# Within-channel model
# sir-stir

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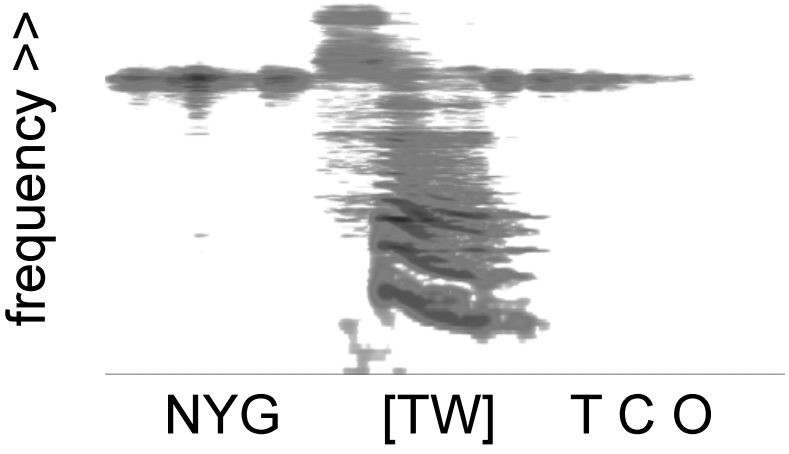
1. Motivation for a within-channel model of perceptual compensation for reverberation

2. Implementation: constructing a within-channel model
   - Recycling/extending across-channel framework
   - MPR: a band-by-band metric?
   - Context Windows

3. Modelling experiments
   - Parameter tuning
   - Integration with ASR studies

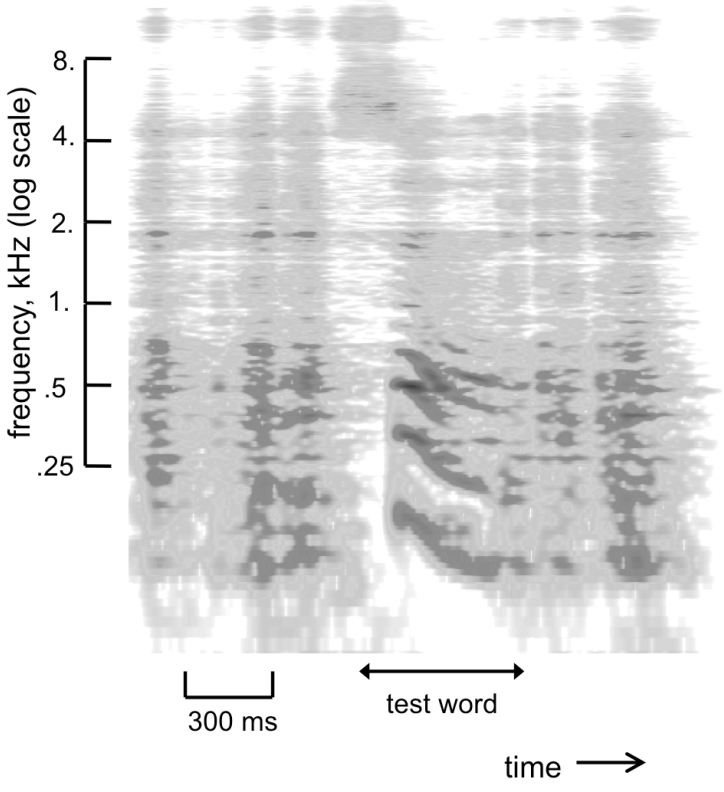
# Evidence for band-by-band (i)




- Single band-context gives little or no compensation
- Compensation increases when a number of such bands are used
- Compensation effects appear to be confined to context's freq range

Ref: Watkins & Makin 2007 JASA, 2007 AAUA

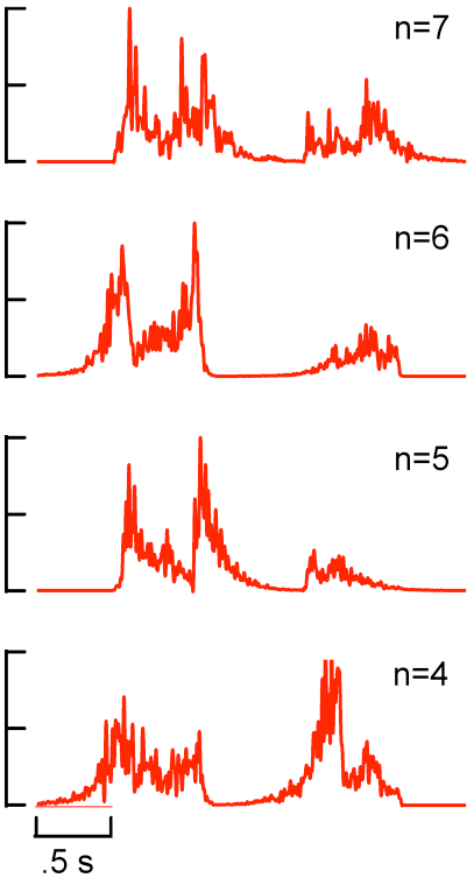
# Evidence for band-by-band (ii)




- Steady-spectrum noise-like contexts give substantial compensation
- esp. for single-band condition (temporal envelope of a single band is imposed in many freq channels)

Ref: Watkins & Makin 2006 ISH, 2007 AAUA

# Evidence for band-by-band (iii)



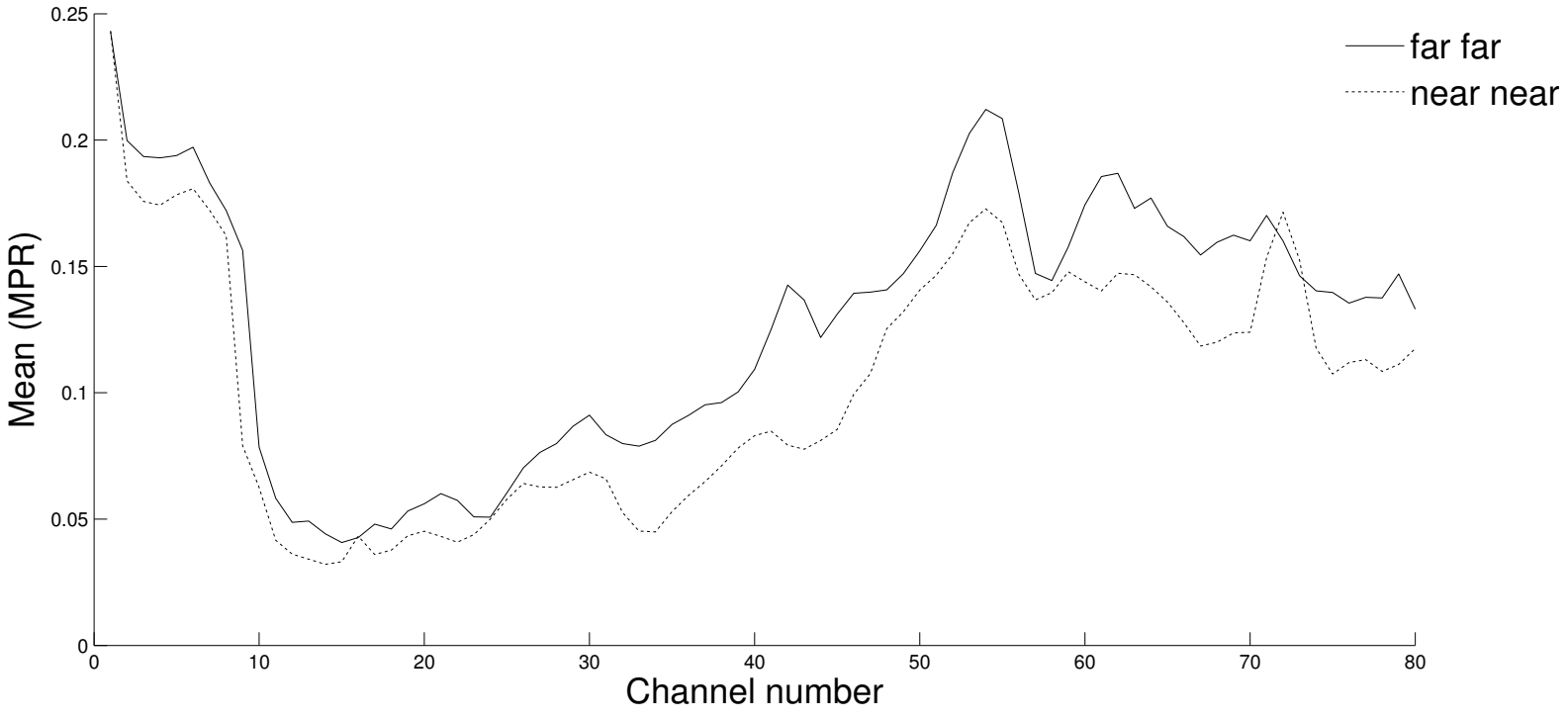

- 8-band noise-vocoder speech
- each band independently present and/or reverberated
- effect of reversing half of the bands same as removing them

Ref: Watkins et al. 2009 BSA

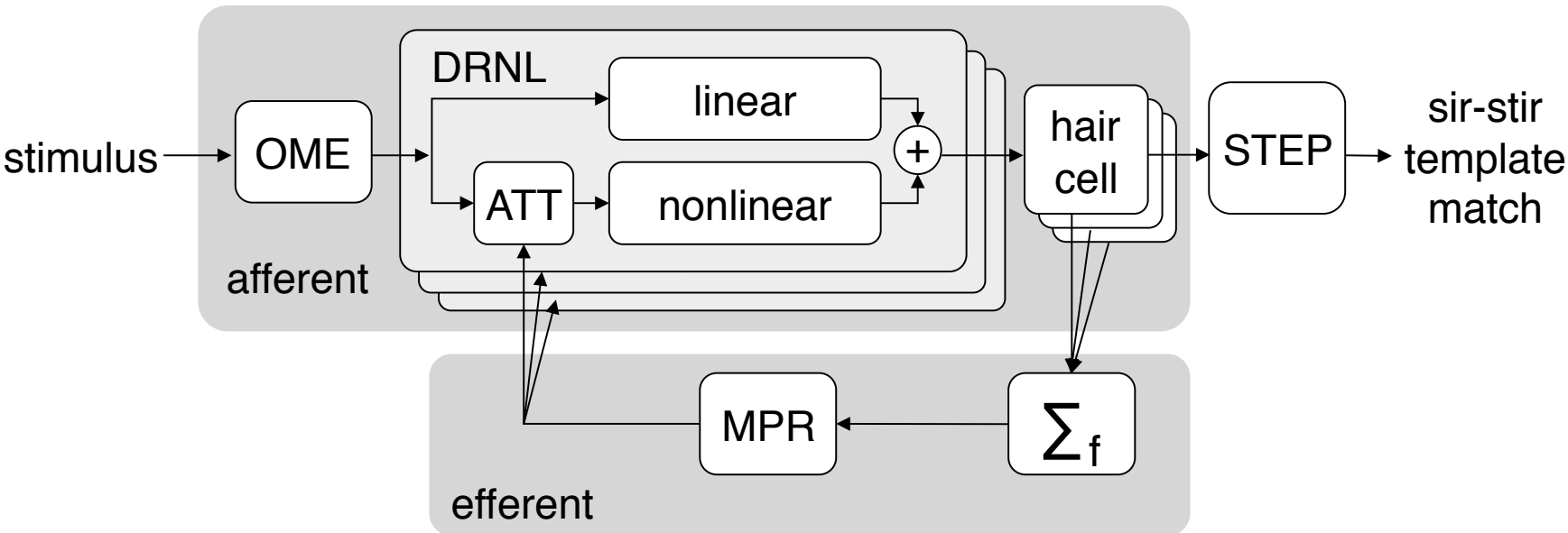
# Model framework

- Extension of across-channel model
- Efferent attenuation determined channel-by-channel (metric works with a single channel's context window)
- Therefore efferent processing varies with frequency

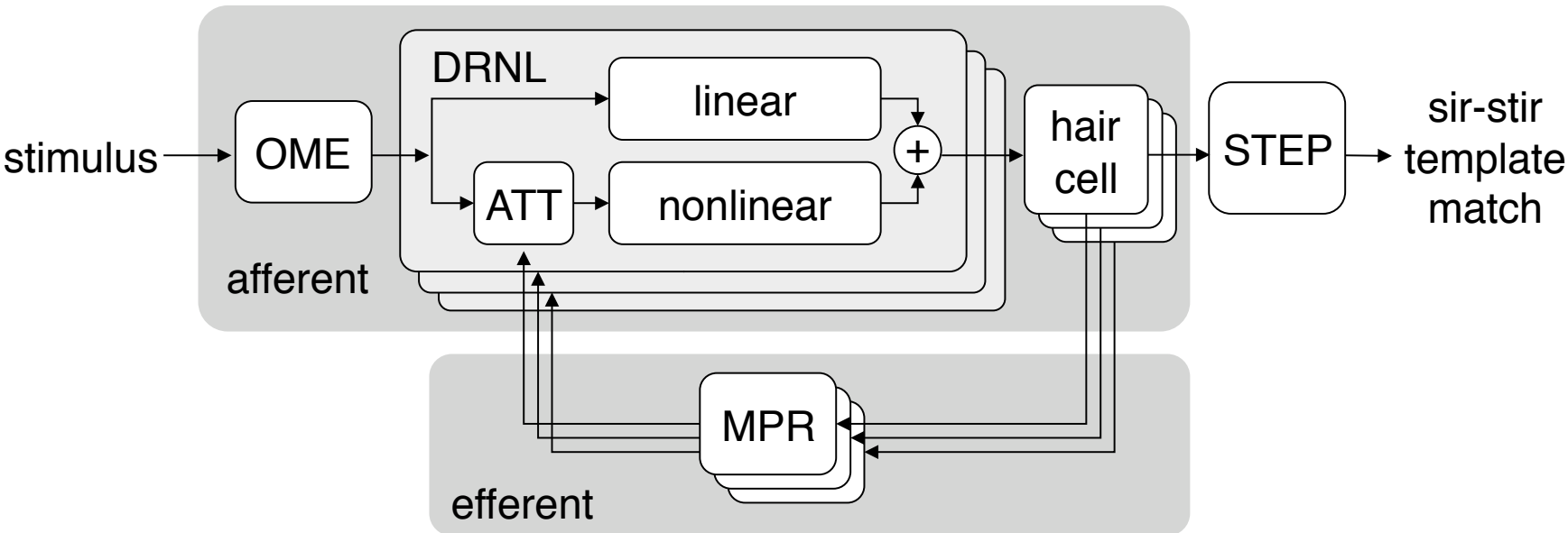
# Reverberation Metric
# MPR: a band-by-band metric?



# Across-channel model schematic

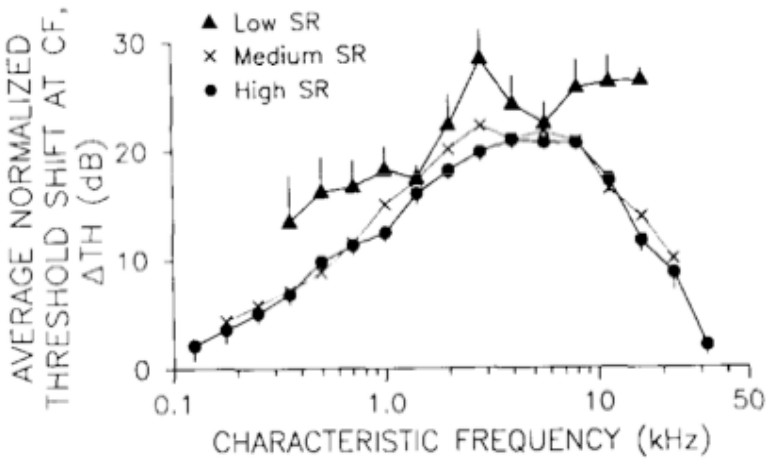


# Within-channel model schematic



# Frequency sensitivity of efferent system

Different contextual awareness in each channel (to determine ATT)




Ref: Guinan and Gifford (1988)

Frequency domain window shape

- flat response
  simulates across channel model
- linear approximation
  in region 100-8000 Hz

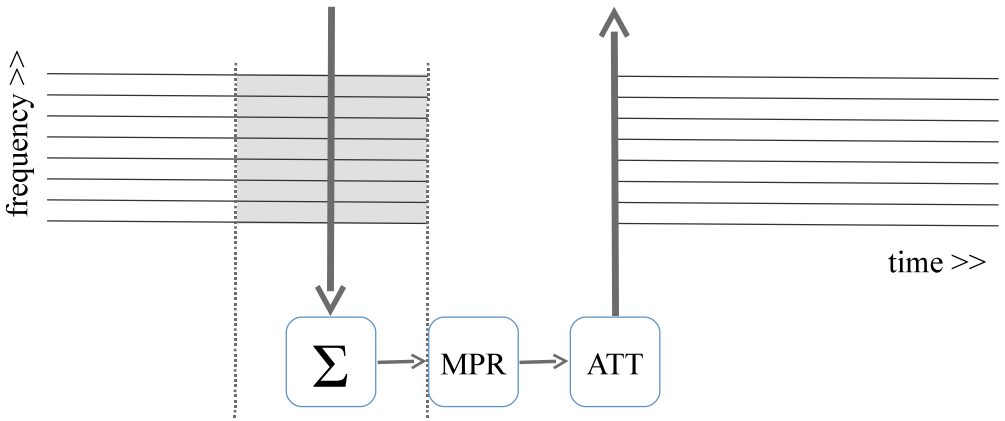
# Context Time-windows

Again,
different contextual awareness in each channel (to determine ATT)

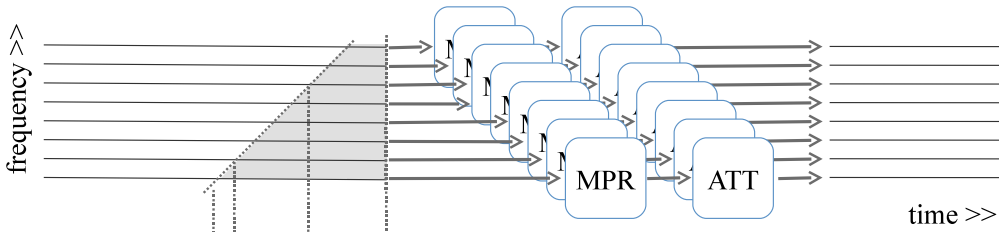
- Time-window length (footprint)
- Time-window shape (forgetting function)

# Time windows (i) length

## Across channel




## Within channel

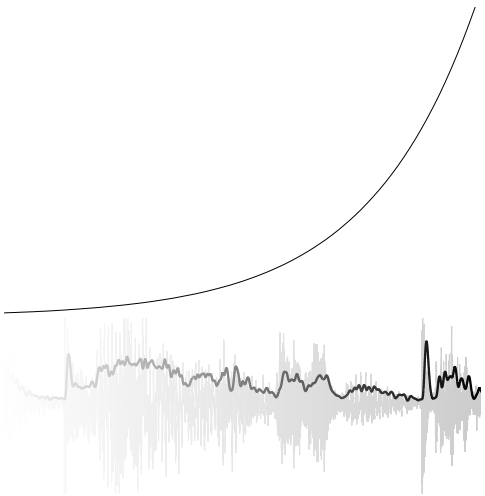



Time domain footprint

- all fixed at 1 s simulates previous
- high freq shorter low freq longer

Ref: Glasberg and Moore (2002)

# Time windows (ii) shape



Forgetting function

- everything remembered equally simulates across channel model
- reversed exponential decay

Ref: Wixted (2004)

# Tuning parameters of the within-band model

Using perceptual experiments to determine parameter settings
i.e., match listener data for sir-stir boundaries

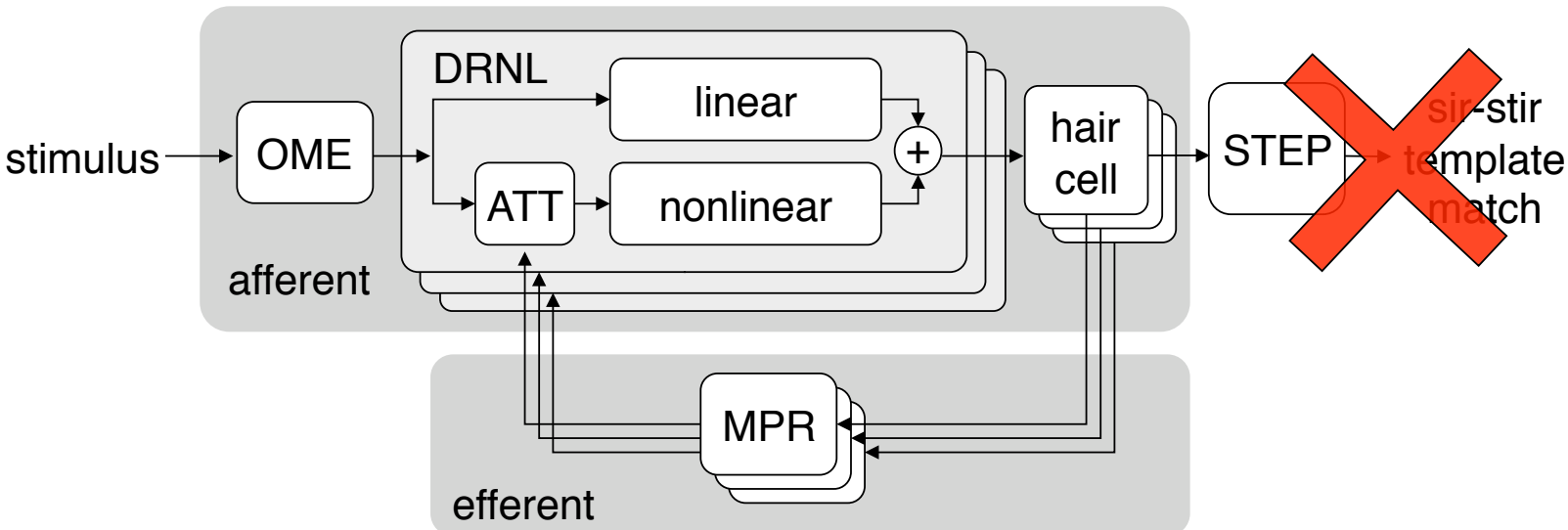
JASA 2007

- speech
- narrowband, broadband
- low, high freq

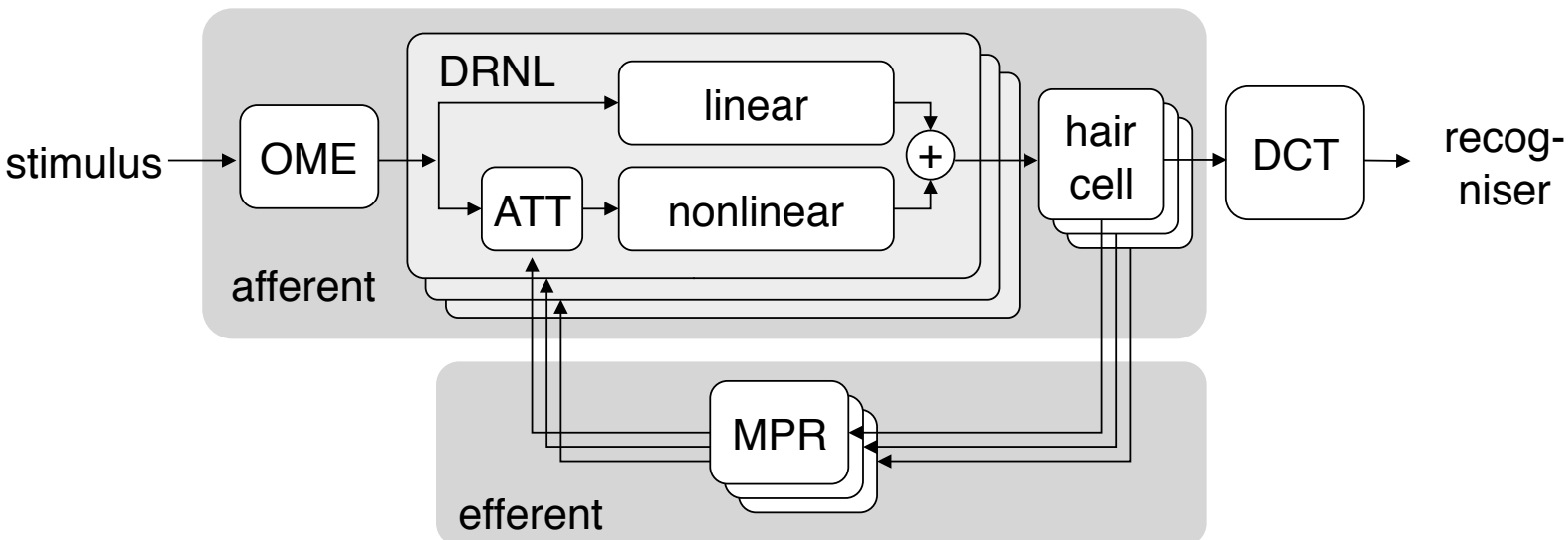
Acustica 2007

- single band
- multi-bands (3,5)
- low, middle, high freq

# Integration with ASR studies



# Integration with ASR studies
# Model used as front end



# Thanks...

# extras

# References

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