Children, Hearing Aids, and Cognitive Demand
Part I

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Children with Hearing Loss

- 30 million Adults
- 1 million Children
Age
Hearing Level
(Pittman & Stelmachowicz, 2002)

Adults (n=248)

Children (n=227)
Hearing Level
(Pittman & Stelmachowicz, 2002)

- 39% Mild (15-40 dB HL)
- 21% Severe (41-60 dB HL)
- 30% Moderate (61-80 dB HL)
- 10% Profound (>80 dB HL)
Age & Hearing Loss

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Children
23 HI Children
60 NH Children

Age
(Stelmachowicz et al, 2000)
Hearing Level
(Boothroyd et al, 1984)

Children
120 HI Children

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<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Significant Impact?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kids</td>
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<tr>
<td>Age</td>
<td>Yes</td>
</tr>
<tr>
<td>Hearing Loss</td>
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Stimulus Level
(Erber & Witt, 1977)

Children
10 HI Children

Figure 1. Percent words recognized correctly and categorized correctly into stress-pattern classes by 10 severely hearing-impaired children. Their scores are shown as a function of acoustic stimulus level (given in dB re each child’s speech detection threshold).
Noise
(Crandell, 1993)

Children
20 HI Children
20 NH Children

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Reverberation
(Finitzo-Hieber & Tillman, 1978)

Children
12 HI Children
12 NH Children

![Graph showing performance in terms of reverberation time and age, with bars for NHC and HIC groups.]
Reverberation + Noise (6 dB SNR)  
(Finitzo-Hieber & Tillman, 1978)

Children
12 HI Children
12 NH Children

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<td>Noise</td>
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<tr>
<td>Reverberation</td>
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HEARING AID CHARACTERISTICS
Amplitude Compression
(Jenstad et al, 1999)

Children
12 HI Children (& adults)

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Directional Microphones
(Ricketts, Galster & Tharpe, 2007)

Children
26 HI Children

Figure 4. The average speech recognition performance as measured by the Hearing in Noise Test for Children within the five simulated classroom conditions in each of the two microphone modes. The error bars represent 1 SD. Dir = directional; SNR = signal-to-noise ratio.
Digital Noise Reduction
(Stelmachowicz et al, 2011)

Children
16 HI Children

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Digital Noise Reduction
(Stelmachowicz et al, 2010)

Children
16 HI Children

![Graph showing hearing loss and signal-to-noise ratio for 5-7 year olds and 8-10 year olds with and without noise reduction.](chart)

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Frequency Lowering
(Glista et al, 2009)

Children
11 HI Children

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Hearing Aid Bandwidth
(Stelmachowicz et al, 2007)

Children
24 HI Children
32 NH Children

Fig. 7. Mean PBK scores (in %) as a function of age group for children with normal hearing (upper panel) and hearing loss (lower panel) children. Error bars represent ±1 SD.
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</table>
Receptive Vocabulary
(Pittman, 1998-2008)

Children
76 HI Children
137 NH Children

Delayed lexical development as a function of age
Receptive Vocabulary
(Blamey et al., 2001)

Children
40 HA Children
47 CI Children

Impaired lexical development as a function of age