

Word Reading, Text Comprehension and Hyperlexia in Autism

David Saldaña
 Universidad de Sevilla
 dsaldana@us.es



Trondheim, 2009

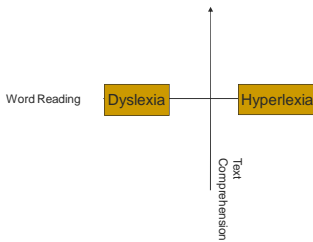
Definition

Hyperlexia the ability some children have to read words above their "expected level" (Sielberg & Sielberg, 1967)



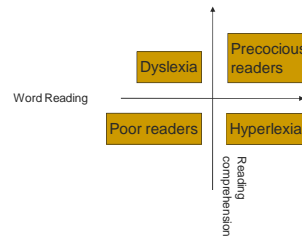
Definition

Hyperlexia the ability some children have to read words above their "expected level" (Sielberg & Sielberg, 1967)

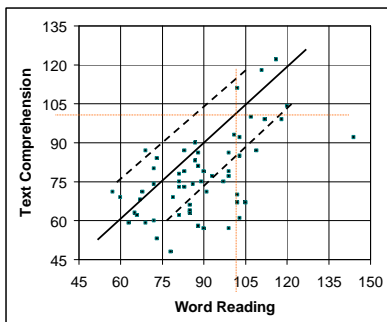


Definition

Based on Nation (1999) Psych. Bull.

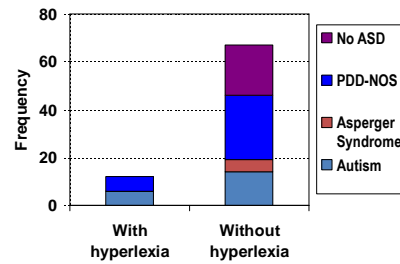


Reading in Autism



Saldaña(2006) unpublished data

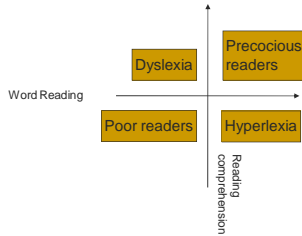
Specificity of hyperlexia



Grigorenko et al., (2002) JADD

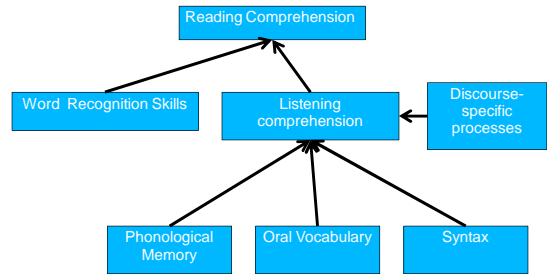
Superability vs. disability

(Grigorenko et al., 2003)



Based on Nation (1999) *Psych. Bull.*

What is needed to read?

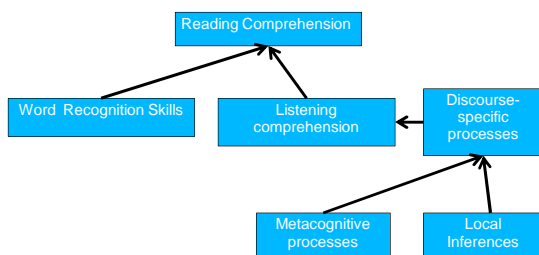


Pennington & Bishop (2009)

Why the poor text comprehension?

Comprehension problems in ASD

- In inferential items vs. retrieval of literal/factual information (Myles et al., 2002)
- Less proficient in providing context-appropriate pronunciation of homographs (Frith & Snowling, 1983; Happé, 1997; Norbury & Bishop, 2002)
- Difficulties in gap-filling inferences (Norbury & Bishop, 2002)



Local inferencing in ASD

- ❖ Michelle waited for over an hour for Jim outside MacDonalds.
- ❖ Michelle ran home and refused to take any phone calls.

Michelle didn't want to talk on the phone because:

- she was angry with Jim and wasn't going to hear his excuses
- she went home to ask her sister where Jim might be
- she was too upset to speak in case something had happened to Jim

(Loliffe & Baron-Cohen, 1999)

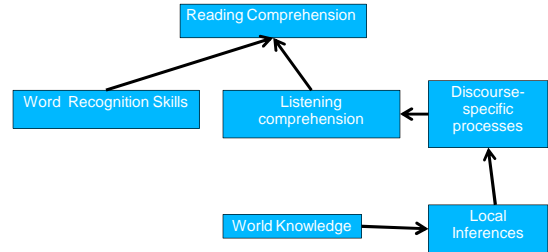
Local inferencing in ASD

- ❖ From a distance the campers watched as the great mountain rumbled.
- ❖ The TV showed fields of black tree stumps instead of a forest.

The forest turned into black tree stumps because:

- vandals had set the forest on fire
- a volcano erupted and lava poured into the forest
- a bomb had exploded, setting the forest on fire

(Jolliffe & Baron-Cohen, 1999)



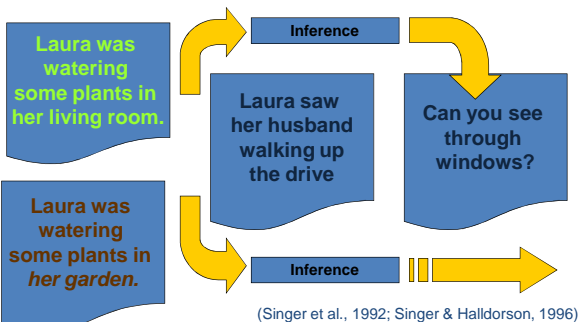
Aims and Hypotheses:

- Confirm deficit in bridging inferences with an *on-line* task:
 - Readers with autism will not be able to produce bridging inferences
- Analyze the role of knowledge-activation in bridging inferences in ASD readers:
 - The ability to produce bridging inferences will relate to social nature of text content
 - Lack of activation of relevant social knowledge will hinder bridging inferences in readers with autism

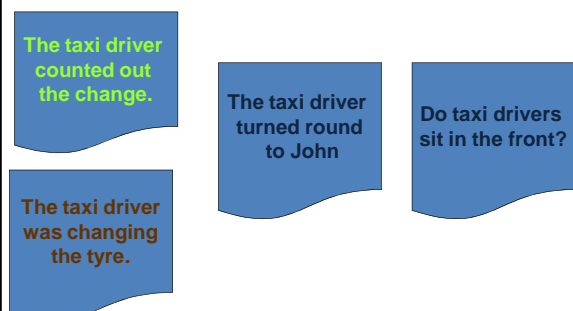
Participants

	Age	BPVS	Standard Word Reading	Standard Text Comprehension
ASD N=16	14:9 (1:11)	98.2 (23.9)	101.8 (9.6)	80.4 (13.9)
Control N=16	13:11 (1:11)	98.7 (14.0)	101.6 (8.0)	98.9 (9.1)

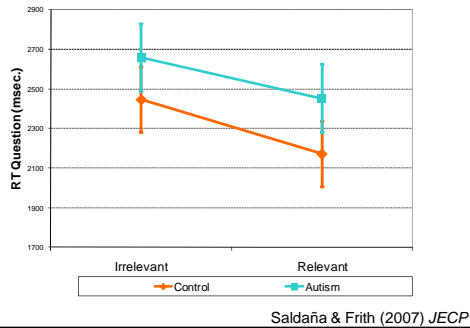
Experiment 1: Inferencing task with physical knowledge content



Experiment 1: Inferencing task with physical knowledge content



Experiment 1: Results



Experiment 1 – Physical Content: Conclusions

- Validation effect replicated
- Validation effect appears in low-comprehenders with autism
- Low-comprehenders with autism are:
 - Producing inferences linking sentences with physical content
 - Activating relevant knowledge of physical content

Experiment 2: Inferencing task with social knowledge content

Maria had never won a race before.

The tears streamed down Maria's face

Can people cry because they are happy?

Maria had never *lost* a race before.

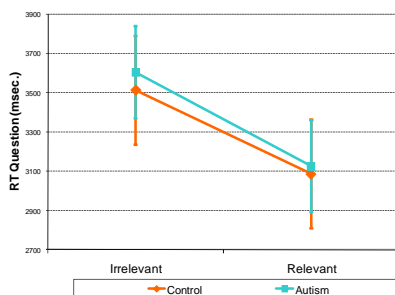
Ben was late to dinner with his girlfriend that evening.

Ben decided to take a bunch of flowers

Do men try to apologize with little presents?

Ben and his girlfriend went to a birthday party late that evening.

Experiment 2: Results



Experiment 2 – Social Content: Conclusions

- Validation effect replicated for social content phrases
- Validation effect again appears in low-comprehenders with autism
- Low-comprehenders with autism are:
 - Producing inferences linking sentences with social content
 - Activating relevant knowledge of social content

Some 'non-reasons' for poor comprehension

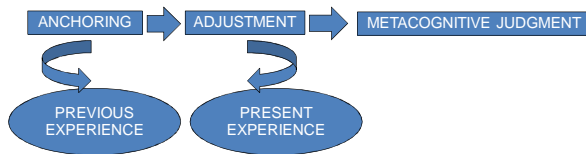
- Not supported:
 - Problems in bridging inferences
 - Difficulties in activating relevant knowledge in sentence processing
- Unlikely:
 - Lack of suppression of irrelevant information
- Off-line vs on-line

Comprehension Monitoring and Reading

- Comprehension monitoring as a fundamental ability in text comprehension.
- It is a differentiating factor between good and poor readers (Skarakis-Doyle, 2002, Vehovec, & Bajanski, 2001)
- Traditionally researched with metacognitive judgment tasks.

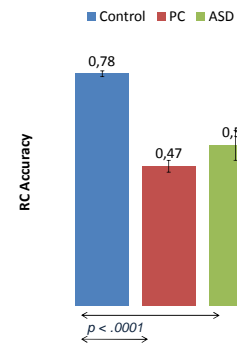
Metacognitive Judgments

Anchoring and Adjustment
(Tversky y Kahneman, 1974; Zhao y Linderhorn, 2008)



Participants

- Three groups:
- Control ($n = 29$) No ASD, no poor comprehension
 - PC ($n = 23$) No ASD, poor comprehension
 - ASD ($n = 20$)



Participants

	Control	PC	ASD	
Reading fluency (Words/min)	X = 154.1 (SD = 27.0)	X = 137.6 (SD = 26.2)	X = 126.9 (SD = 35.9)*	.006
Age	X = 13.7 (SD = 2.08)	X = 13.8 (SD = 1.62)	X = 13.3 (SD = 2.38)	.63
Non-verbal IQ	X = 101.3 (SD = 13.3)	X = 100.1 (SD = 12.7)	X = 106.3 (SD = 19.4)	.30
Working Memory	X = 111.2 (SD = 15.0)	X = 101.3 (SD = 7.91)*	X = 106.0 (SD = 13.8)	.04

*differences with control group, $p < .01$

Saldaña et al. (in prep)

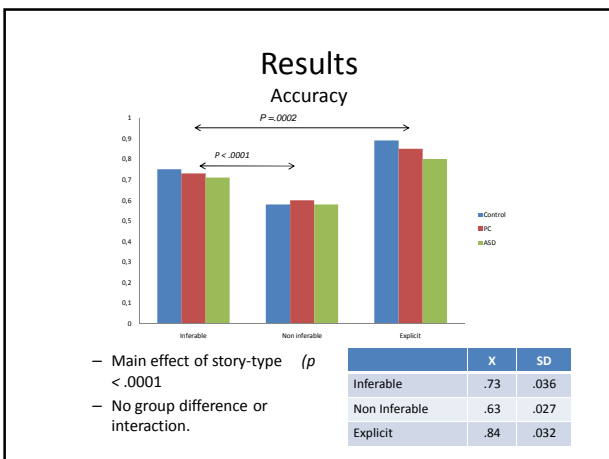
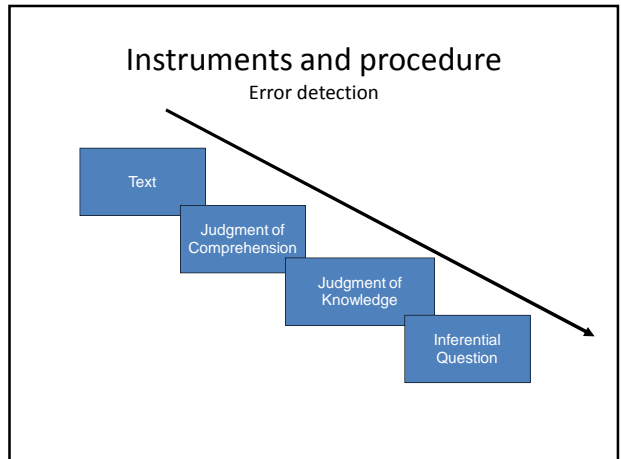
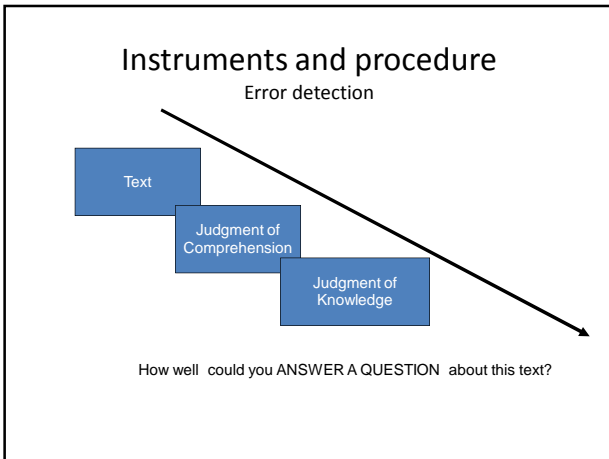
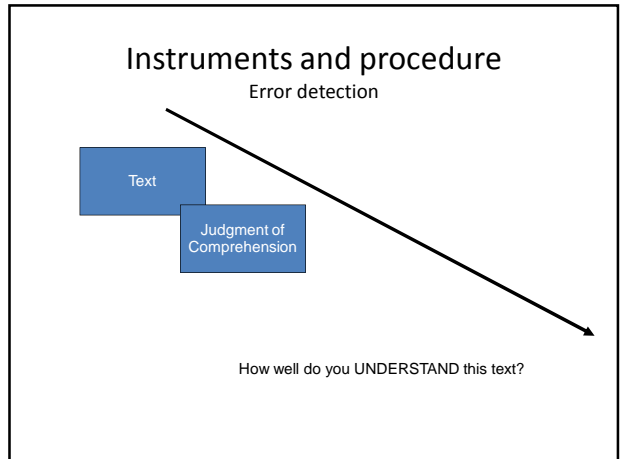
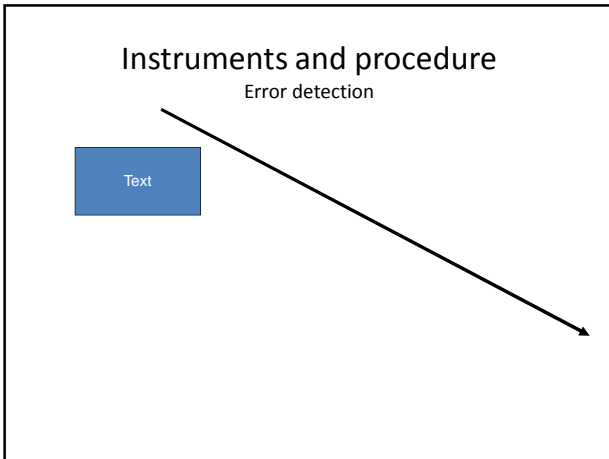
Instruments and procedure

Error detection

- 21 texts in total presented.
- Three conditions:
 - **Inferable**: included a pseudoword with contextual clues.
 - **Non inferable**
 - **Explicit**

EXAMPLE OF INFERABLE TEXT

- Nobody miffed as well as Penelope.
- Everyone invited her to their parties and meetings.
- She used to say that her grandmother had taught her all the recipes [everything she knows].
- Nobody sees her much since she left to work in Paris.



Summary: judgments by condition

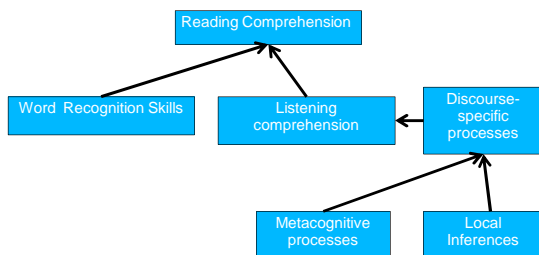
- Control group:
 - Distinguishes between inferable and non-inferable stories, on the one hand, and explicit, on the other.
- Poor comprehenders distinguish non-inferable and explicit.
- ASD group may distinguish in Judgment of Comprehension and does not in Judgment of Knowing.

Discussion and conclusions

- **Participants in the control group:**
 - Are capable of knowing when a text requires an inference.
 - Seem to value their performance based on effort.
 - Adjust according to this effort.
 - Predict their performance adequately.
- **Poor comprehenders:**
 - Only distinguish when there is need for a greater processing effort: they only recognize non-inferential texts.
 - Do not predict performance appropriately.
 - Coincides with previous literature (e.g. Oakhill, Hartt y Samols, 2005)
- **ASD readers:**
 - Do not distinguish among tasks.
 - Do not predict performance.

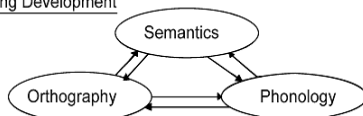
Summary on text comprehension

- **Unlikely “culprits”:**
 - Lack of world knowledge
 - Local automatic bridging inferences
- **Potential difficulties in:**
 - Self-regulated text processing
- **In need of research:**
 - Global textual inferences
 - Other local automatic inferences (i.e. anaphoric).



Why the good word reading?

Reading Development



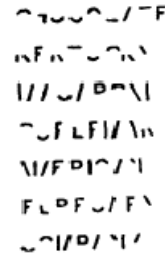
Harm & Seidenberg, 1999

Phonological mediation in word reading in hyperlexic children

- Difficulties in phonological mediation (Sparks, 1995, 2001; Richman & Wood 2002)

Phonological mediation in word reading in hyperlexic children

- Difficulties in phonological mediation (Sparks, 1995, 2001; Richman & Wood 2002)
- Superior visuospatial memory tasks (Cohen, Hall & Riccio, 1997)



- CHOCOLATE
- KENTUCKY
- MACARONI
- SUPERMAN
- AMERICAN
- FEBRUARY
- COMPANY

(Cobrinik, 1982)

Phonological mediation in word reading in hyperlexic children

- Difficulties in phonological mediation (Sparks, 1995, 2001; Richman & Wood 2002)
- Superior visuospatial memory tasks (Cohen, Hall & Riccio, 1997)
- Direct orthographic route as main pathway? (Glosser, Friedman, & Roeltgen, 1996; Glosser et al., 1997; Kennedy, 2002; Sparks, 2004; Talero-Gutierrez, 2006)

Phonological mediation in word reading in hyperlexic children

- Reading of pseudowords (Aram, 1997; Goldberg & Rothermel, 1984; Snowling & Frith, 1986)
- Regular words are read more easily than irregular words (Aram, 1997; Frith & Snowling, 1983; Goldberg & Rothermel, 1984).
- Performance as controls on phonological awareness, pseudoword reading and writing (Newman et al. 2007)

Aims

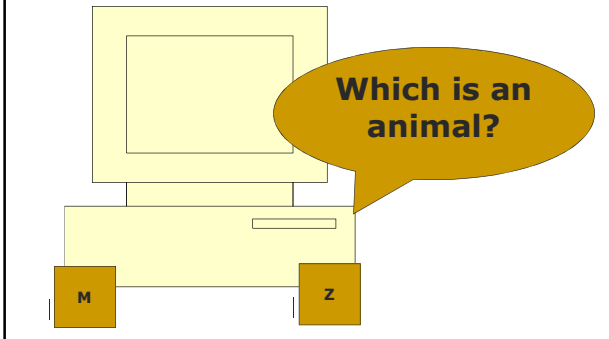
- Explore the use of phonological, semantic and orthographic pathways in children with hyperlexia.

Participants

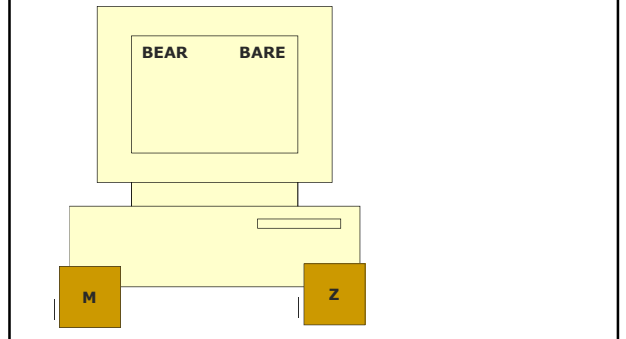
	Age	Word Reading	BPVS	Reading Comp.
ASD n = 14	13.9 (1.3)	99.4 (7.9)	86.1 (18.7)	75.7 (11.5)
Control n = 12	13.7 (1.9)	102.7 (6.2)	99.2 (14.4)	101.1 (8.2)

Saldaña, Carreiras & Frith (2009) Dev Neuro

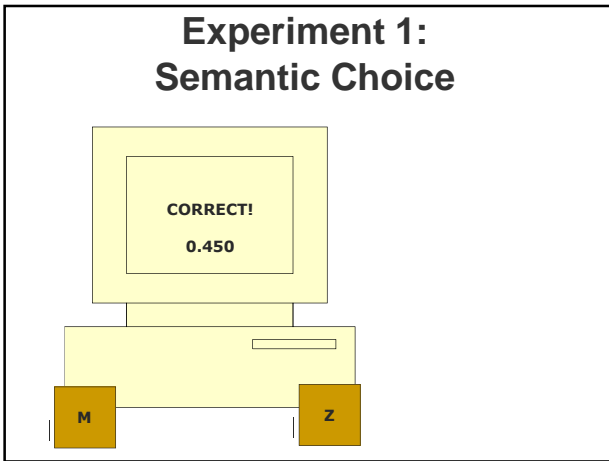
Experiment 1: Semantic Choice



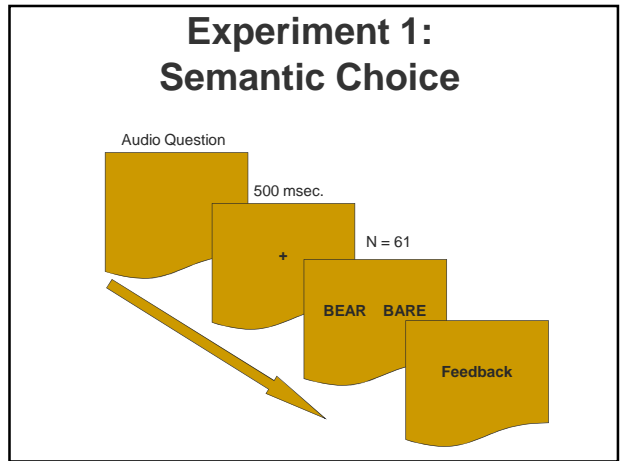
Experiment 1: Semantic Choice



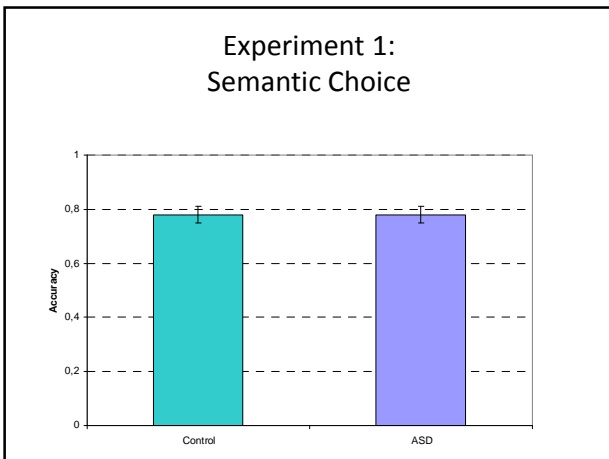
Experiment 1: Semantic Choice



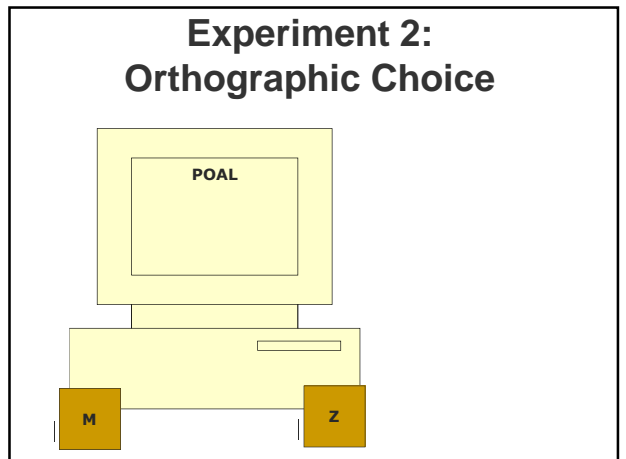
Experiment 1: Semantic Choice



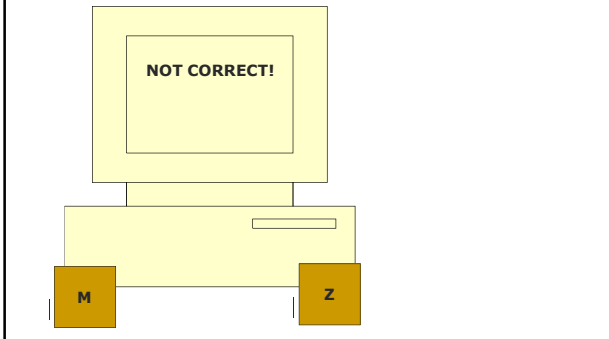
Experiment 1: Semantic Choice



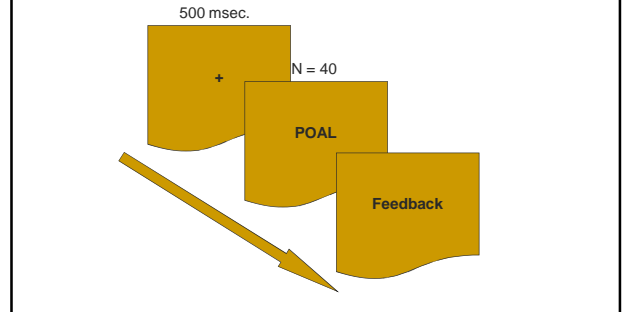
Experiment 2: Orthographic Choice



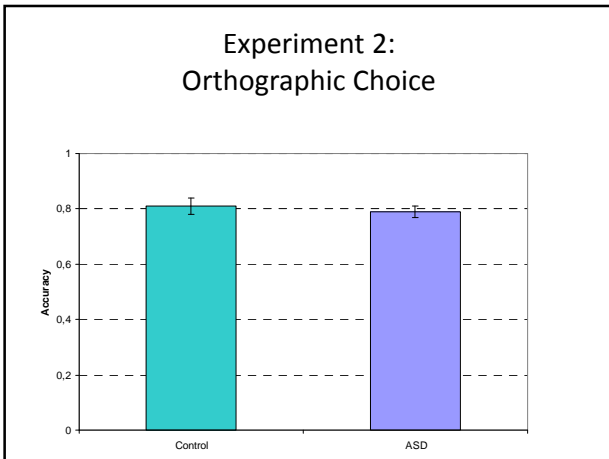
Experiment 2: Orthographic Choice



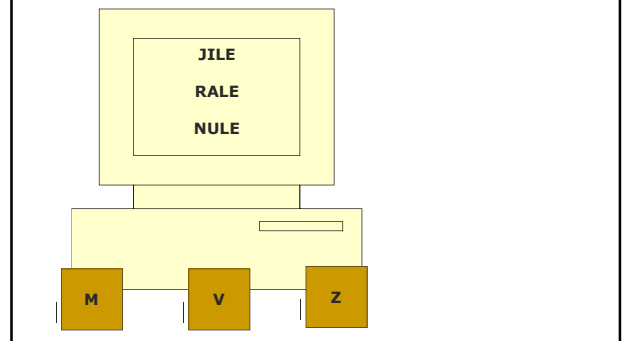
Experiment 2: Orthographic Choice



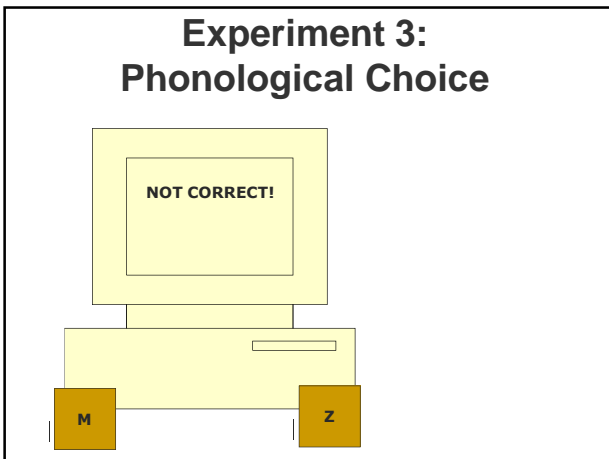
Experiment 2: Orthographic Choice



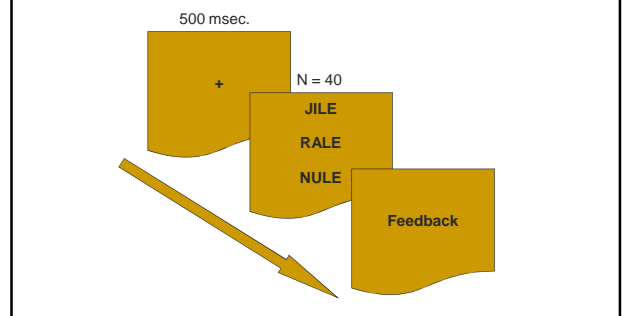
Experiment 3: Phonological Choice



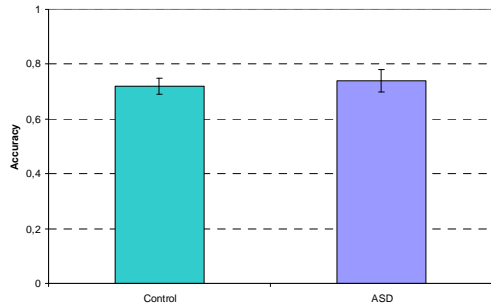
Experiment 3: Phonological Choice



Experiment 3: Phonological Choice

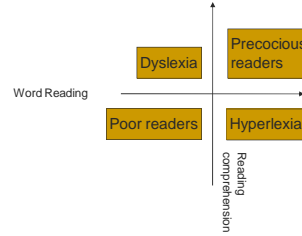


Experiment 3: Phonological Choice



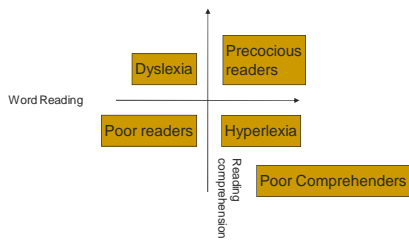
Superability vs. disability (Grigorenko et al., 2003)

Based on Nation (1999) *Psych. Bull.*

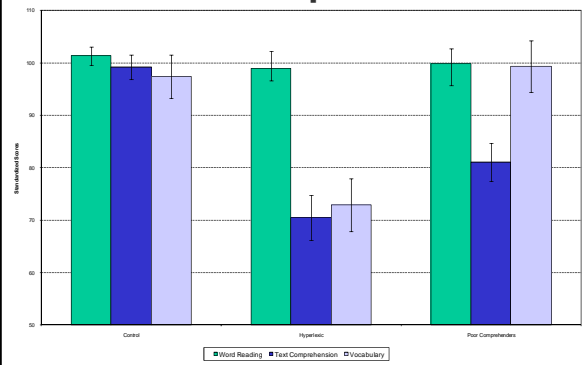


Superability vs. disability (Grigorenko et al., 2003)

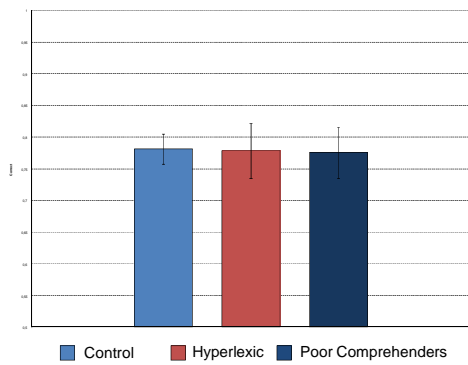
Based on Nation (1999) *Psych. Bull.*



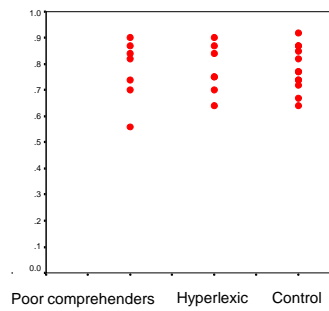
Participants



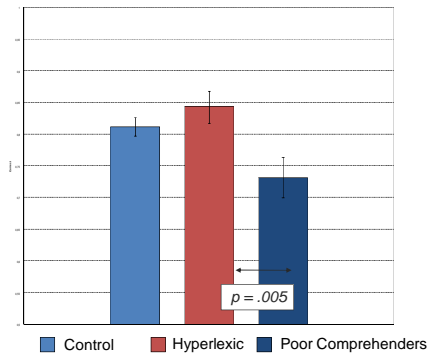
Experiment 1: Semantic Choice



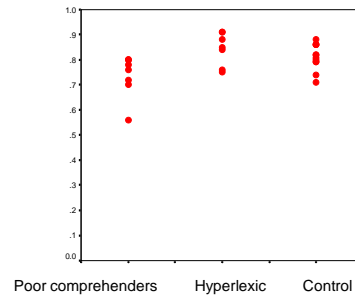
Experiment 1: Semantic Choice



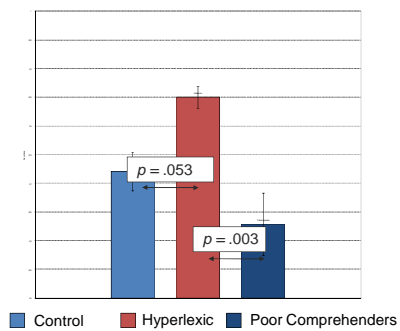
Experiment 2: Orthographic Choice



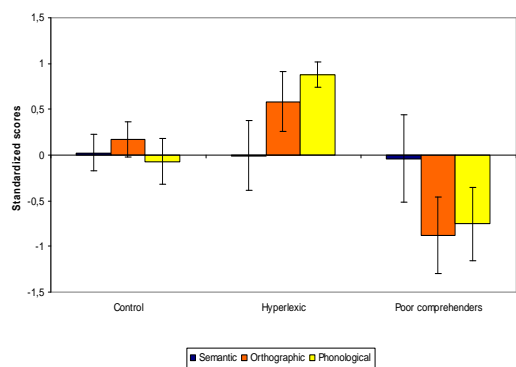
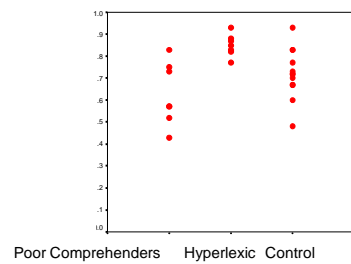
Experiment 2: Orthographic Choice



Experiment 3: Phonological Choice



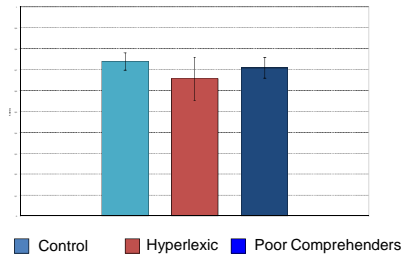
Experiment 3: Phonological Choice



Partial Summary

- Semantic pathway
 - No differences among groups
- Orthographic pathway
 - No differences between hyperlexic and control
 - Differences between hyperlexic and poor comprehenders
- Phonological pathway
 - Superiority of hyperlexic group
 - Difference between hyperlexic and poor comprehenders

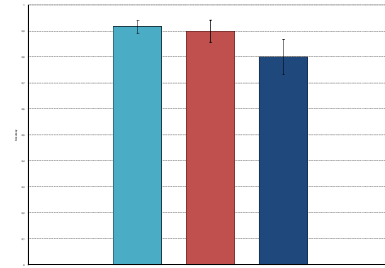
Spoonerisms



Control Hyperlexic Poor Comprehenders

(task from Frederikson, Frith, & Reason, 1997)

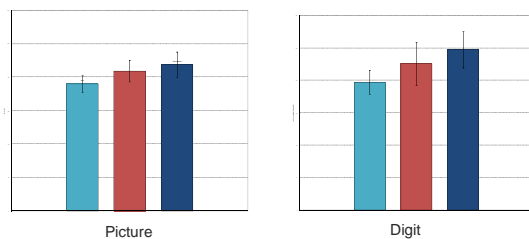
Non-word reading



Control Hyperlexic Poor Comprehenders

(task from Frederikson, Frith, & Reason, 1997)

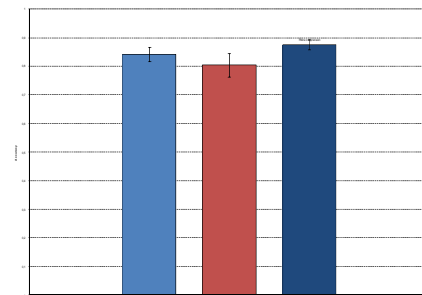
Naming Speed Test



Picture Digit
Control Hyperlexic Poor Comprehenders

(task from Frederikson, Frith, & Reason, 1997)

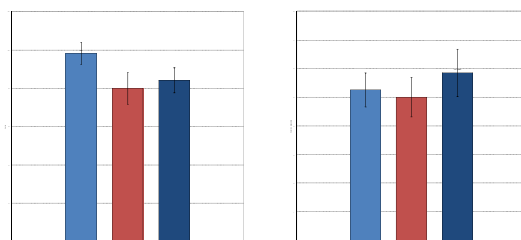
Non-word Repetition



Control Hyperlexic Poor Comprehenders

(task from Gathercole & Baddeley, 1996)

Digit Span



Forward Backward
Control Hyperlexic Poor Comprehenders

Partial Summary


- Phonological mediation: Spoonerisms, non-word reading, non-word repetition.
 - No differences
- Naming speed:
 - No differences
- Short-term and working memory
 - Trend on forward digit span in favour of controls ($p = .074$).

Conclusions on word reading

- Both orthographic and phonological pathways are used.
- If any, superiority in phonological representation.
- Some form of phonological “expertise” present? Where from?
- Definition of hyperlexia could include reference to vocabulary knowledge

Thanks

Collaborators

 Antonio Aguilera
Alfonso Luque
Isabel de los Reyes Rodríguez
Francisco Javier Moreno



Uta Frith



Manuel Carreiras

Data Collection

Ade Owolabi
Sarah Johnson
Megan Fisher
Ana Maria Benjumea
Inmaculada González
María José Tirado

Participating schools,
families and children

Dr. Sarah White
Prof. Richard Olson

Sponsors

