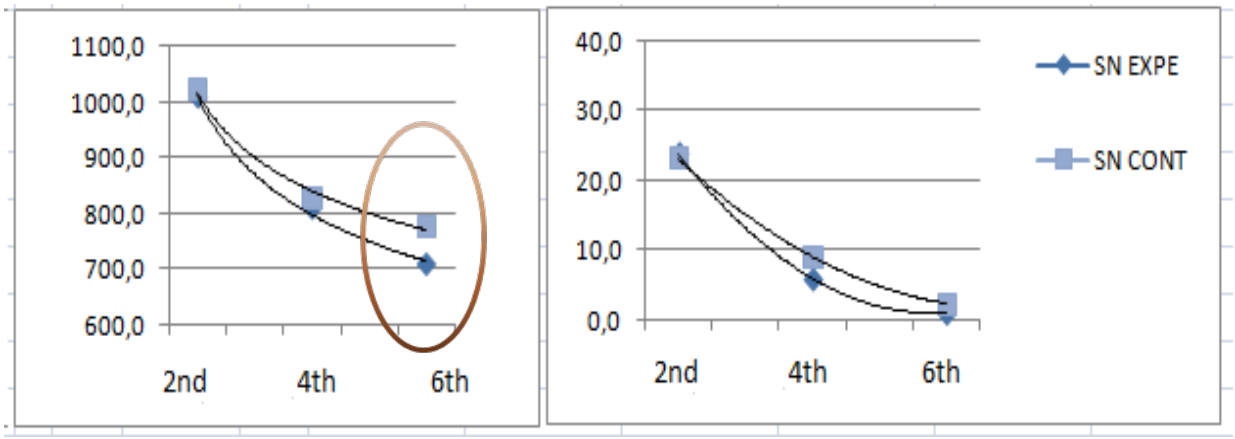


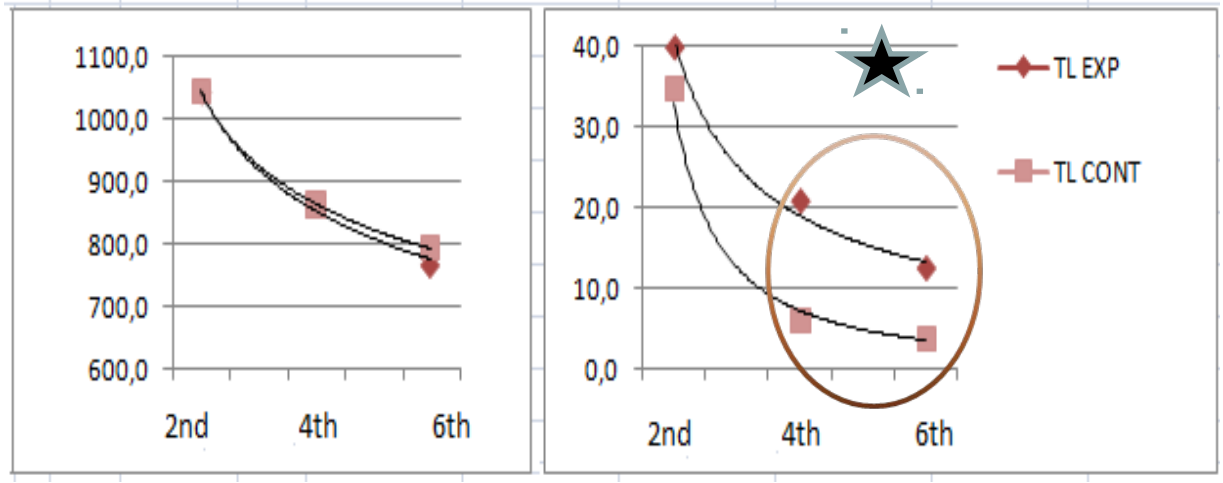
Wrong utterances

Results developing readers

Reading times (in ms)

% errors

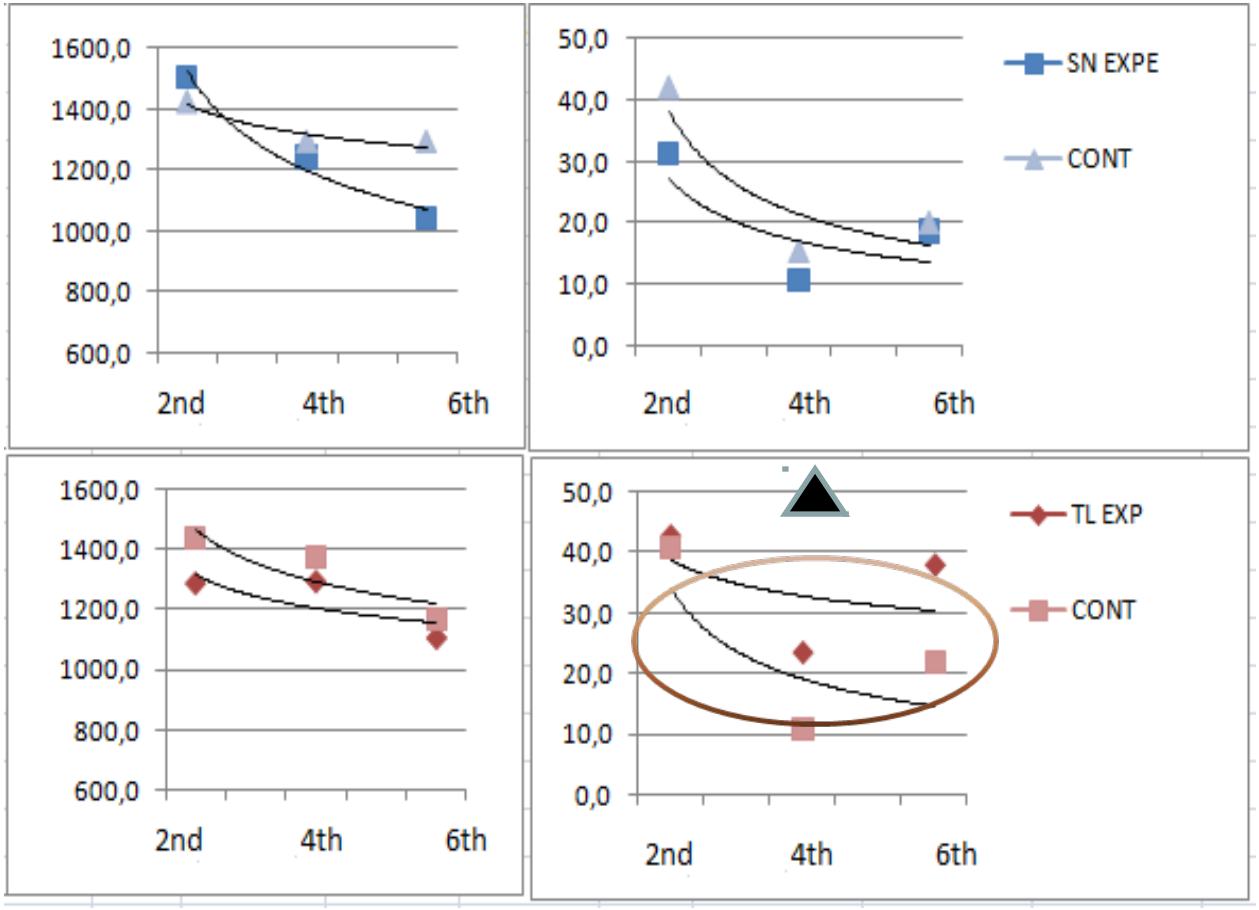




Results dyslexic readers

Reading times (in ms)

% errors



Summary results

poorly tuned lexicon

SN

TL

2nd grade

Sublexical reading: negligible HFN effect

4th and 6th grade

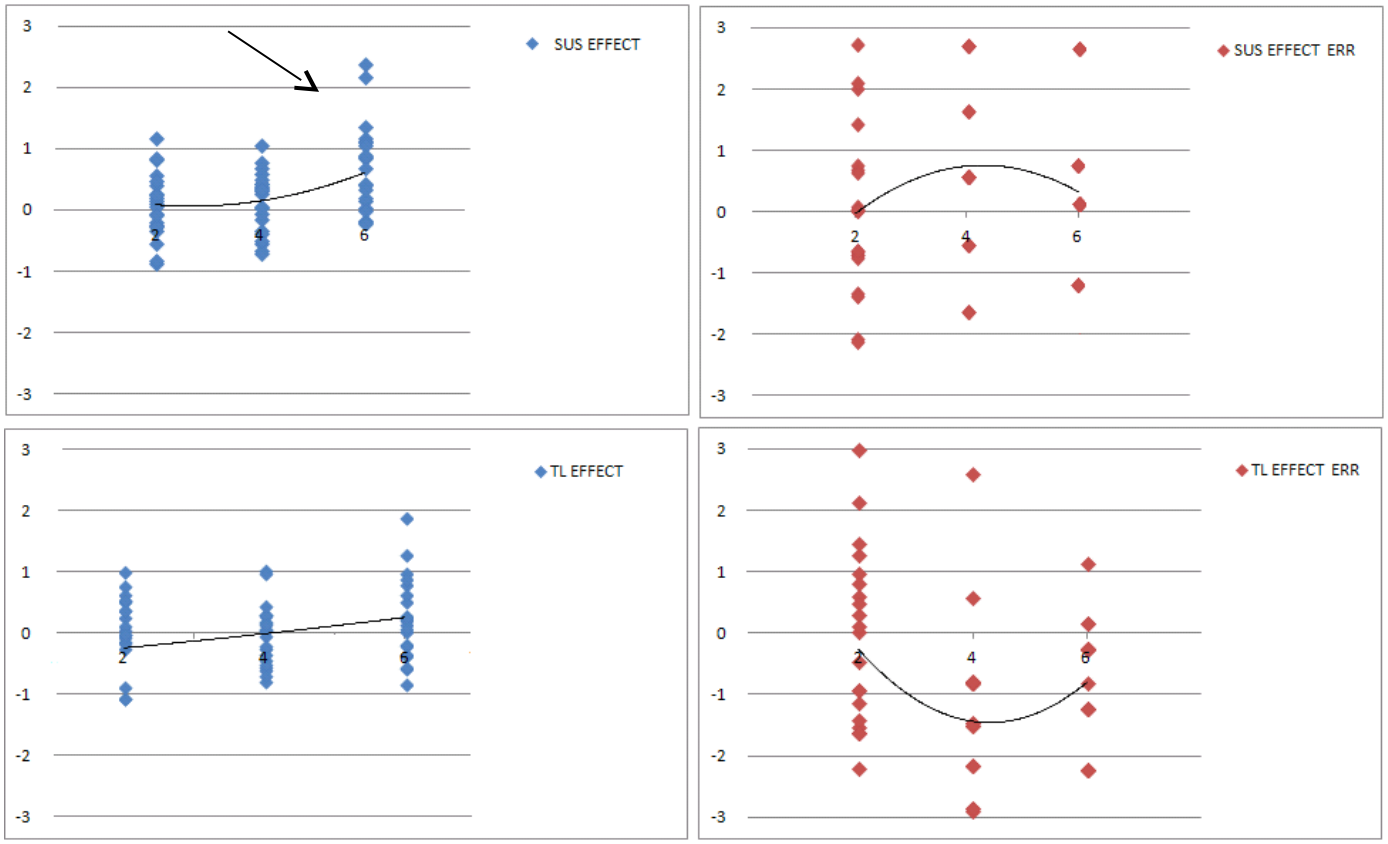
Paralell processing: hesitations – misreading

finely tuned lexicon

6th grade

Paralell processing: facilitative effect - accuracy

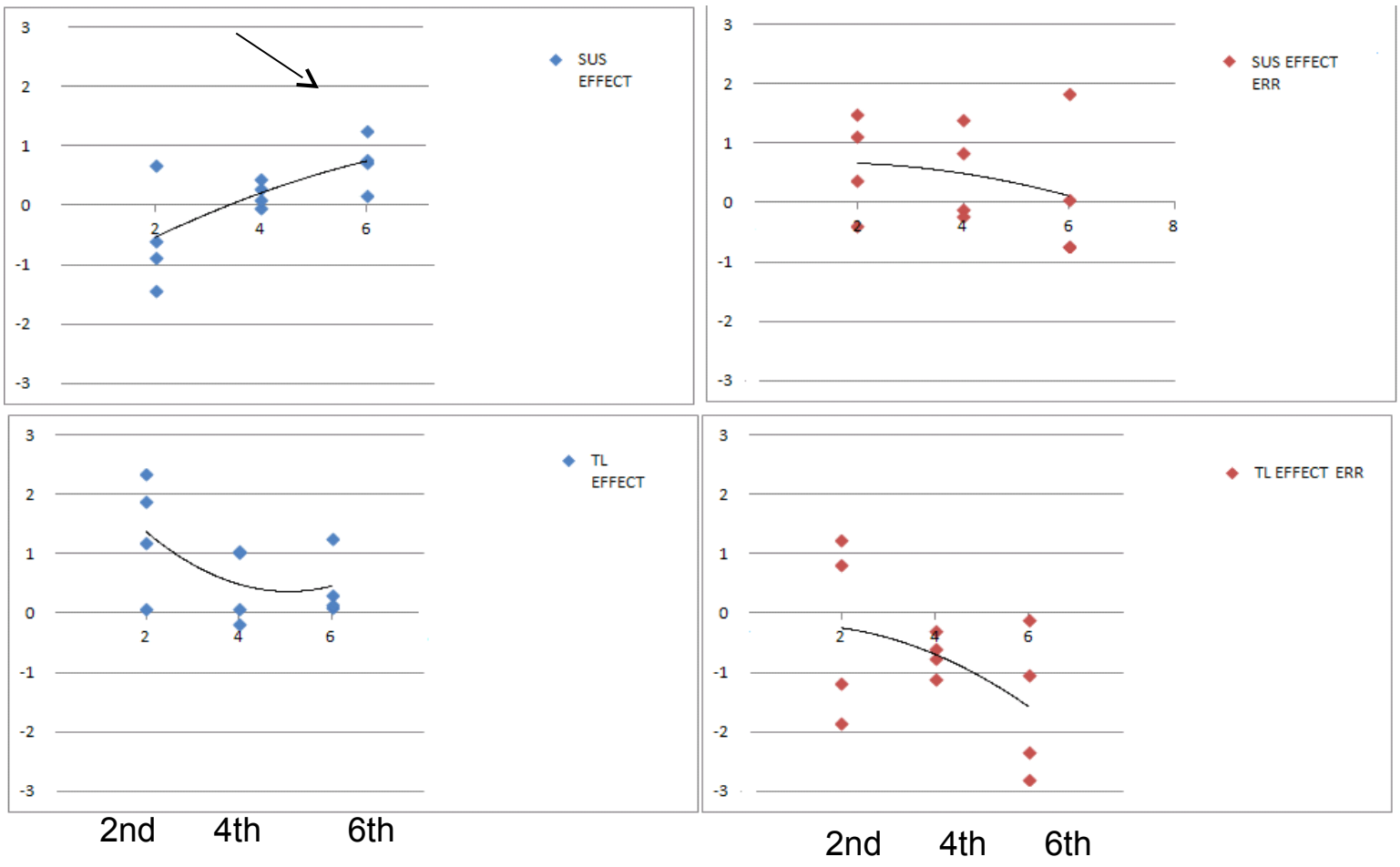
Evolution of effects: developing



2nd 4th 6th 2nd 4th 6th

Z scores

Evolution of effects: dyslexic



Z scores

Conclusions

- HFN hallmark of impact of whole-word representations on finely or coarsely tuned developing lexicon

- As previous work suggested, under certain conditions, HFNs can exert detrimental effects on reading

Depending on the developmetal reading stage

Depending on whether the conflict affects letter identity or letter position coding mechanisms

Conclusions

- Beginning readers -> low vocabulary size, spelling to sound mapping reading strategy = negligible effects from substitution or transposed letter HFN

- Increasing age-> greater vocabulary size, coarse grained processing

finely tuned orthographic representations= facilitative effects of HFNs  Invariant letter location SN

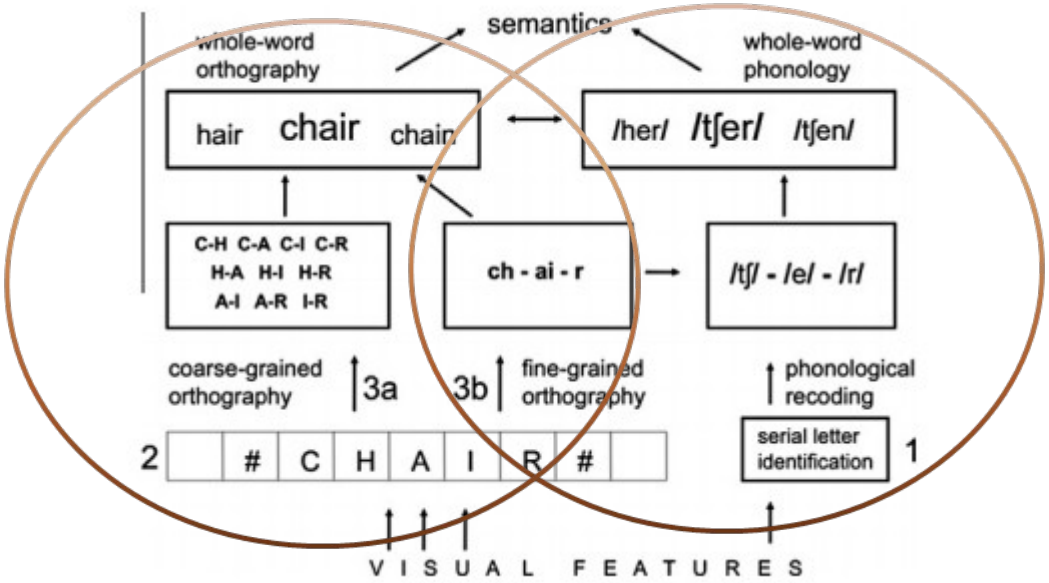
poorly tuned orthographic representations = detrimental effects of HFN  TLN

Conclusions: normal developing

- In early stages of learning to read letter identity is relevant->children become efficient resolving letter identity mismatchs
- Further stages devoted to position coding mechanisms, which take longer to develop
- Both stages essential for correct and automatic reading to converge at some point

Conclusions: normal developing

- These data are in line with previous experiments using other manipulations (Castles et al., 2007; Perea & Estevez, 2008)
- Can be accounted by recent models of reading



A multiple-route model of reading

J. Grainger et al./Cognition 123 (2012)

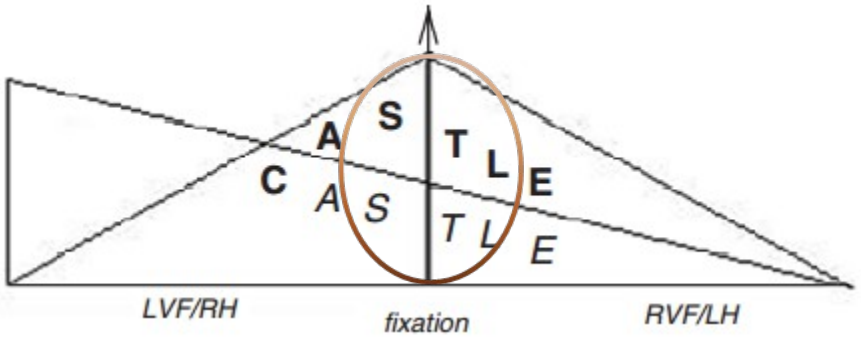
Conclusions: dyslexic children

- This progression might be difficult for dyslexics
- Due to their phonological impairment at the perceptual level they do not create bottom up letter-based exahustive representations
- Coarse orthographic coding imposed from beginning of reading experience
- Creation of location invariant representations difficult

Conclusions: dyslexic children

- This idea is supported by patients with letter position dyslexia (Kohnen et al., 2012; Friedmann & Rahamim, 2014)
- Accounted by SOLAR model of reading (Whitney & Cornelissen, 2005)

2. Attentional gradient: Top down activation



1. Spatial gradient: serial letter coding- bottom up activation ✗

Thank you