

# Communicating in adverse conditions

Listening to speech in noise



# My long road into interdisciplinary research

# Projects



2007 – 2010

Particular speech cues



2013 – 2016

Listening strategies

ongoing

Linking objective and subjective measures of speech perception

# Longevity: from burden to asset



Social Participation



Communication



Speech Perception



In adverse conditions



Getty



# FLARE

- Age-related changes in the perception of a phonetic cue
- Experimental Psychology + Linguistics
- With Prof. Sarah Hawkins (Phonetics, Cambridge)

Sadie hoped to see the  
Sadie hoped to see the

# Speech material

## Matched

ll Sadie hoped to see the miller today

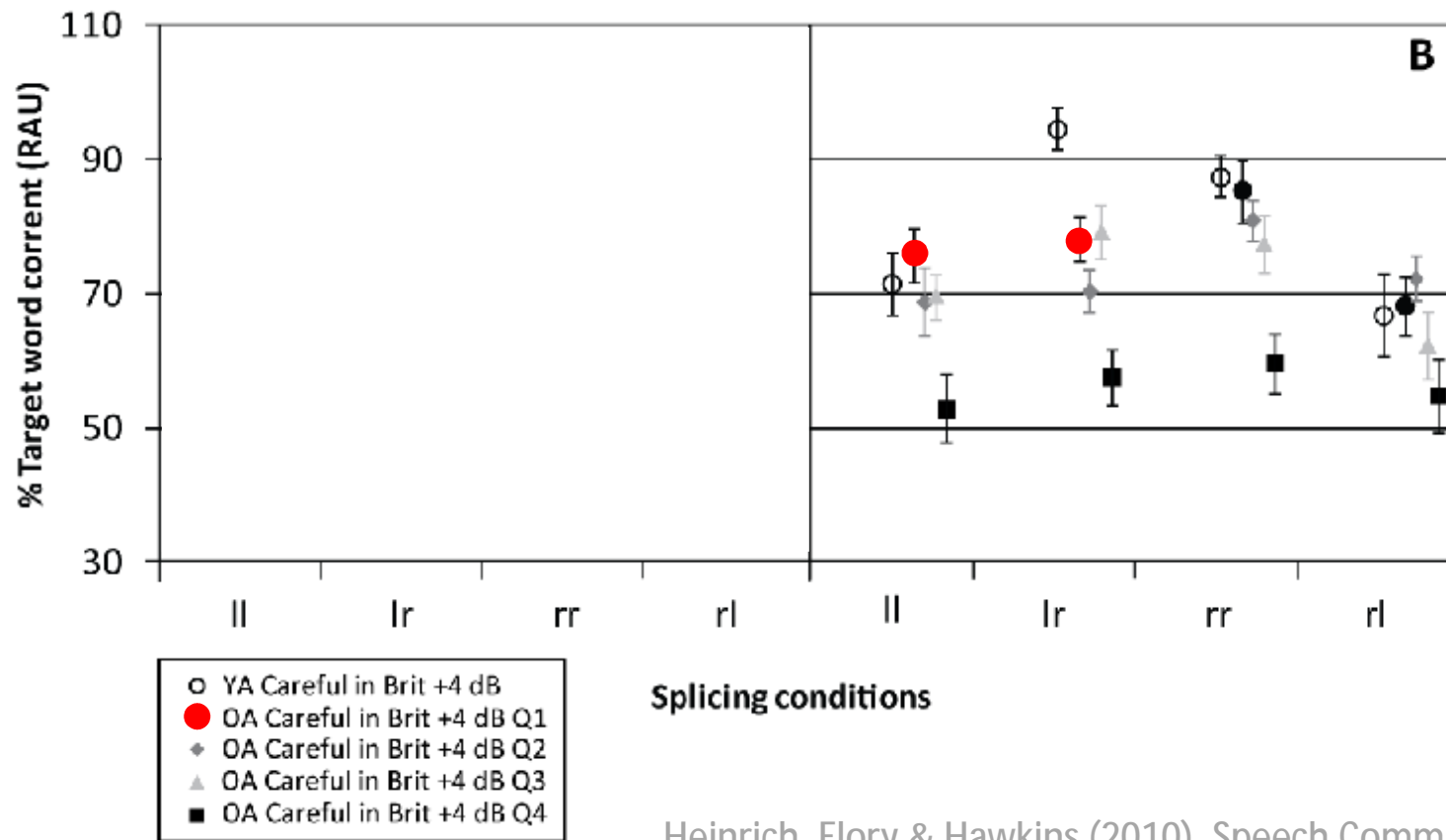
rr Sadie hoped to see the mirror today

## Mismatched

lr Sadie hoped to see the mirror today

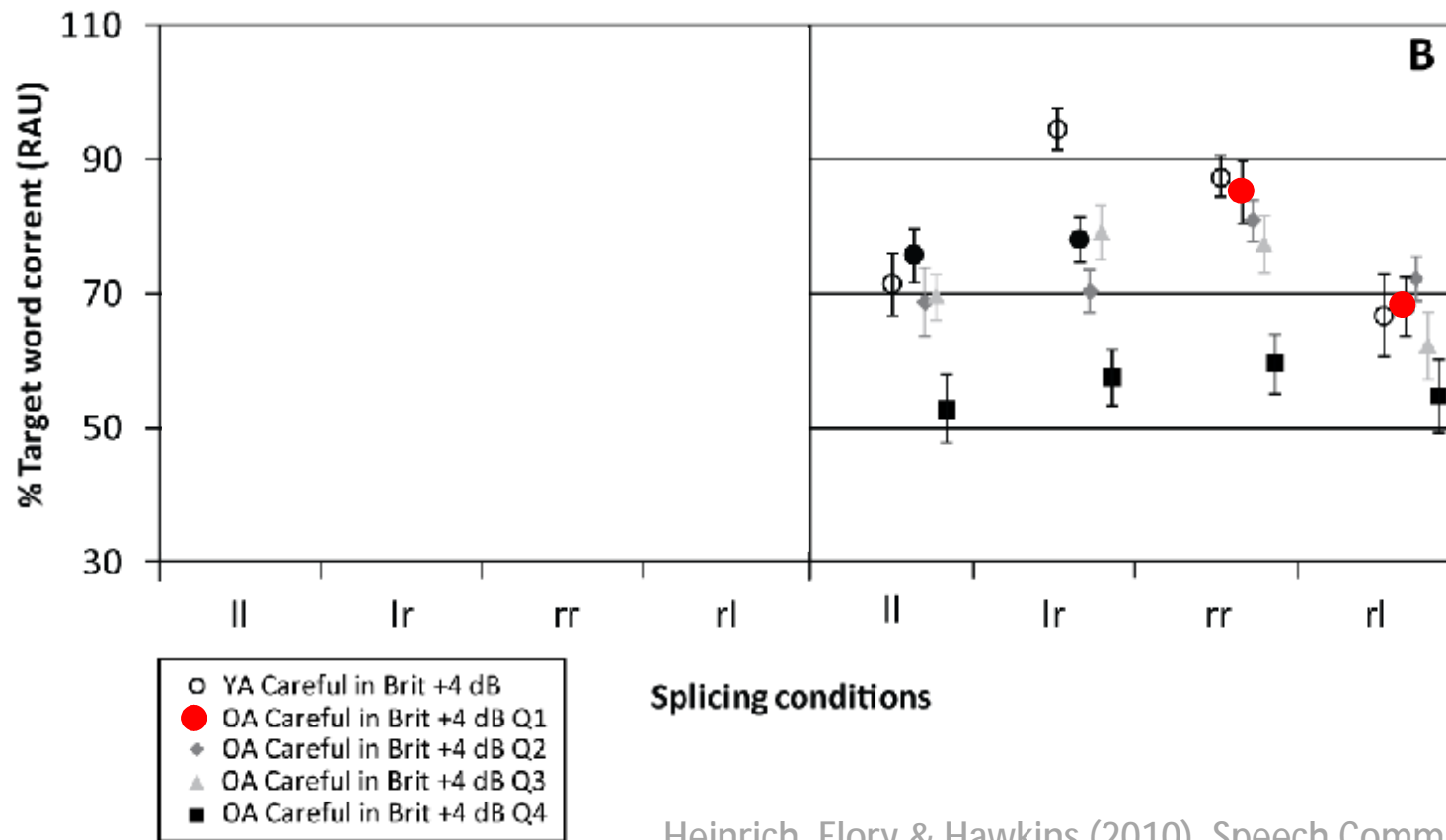
rl Sadie hoped to see the miller today

# Results



Heinrich, Flory & Hawkins (2010). *Speech Comm*, 52, 1038-1055

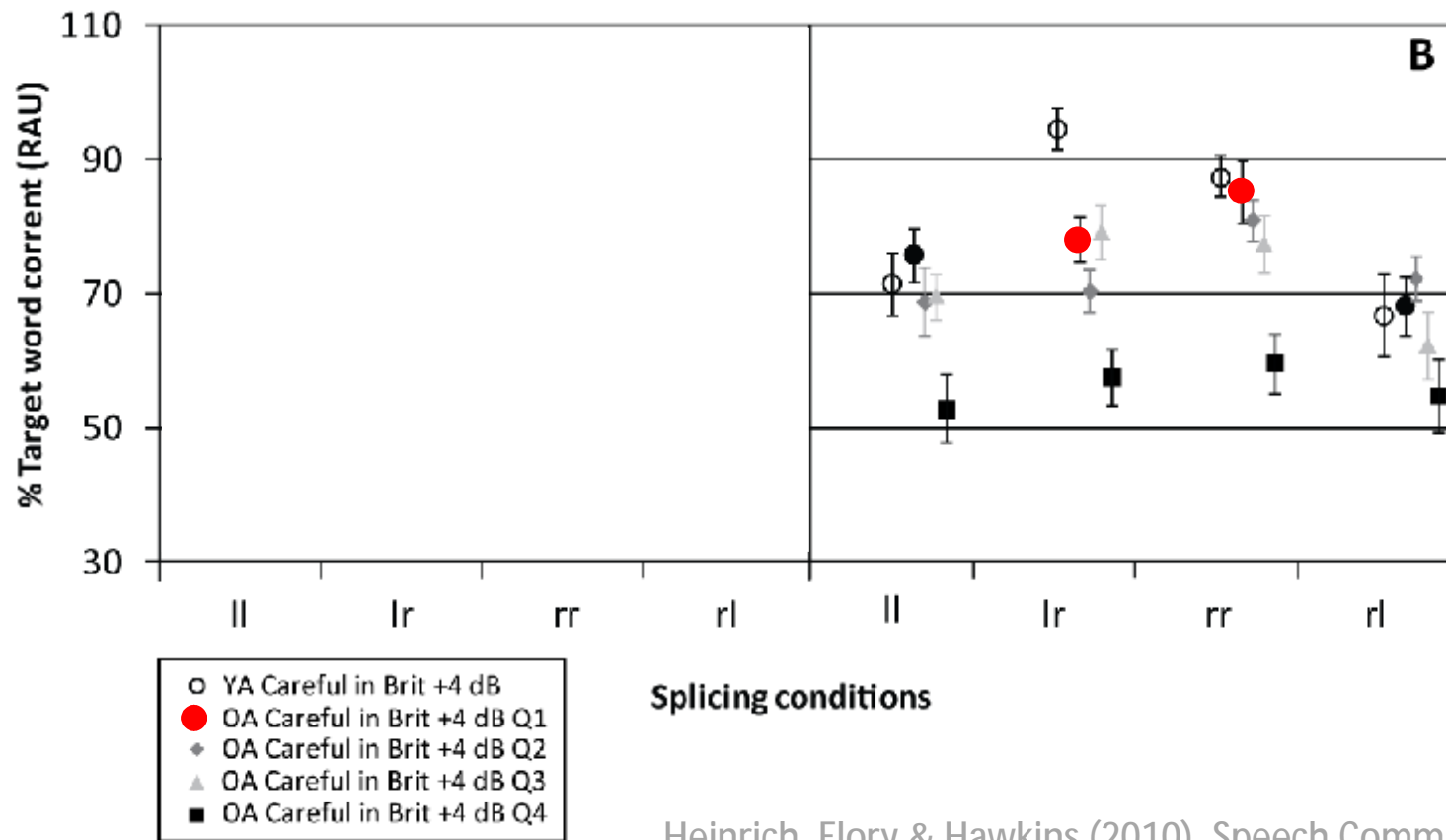
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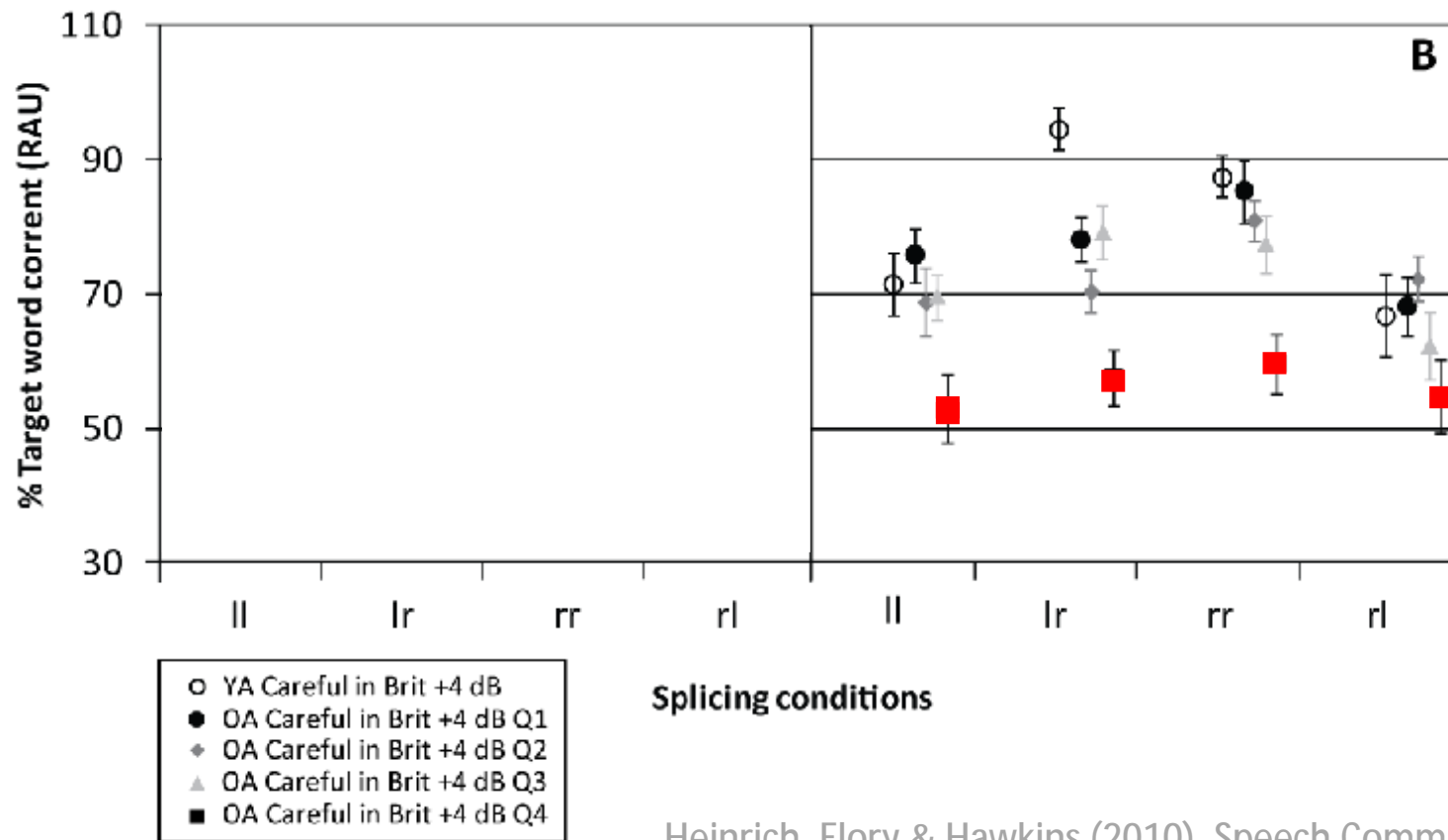


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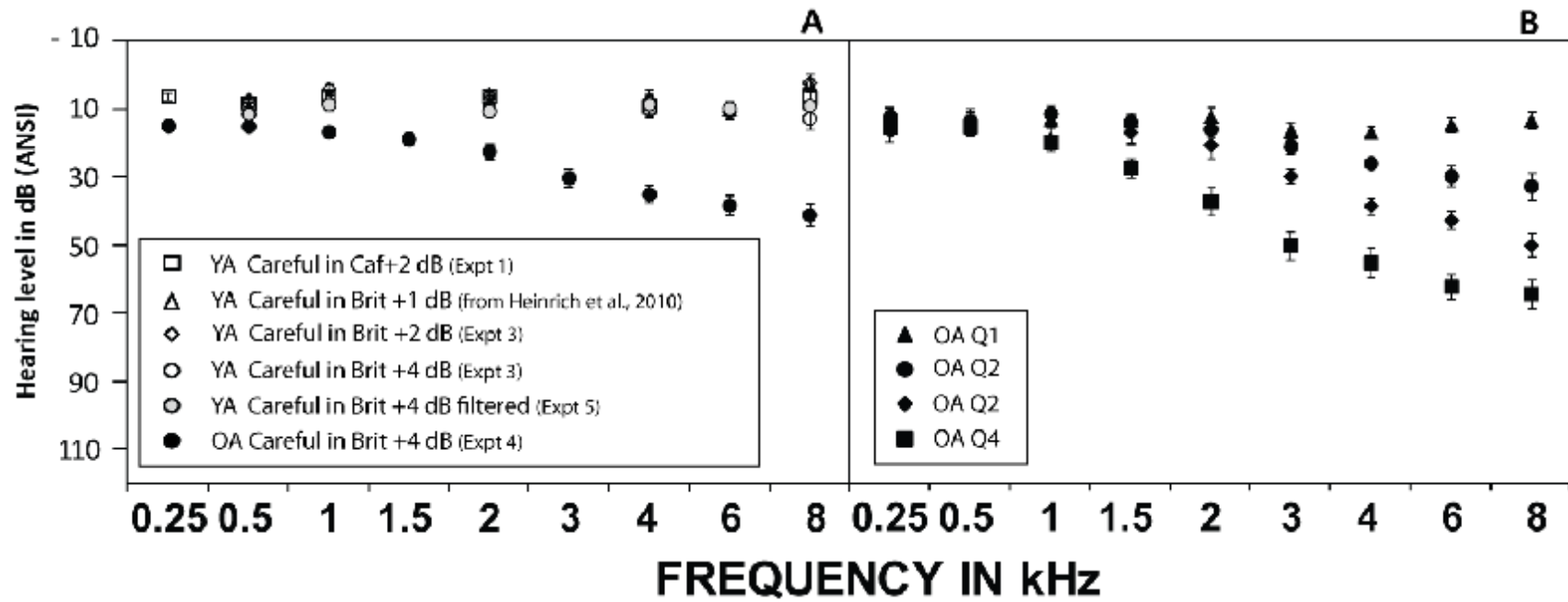
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# Results



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# Results



# Results

Cond	Y English Listeners N = 27	Y German Listeners short-stay N = 14	Y German Listeners long-stay N = 13	O English Listeners low PTA N = 12	O English Listeners high PTA N = 12
ll	0.105	0.093	0.308*	0.092	0.209
lr	0.240	0.255	0.302*	0.055	0.326*
rr	0.152	0.250	0.307*	0.122	0.162
rl	0.002	0.284*	0.284*	0.179	0.350 *

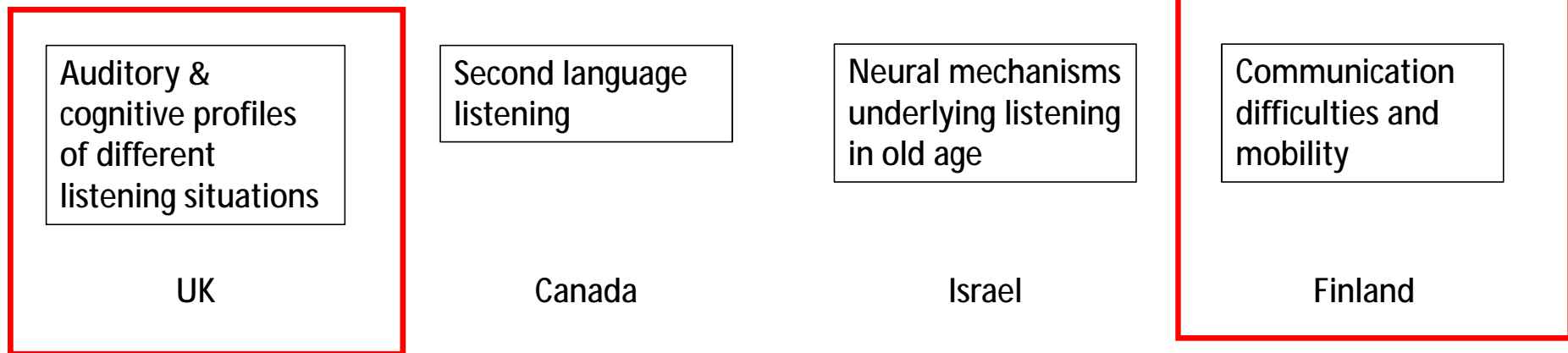
# Discussion

- Older listeners with good hearing used phonetic cues
- Older listeners with poor hearing used lexical cues
- Young second language listeners used lexical cues

		Phonetic knowledge	
		Y	N
Hearing ability	Y	Phonetic cue	lexical
	N	lexical	

## Auditory and cognitive contributions to speech perception in a greater range of listening situations

- As part of larger project on communication in old age



# Speech tasks

- Sentences (n=112)

HP: Tom rode his bike because he didn't have a car.

LP: Ann told a joke because he didn't have a car.

# Cognitive tasks

Working memory

Inhibition

General linguistic ability



# Cognitive tasks

## Working memory

- Letter Number Sequencing (LNS): L – 4 – S – 1 vs 1 – 4 – L – S
- Reading Span Task (RST)

## Inhibition

## General linguistic ability

# Cognitive tasks

## Working memory

- Letter Number Sequencing (LNS): L – 4 – S – 1 vs 1 – 4 – L – S
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## Inhibition

- Stroop



## General linguistic ability

# Cognitive tasks

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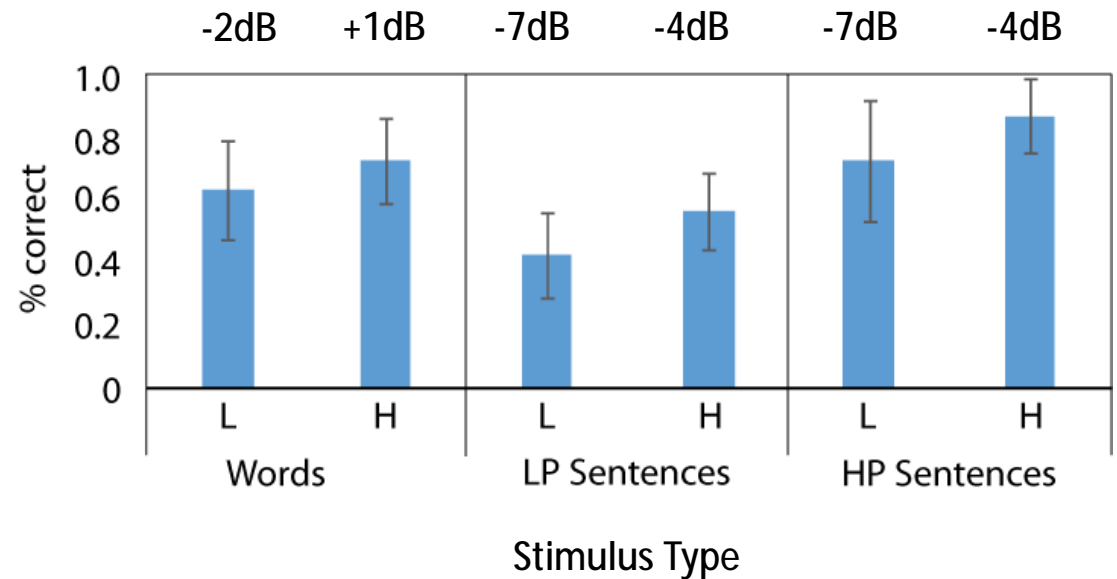
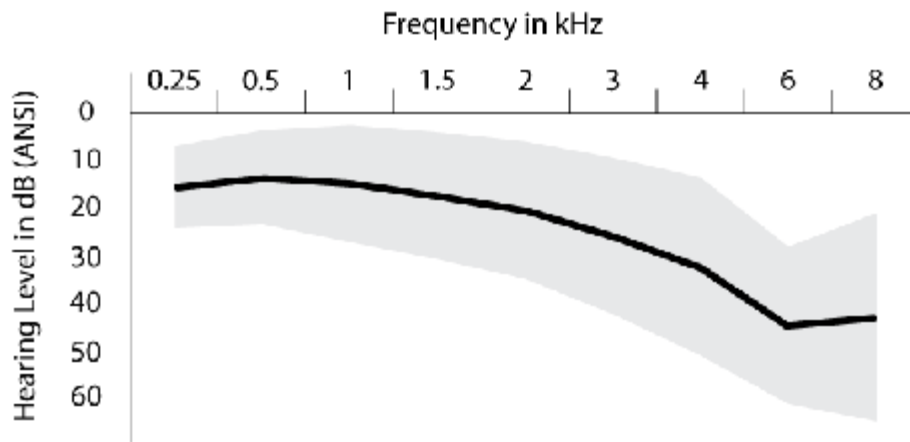
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## General linguistic ability

- Mill Hill Vocabulary Task (MH)
- Nelson-Denny Reading Comprehension (ND)

# Results – Group means



N= 30

Age: 70.2 years (62 – 84)

Power<sub>0.80</sub> to detect at  $\alpha_{\text{two-tailed}} = 0.05$ :

- N = 30: large effect (r = 0.50)
- N = 50: medium effect (r = 0.35)

Stimulus type: LP < words < HP

SNR: low < high

No interaction

# Results – Individual differences

		p-values		
		ME	SNR	Type * SNR
		var		
Auditory		PTA	<0.001	0.007
		TPT		0.04
WM	Moderate processing	LNS	0.003	
	High proc.	RST		0.04
Inhibition		Stroop		
Vocabulary		MH		
Comprehension		ND		

# Results – Individual differences

		p-values			Pearson product-moment correlations					
		ME	SNR	Type * SNR	Words		LP sentences		HP sentences	
var					Low SNR	High SNR	Low SNR	High SNR	Low SNR	High SNR
Auditory	PTA	<0.001	0.007	0.05	-.57	-.60	-.66	-.53	-.69	-.61
	TPT			0.04	-.18	-.38	-.33	-.20	-.29	-.26
WM	Moderate processing	LNS	0.003		.34	.43	.54	.55	.38	.55
	High proc.	RST		0.04	.16	.20	.33	.03	.36	.27
Inhibition		Stroop			.01	.06	-.08	.16	.10	.12
Vocabulary		MH			-.03	-.06	.07	.03	-.02	.22
Comprehension		ND			.06	.10	.30	.02	.17	.26

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# Assessing communication ability: speech test versus self-reported hearing

Setting	Test	N
Laboratory	Speech tests	Small
Clinical / population-based	Self-report questionnaires	large

***EQ-5D*** ([The EuroQol Group, 1990](#)) health-related quality of life

- 3-point scale (no problems, some problems, extreme problems)
- General: mobility, self-care, usual activities, pain/discomfort and affective disorders (depression/anxiety)
- hearing-specific: communication, confidence, family activities, social and work activities, and energy level

***ALDQ***: The *Auditory Lifestyle and Demand Questionnaire* ([Gatehouse et al., 1999](#))

- Frequency / Importance (very rarely / sometimes / often) with higher value indicates a richer auditory environment of higher importance to the listener
- listening to sounds of various intensities, listening to distorted or masked speech, listening to various sound types.

***Glasgow Hearing Aid Benefit Profile*** (GHABP) ([Gatehouse, 1999](#))

- five-point scale (1 = no difficulty to 5 = cannot manage at all).
- TV level set to suit other people, conversation with one other person in no background noise, in a busy street, with several people in a group) on a

***Speech, Spatial and Qualities of Hearing*** (SSQ) questionnaire ([Gatehouse and Noble, 2004](#))

- 0 – 10 point scale
- 14 questions in each of 3 domains

# Results

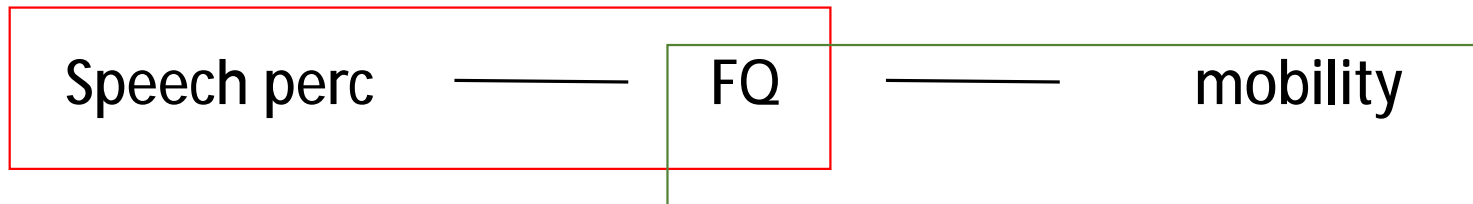
		Correlation			
		PD	DTT <sub>VS</sub>	DTT <sub>VN</sub>	ASL
Health-Related Quality of Life (HRQoL)	EQ-5D general	.10	.11	-.08	-.17
	EQ-5D hearing-specific	.10	-.26	-.38*	-.42**
Self-Report of Hearing	ALDQ	.25	.25	.35*	.26
	GHABP	.04	-.26	-.33*	-.02
	SSQ	-.06	-.37*	-.29*	-.25

Heinrich, Henshaw & Ferguson (2015). *Frontiers in Psychology*, 6:782

# Future

Nottingham

Finland



# Contact

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