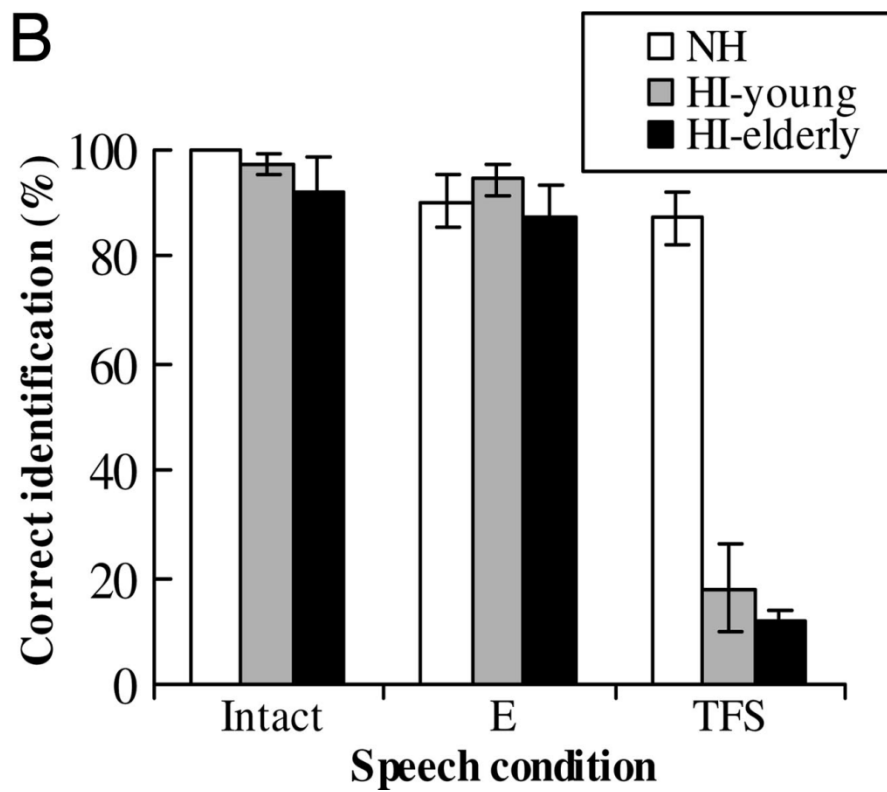
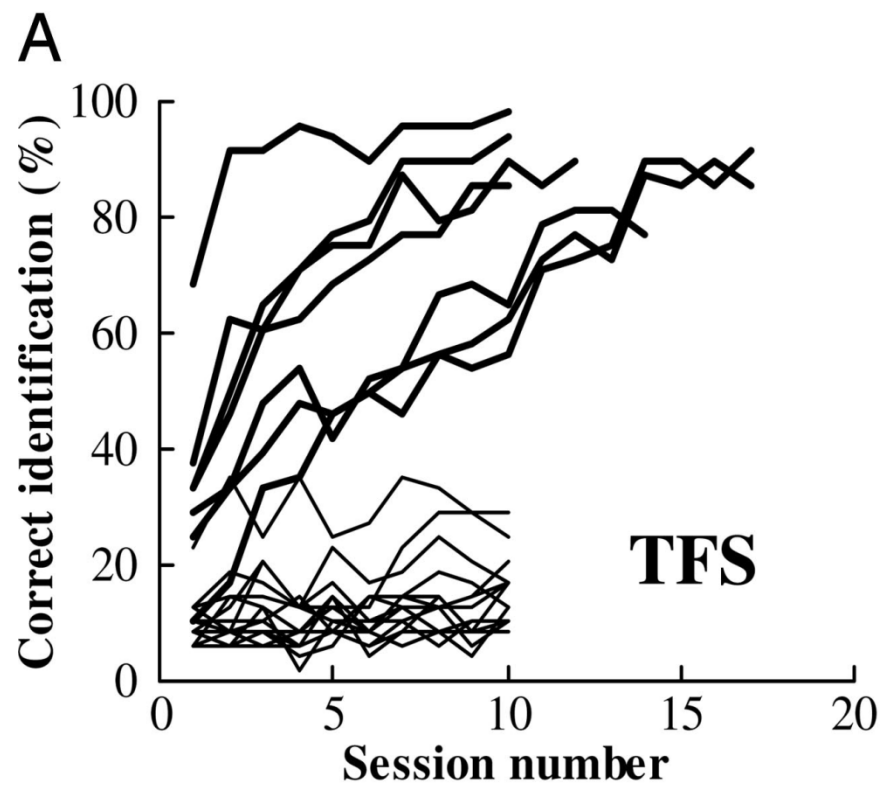


1 Parole = source modulée en fréquence (voix, bruit) et en amplitude (résonateurs).

2 signal = fréquence centrale modulée en fréquence et en amplitude  
Décomposition par transformée de Hilbert.

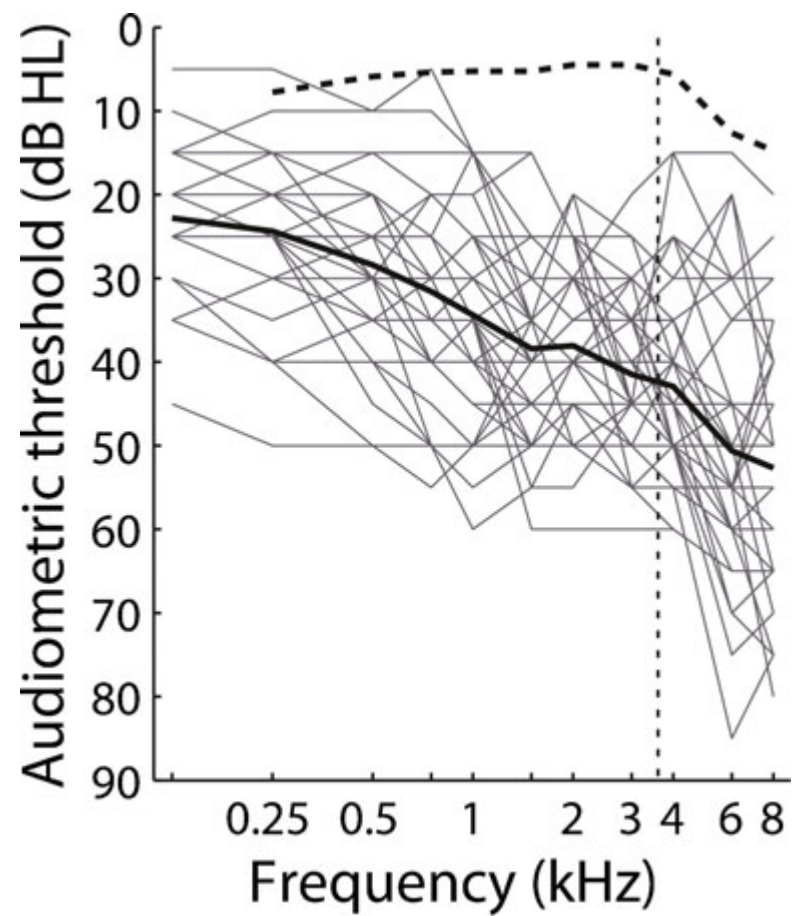
3 MA seulement : Vocoder, démonstrations : nb filtres et taux de réjection

4 MF extraction par transformée de Hilbert -> synthèse type vocoder  
intelligibilité requiert long apprentissage  
et sourds ne peuvent pas apprendre.



5 MF extraction par transformée de Hilbert -> pas distinction signal/  
bruit de fond

-> seuillage de profondeur d' extraction

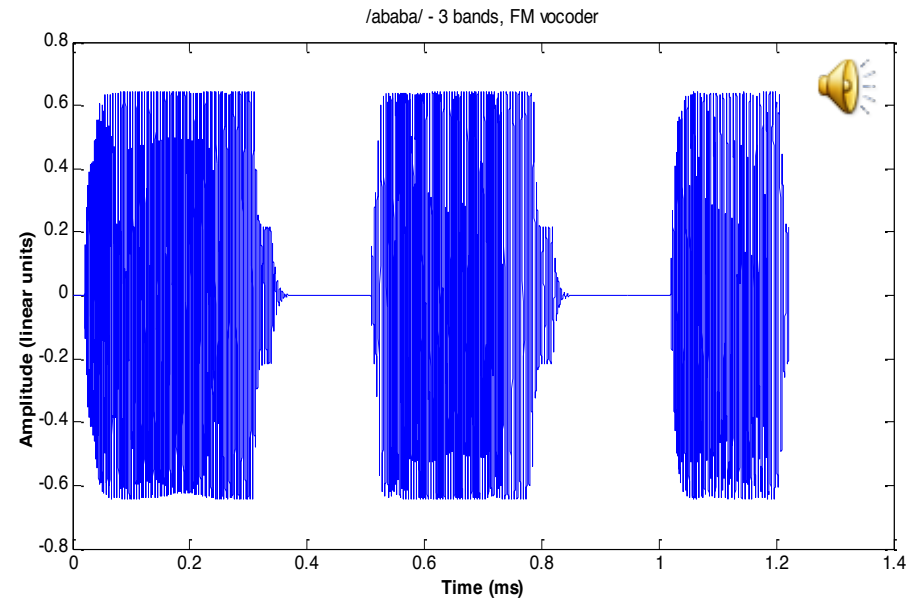
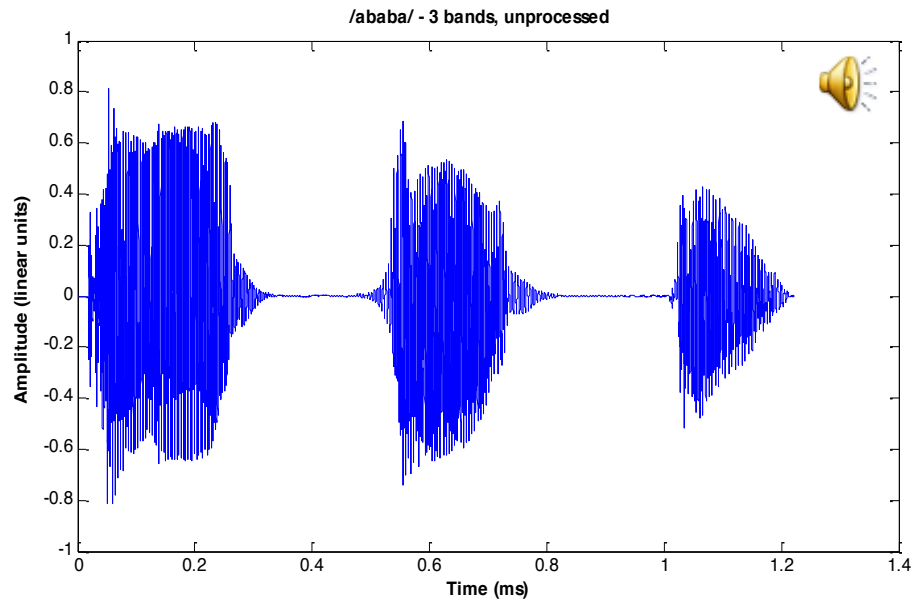


# Effects of cochlear damage

Objective: develop a fast clinical test based on *FM speech* promoting **maximum peripheral/central E-re/construction from FM/TFS**



and limiting the effects of stimulus generation artifacts such as the amplification of recording noise



**Stimuli:** /VCVCV/ presented in quiet

1 single session

- Unprocessed, or FM vocoded
- NH 65dB SPL; HI: 65 dB SPL or Amplified

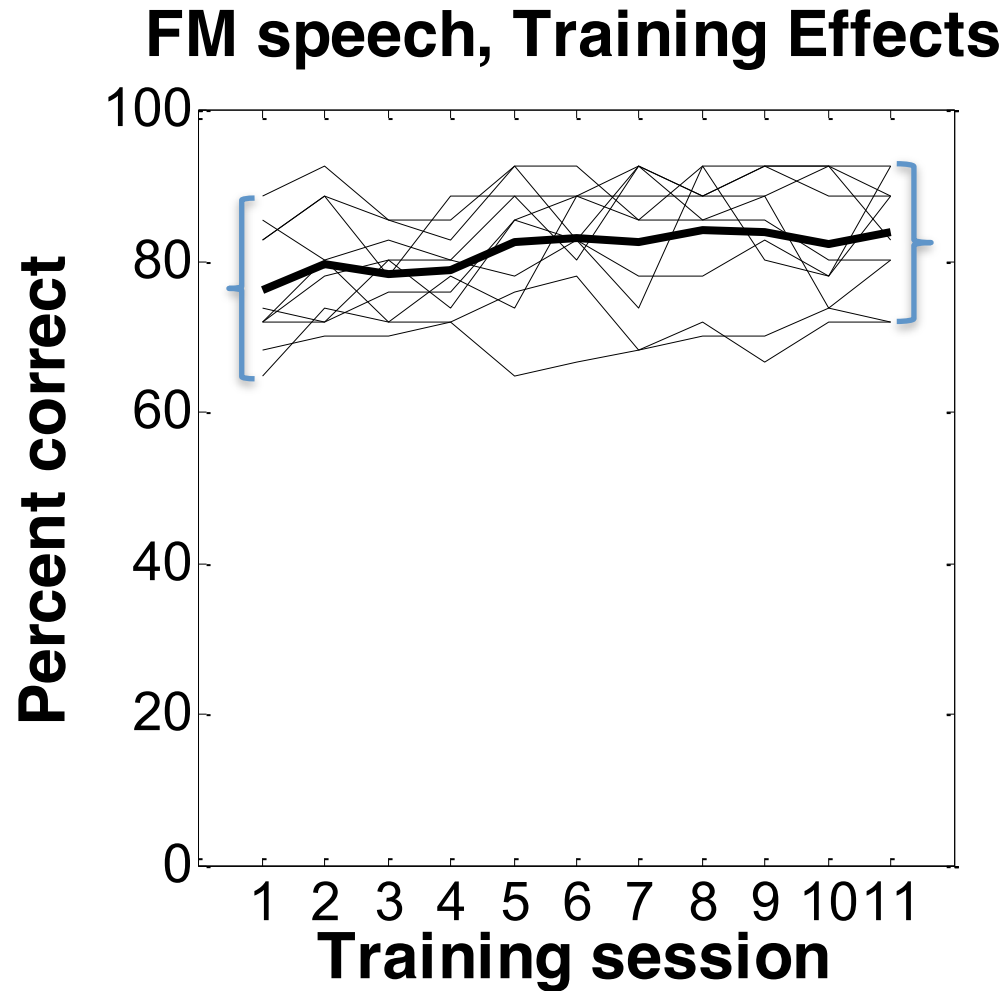
In collaboration with N Wallaert, S Garnier, Y Cazals

- ☐ 3 **broad** analysis bands (gammatone; 8-ERB wide; 65-3645 Hz)
- ☐ **FM extraction** for signal > -20dB re: RMS
- ☐ SSN masker > 3.6kHz, SNR = +12 dB

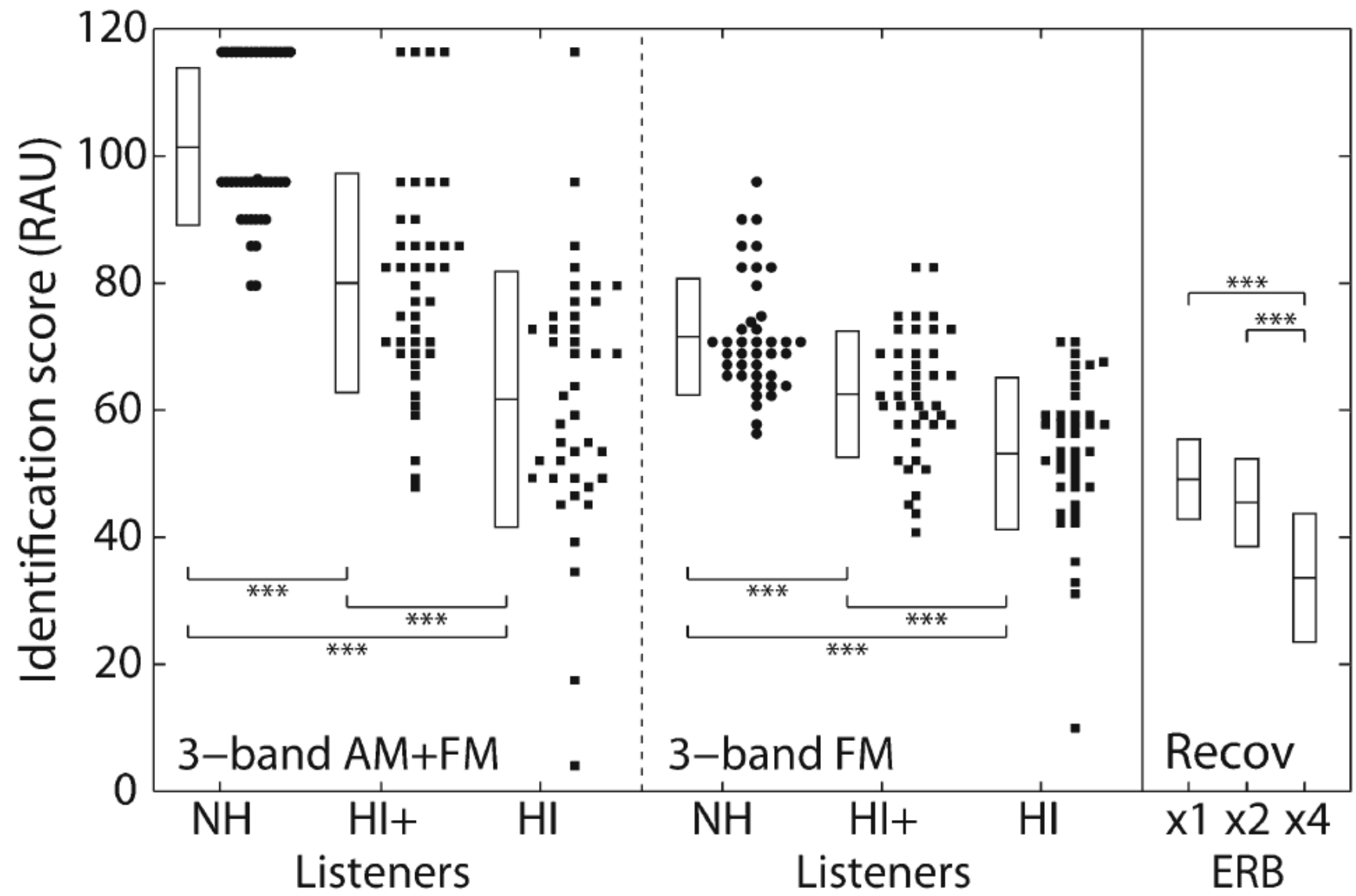
	B1	B2	B3
CF (Hz)	263	940	2535
BW (Hz)	395	936	2220

NH: n=10 list.

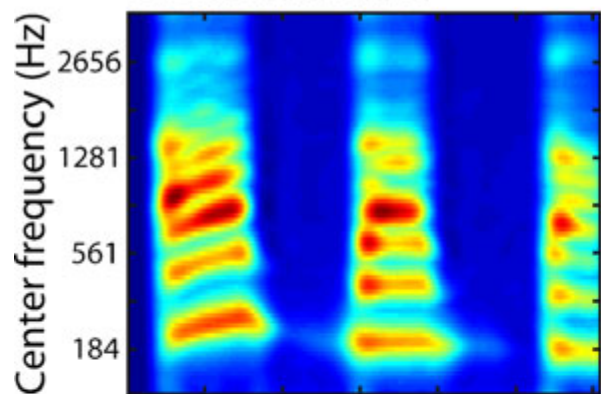
## Results



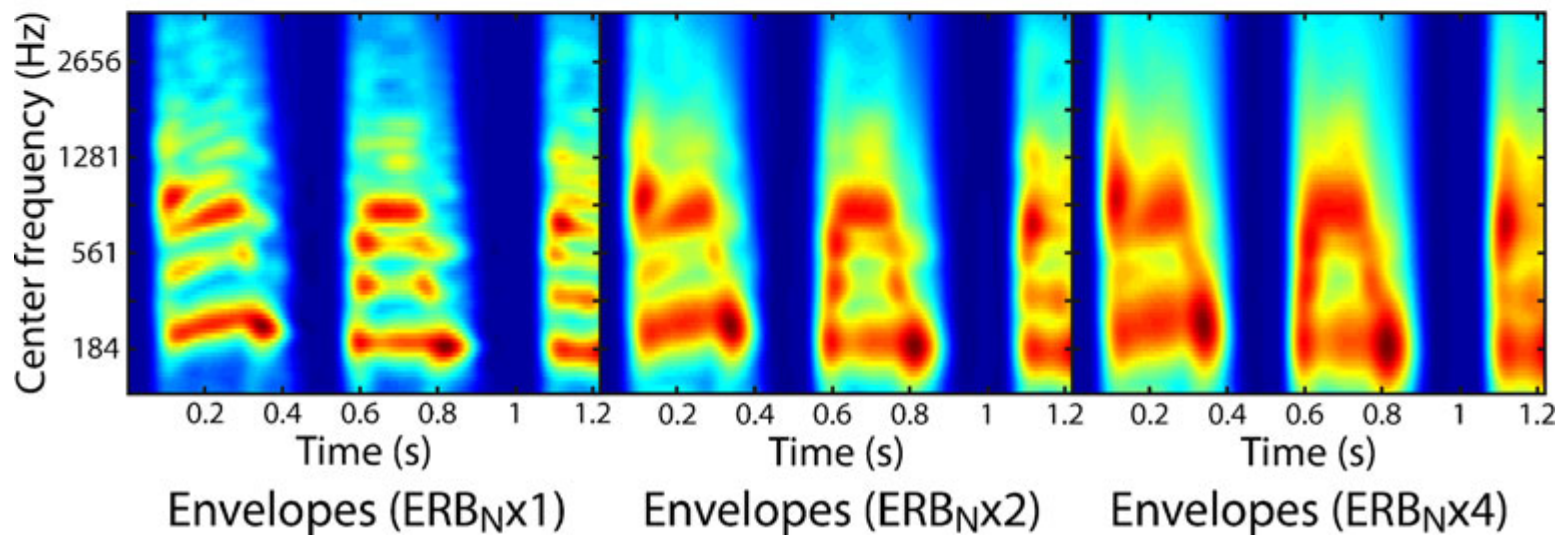
Re: previous FM-speech perception studies: 3-band FM= *small effect of training*



3-band AM+FM

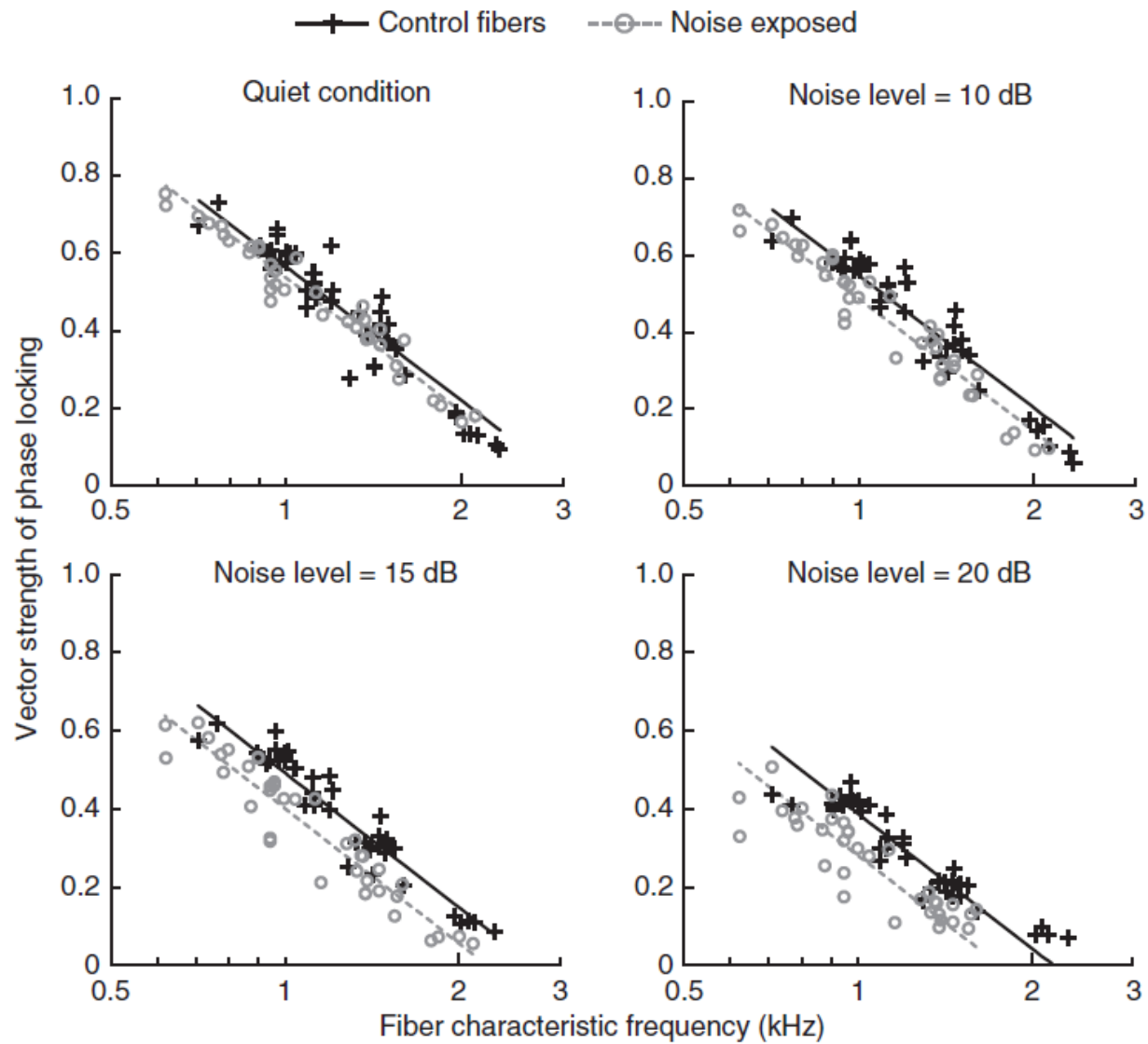


3-band FM





# Henry et Heinz Nat Neurosci 2012



Recent studies suggest that normal-hearing listeners maintain robust speech intelligibility despite severe degradations of amplitude-modulation (AM) cues, by using temporal-envelope information recovered from broadband frequency-modulation (FM) speech cues at the output of cochlear filters. This study aimed to assess whether cochlear damage affects this capacity to reconstruct temporal-envelope information from FM. This was achieved by measuring the ability of 40 normalhearing listeners and 41 listeners with mild-to-moderate hearing loss to identify syllables processed to degrade AMcues while leaving FM cues intact within three broad frequency bands spanning the range 65–3,645 Hz. Stimuli were presented at 65 dB SPL for both normal hearing listeners and hearing-impaired listeners. They were presented as such or amplified using a modified half-gain rule for hearing-impaired listeners. Hearingimpaired listeners showed significantly poorer identification scores than normal-hearing listeners at both presentation levels. However, the deficit shown by hearing-impaired listeners for amplified stimuli was relatively modest. Overall, hearing-impaired data and the results of a simulation study were consistent with a poorer-than-normal ability to reconstruct temporalenvelope information resulting from a broadening of cochlear filters by a factor ranging from 2 to 4. These results suggest that mild-to-moderate cochlear hearing loss has only a modest detrimental effect on peripheral, temporal-envelope reconstruction mechanisms.

AM patterns can be reconstructed from the broadband FM components as a result of cochlear filtering (Ghitza 2001; Zeng et al. 2004; Gilbert and Lorenzi 2006; Sheft et al. 2008; Heinz and Swaminathan 2009; Ibrahim and Bruce 2010; Swaminathan and Heinz 2012; see also Apoux et al. 2011). Gilbert and Lorenzi (2006) demonstrated that recovered AM cues contribute substantially to the identification of vocoded syllables retaining FM cues only when a wide analysis filter bandwidth is used to generate the vocoded signals. More precisely, their results showed that recovered AM cues played a major role in the identification of Fm vocoded syllables when the bandwidth of analysis filters used to vocode speech was greater than about four times the bandwidth of a normal cochlear filter.

## Sourds détection normale d' AM

HI listeners typically show normal or near-normal ability to use AM speech cues (e.g., Turner et al. 1995; Baskent 2006; Lorenzi et al. 2006, 2009). However, they may not be able to recover temporal-envelope information from FM as well as NH listeners do because cochlear filters tend to broaden with the amount of hearing loss (see Moore 2007, for a review).

