Using Floating Linear Gain compression to improve speech recognition of children and adults with moderately to severe hearing loss
People add about a thousand word forms (a word and its close morphological relatives) per year. This translates to about three word forms per day, every day of the year which entails more lexical change than one might expect.

Leach L, Samuel AG. Lexical Configuration and Lexical Engagement: When Adults Learn New Words.
Children with hearing loss require **three times the exposure** to learn new words and concepts because of reduced acoustic bandwidth compared to typical hearing peers.

*Dehaene (2009)*
*The Auditory Brain: Conversations for Pediatric Audiologists; Carol Flexer, PhD, CCC-A, LSLS Cert. AVT*
A clear message helps individuals make the most out of every opportunity to learn new information.
Compression

10 dB

Output level

Compression

Noise

Speech

Input level

20 dB

CR => the desired gain to make sounds audible

CS => when do we make it audible
Floating Linear Gain & How sounds will be processed

Estimating signal level

Let us consider one channel with accompanying level detector and gain.

Input Signal → Filter → Guided Level Detector → Fast Level Detector → Difference

- band signal
- band level

Single gain calculation

+ 4.5
- 7.5
Floating Linear Gain
Speech Guard E

- Slowly follows gradual input changes
- Quickly reacts to large increases in input
- Quickly reacts to large decreases in input
Andrea L. Pittman et al. 2014

“Effects of Fast, Slow, and Adaptive Amplitude Compression on Children’s and Adult’s Perception of Meaningful Acoustic Information”

Journal of American Academy of Audiology (JAAA)
(Accepted)
Participants

Children
- 20 with normal hearing
  7-12 years
- 15 with hearing loss
  7-12 years
Adults
- 21 with normal hearing
  21-30 years
- 26 with hearing loss
  50-65 years
  66-78 years

Amplitude Compression Parameters

- Single compression model
- 4 channels
- Compression ratio = 3:1
- Knee point of 40 dB SPL
- Timeconstants
  - Slow: attack ~20ms, release ~800ms
  - Fast: attack ~10ms, release ~40ms
  - Adaptive: Speech Guard
Test paradigm:

Stimuli:
- 71 dB Bark
- 65 dB “Owl”

Categories:
- Person
- Food
- Animal
- ??

Background playground noise

71 dB
65 dB
62 dB
Fast, slow and adaptive amplitude compression
Impact on the sound envelope
**Children and adults with hearing loss achieved optimal performance with adaptive compression i.e. Speech Guard E especially in complex listening environments.**
Every child benefits 6-8% better speech understanding in noise

“Using Floating Linear Gain compression to improve speech recognition of children with moderately severe hearing loss”
The benefit of speech guard was preserved when the children were cognitively loaded.

"Using Floating Linear Gain compression to improve speech recognition of children with moderately severe hearing loss"
A significant speech recognition in noise and reverb advantage of 6.6% was found for Sensei Pro above Safari and above linear amplification.
Compression strategy is a vital decision in fitting a child or an adult with a hearing aid. The choice of strategy can influence the ability and the number of occasions for the hearing impaired to use and learn (new) information.
Relevant literature:


- **McCreery et al. (2012).** "An evidence-based systematic review of amplitude compression in hearing aids for school-age children with hearing loss." *Am J Audiol* 21(2): 269-294. Read the introduction and get an impression of how little evidence actually exists on the effect of amplitude compression in pediatrics. This puts into perspective the value of the data obtained in this study, not just to Oticon Peds but for children with hearing loss in general. Abstract at: [http://aja.asha.org/cgi/content/abstract/21/2/269](http://aja.asha.org/cgi/content/abstract/21/2/269)

- **Crukley et al. (2011).** "An Exploration of Non-Quiet Listening at School." *Journal of Educational Audiology* 17: 23 -35. Get the details about the listening environments of today's children. In particular see fig. 3 and 5.

More specific references:

