



THE UNIVERSITY
of EDINBURGH

SOUNDFIELD AND EDUCATIONAL ATTAINMENT

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SUGGESTED OUTCOMES FROM PREVIOUS STUDIES

HEARING - SOUNDFIELD

- Improvements in:
- reading (Arnold and Canning, 1999, Milette and Purcell, 2010)
- reading, listening comprehension & phonological awareness (Henney, 2007)
- literacy (Darai, 2000)
- literacy and numeracy (Massie and Dillon, 2006)
- listening behaviour (McSporran et al., 1997)
- listening and learning skills (Ronnberg et al., 2008)

DEAF - SOUNDFIELD AND FM

- Soundfield and FM better speech perception outcomes compared to soundfield alone (Anderson and Goldstein 2004).
- Digital FM better than traditional FM system (Wolfe et al 2013)

LIMITATIONS OF PREVIOUS STUDIES

HEARING – SOUNDFIELD

- Poor study design compromised findings:
 - Hearing screening not performed prior to the intervention
 - Acoustic measurements within the classrooms were not obtained
 - Sample size was too small
 - Attendance not factored into the design
 - No objective data on usage
 - Collecting and analysing the data not blind to the intervention

DEAF – SOUNDFIELD AND FM

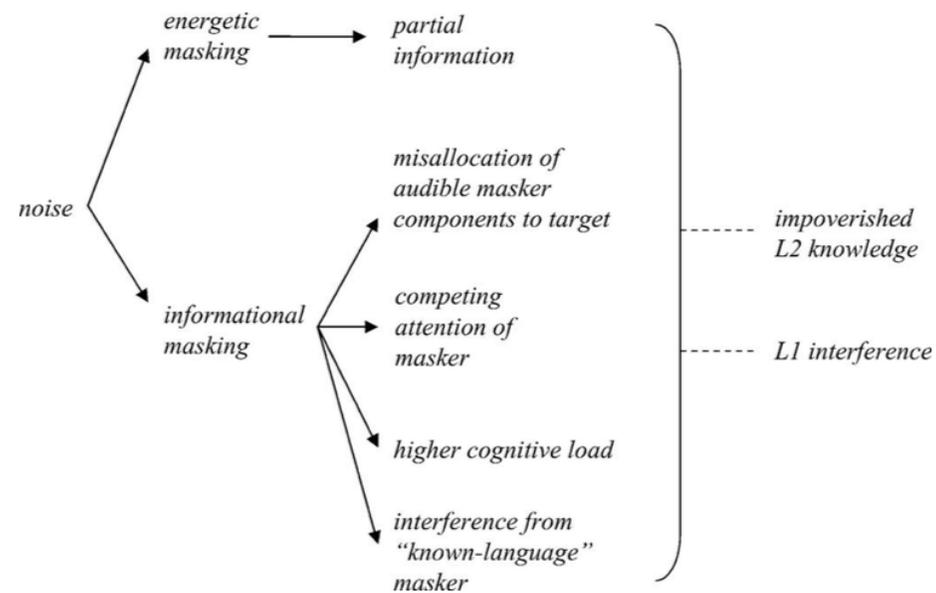
- limited exposure to the different FM/soundfield systems prior to testing
- No comparison between classroom soundfield and FM
- Rebroadcasting of FM via soundfield
- Adults used in the testing

FACTORS THAT CONDITION LISTENING TO SPOKEN COMMUNICATION WITHIN A CLASSROOM

- The level of speech signal (Leibold et al 2007)
- The amount of reverberation (Klatte et al 2010)
- The level and characteristics of the background noise (Leibold et al 2007)
- The number of competing talkers in the classroom (Viswanathan et al 2016)
- Classroom management
- Classroom activity (Shield and Dockrell, 2008)
- Cognitive and linguistic capabilities of the learner (Hallgren 2005)

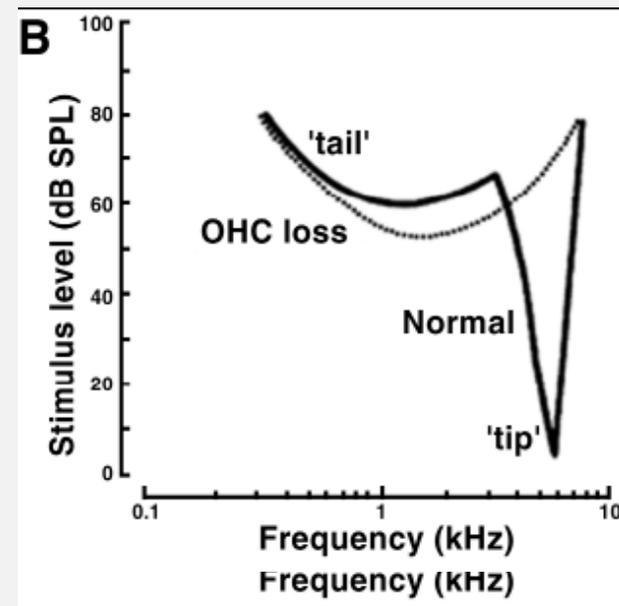
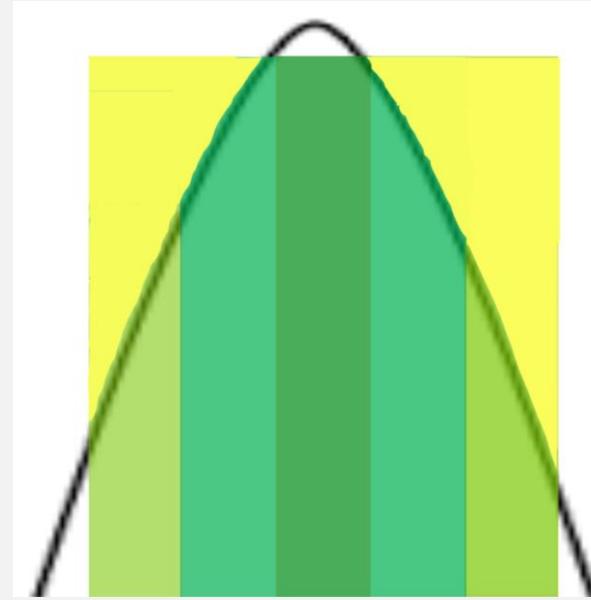
PSYCHOACOUSTIC BASIS FOR LISTENING IN NOISE

- **Energetic masking**
- **Informational masking**



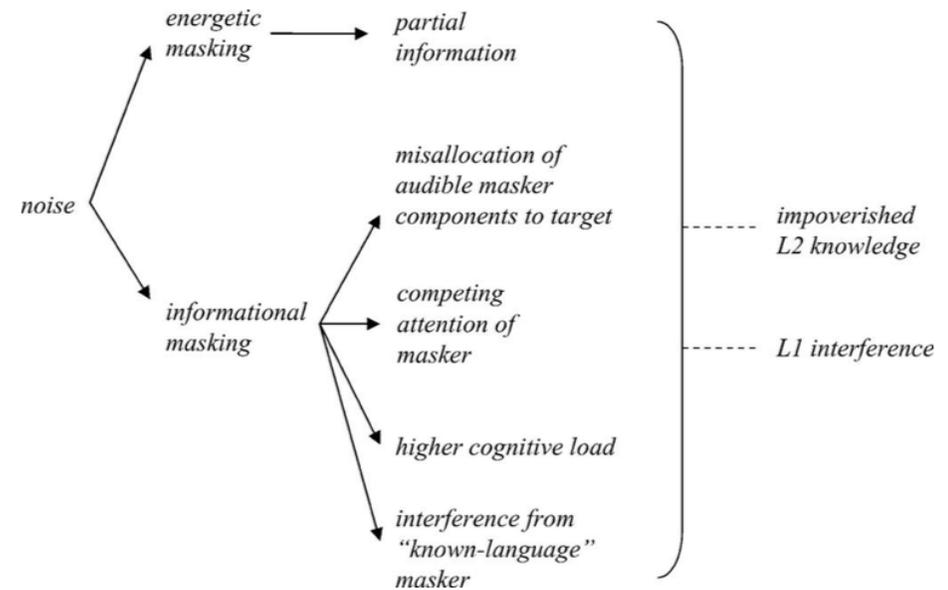
ENERGETIC MASKING

- the listener makes use of an auditory filter with a centre frequency close to the signal
- the filter removes most of the noise.
- only noise passing through the filter will mask the signal.
- the signal to noise ratio is determined by the amount of noise passing through the filter. ([Moore, 2008](#)).



INFORMATIONAL MASKING

- informational masking as everything that reduces speech intelligibility in noise once energetic masking has been accounted for: attending to a single voice in a multi-talker environment ([Cooke et al. \(2008\)](#))
- similarities between the target signal and interferer, or uncertainty over which speech source is the target and which is the interferer ([Arbogast et al. \(2002\)](#).)
- the listener misallocates elements of masker to arrive at an incorrect identification of the target signal,
- increased cognitive load as both the target and masker may contain information relevant to the listener and so attending to the target increases listening effort
- if the masker contains a language known to the listener then language specific decoding processes is compromised



RATIONALE FOR CURRENT STUDY

HEARING

- Attainment gap
- Auditory development and refinement
- Spatial segregation
- Energetic and informational masking
- Knowledge of linguistic rules
- Listening effort

DEAF

- Attainment gap
- Auditory development and refinement
- Spatial segregation
- Energetic and informational masking
- Knowledge of linguistic rules
- Listening effort
- Distortion and attenuation (Plomp, 1978)

STUDY DESIGN

HEARING

- a longitudinal quasi-experimental study design
- multiple control and intervention groups.
- pre-test/post-test design using standardised measures of attainment that were automatically marked.
- group speech assessments were carried out in classrooms
- Comparison with 15 sensorineural deaf learners fitted with BTE hearing aids

DEAF

- a within-subjects crossover design with each student acting as a control.
- Sensorineural deaf learners wearing BTE hearing aids.
- Two separate interventions - dynamic soundfield and FM system; dynamic soundfield and 2.4 Ghz receivers
- 8 week period of each intervention prior to testing
- 3 test set ups – hearing aids only, soundfield only and soundfield with FM/Roger

METHOD

HEARING

- Recruit schools based on SIMD
- Control and intervention classes randomly assigned
- Acoustic measurements in control and intervention classrooms
- Hearing screening on all participants
- Baseline AfE assessments automatically marked
- Soundfield installed and datalogging collected every 4 weeks
- Noise surveys in all classes
- Questionnaires of staff and learners
- Speech assessments
- Post-intervention assessments automatically marked

DEAF

- 8 week period of each intervention prior to testing
- 3 test set ups – hearing aids only, soundfield only and soundfield with FM/Roger.
- Interventions randomly assigned.
- Hearing aids run through test box prior to each test
- FM transparency prior to testing.
- Calibrated speech test using male Scottish voice
- Modified CHEAR test

SUBJECT AREAS ASSESSED

- Reading – word recognition, word decoding & comprehension
- Spelling
- Numeracy – general mathematics and mental arithmetic
- Picture vocabulary
- Non-verbal ability
- Computer based
- adaptive
- Group speech test using calibrated male Scottish voice
- Modified CHEAR test

AFE

Comprehension

Appealing to Your Senses

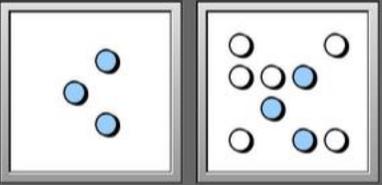
Advertising is a big business and companies aim to stimulate all five senses in an attempt to sell their products. Most people are familiar with advertisements on the radio, magazines, television, and using a combination of vision and sound, and of taste samples of food products in shops. Fewer people are aware that businesses also use perfumes to create an optimal shopping environment in which to market their products. The use of scents in shops and showrooms is frequently so subtle that the



Passage 00:10:00

Next >>

Non-Verbal

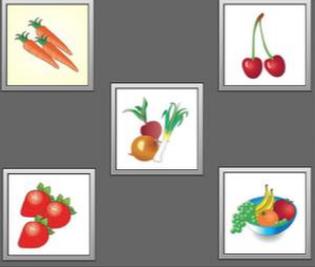


Quiz 00:07:00

Number right 0

Next >>

Picture Vocabulary



Quiz 00:15:00

Question 00:01:00

Again <<

carrots

Spelling

specia

a b c d e f
g h i j k l m n o p
q r s t u v w x y z
(space) (back)



Quiz 00:20:00

Question 00:02:00

Again << Next >>

Word Decoding

awit alit

alwit

alwet alwite



Quiz 00:10:00

Question 00:01:00

Again <<

Word Recognition

leafes leavs

lieves

loaves leaves



Quiz 00:10:00

Question 00:01:00

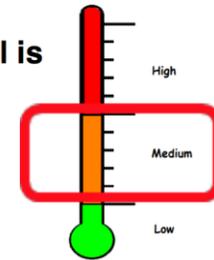
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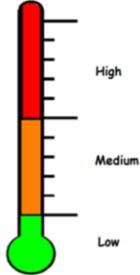
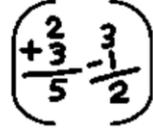
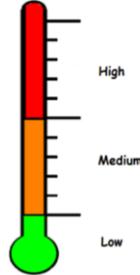
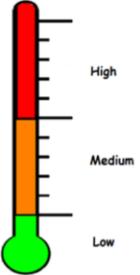
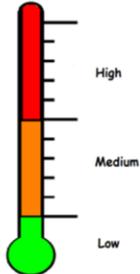
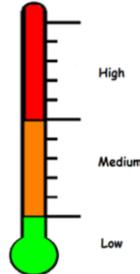
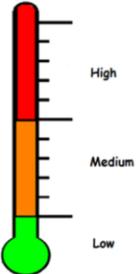
QUESTIONNAIRE EXAMPLE

- Noise levels based on previous research
- Questionnaire used adapted Boardmaker
- Traffic light colour coding system

Question 2 – How noisy or quiet is it during lessons? Put a circle around if the noise level is

Low, medium or high



<p>writing</p>  	<p>Maths</p>  	<p>Circle Time</p>  
<p>Spelling</p>  	<p>Project work</p>  	<p>Problem solving</p>  

NEXT STEPS

- PhD to be finished by 2017
- Data published
- Schools involved in research already using attainment funds to purchase equipment

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