Can children with hearing loss benefit from digital noise reduction?

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Which kids are we talking about?

8-12 year-old children

- Children with hearing loss
  - Mild to moderately-severe
  - Hearing aid users or candidates
Are children being fit with DNR?

Do children need DNR?

Listening Environments Common to Children

- Classroom
- Gymnasium
- Cafeteria
- Playground
- Back seat of the car
- Birthday party
- Ball field
- Locker room
- Movie theater
- Shopping mall
- Fast-food restaurant
Do children need DNR?

Crukley, Scollie, & Parsa (2011) An Exploration of Non-Quiet Listening at School, *Journal of Educational Audiology*
Do children need DNR?

What does DNR do?
Does DNR improve speech perception?

Results in adults are “not very exciting”
(Bentler et al, 2008; Nordrum et al, 2006; Peeters et al, 2009; Ricketts & Hornsby, 2005)

Results in children aren’t very exciting either
(McCreery, Venediktov, Coleman & Leech, 2012)

No change in performance with the use of DNR
- Speech perception in noise (% correct)
- Speech recognition threshold (SRT) in noise (dB)
Can children benefit in other (important) ways?

Challenges of childhood

1. Perceive Speech
2. Aware of Sounds in the Environment
   Recognize environmental sounds and adjust behavior appropriately
3. Manage Complex Environments
   Manage information from multiple sources using multiple modalities
4. Learn
   Detect and configure new auditory information
Learning New Words

1. Quiet
2. Noise
3. Noise w/DNR

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Learning New Words

\[ P_c = 1 - 0.8e^{-n/c} \]
Results
Normal-Hearing Children

8-9 YEAR OLDS
11-12 YEAR OLDS

PERFORMANCE (%) vs TRIAL

QUIET vs NOISE

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Results
Hearing-Impaired Children

8-9 YEAR OLDS

11-12 YEAR OLDS

PERFORMANCE (%) vs TRIAL

QUIET
NOISE
NOISE REDUCTION

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Can children use DNR effectively?

Pittman & Hiipakka (in press) Hearing-Impaired children’s preference for, and performance with, four combinations of directional microphone and digital noise reduction technology, *Journal of the American Academy of Audiology*
Can children use DNR effectively?

1. DIR off DNR off
2. DIR on DNR off
3. DIR off DNR on
4. DIR on DNR on
Competitor: Noise
Speech: Front
Competitor: Noise
Speech: Front

- DIR OFF
- DNR OFF
- DIR ON
- DNR ON

PERFORMANCE
FINAL PREFERENCE

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Competitor: Babble
Speech: Front

- DIR OFF
- DNR OFF
- DIR ON
- DNR ON

Performance and Initial Preference chart.
Competitor: Babble
Speech: Front

DIR OFF
DNR OFF

DIR ON
DNR OFF

DIR ON
DNR ON

DIR OFF
DNR ON

PERFORMANCE
FINAL PREFERENCE
Competitor: Noise
Speech: Back

- DIR OFF
- DNR OFF

- DIR ON
- DNR OFF

- DIR ON
- DNR ON

PERFORMANCE
INITIAL PREFERENCE

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Competitor: Noise
Speech: Back

DIR OFF
DNR OFF

DIR ON
DNR OFF

DIR ON
DNR ON

DIR OFF
DNR ON

PERFORMANCE
FINAL PREFERENCE

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Competitor: Babble
Speech: Back

PERFORMANCE

INITIAL PREFERENCE
Competitor: Babble
Speech: Back

DIAGRAM:

- PERFORMANCE
- FINAL PREFERENCE

Legend:
- DIR OFF
- DNR OFF
- DIR ON
- DNR ON

Graph shows performance and preference comparison between DIR on/off and DNR on/off conditions.
Can children with hearing loss benefit from digital noise reduction?

Yes

– No evidence that DNR is detrimental to performance in children.
– DNR promotes word learning in adverse SNRs.
– Children prefer DNR when listening in steady state noise and in multi-talker babble.
– DNR improves listening comfort without sacrificing intelligibility.
– DNR provides children with an option in noise.
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