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What Determines Speech Understanding?

Donald J. Schum, Ph.D., Vice President of Audiology and Professional Relations, Oticon, Inc.

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What Determines Speech Understanding?

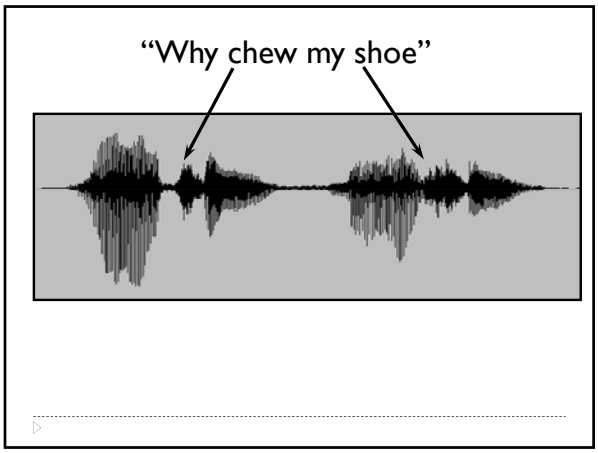
Donald J. Schum, PhD
Vice President, Audiology & Professional Relations
Oticon, Inc.

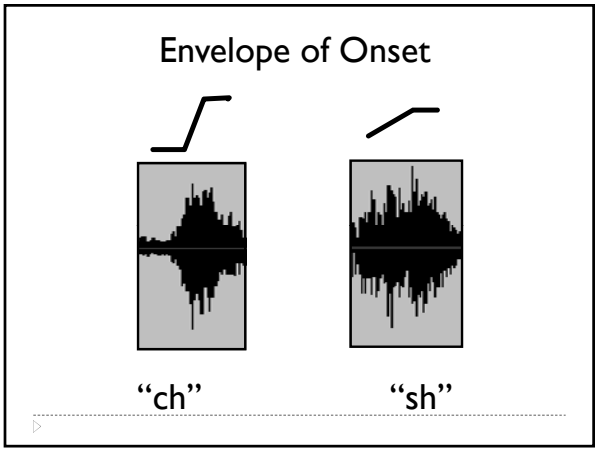
What is Speech?

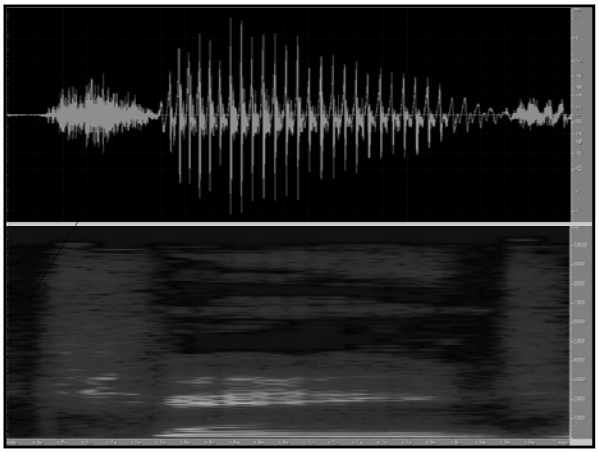
What is Speech?

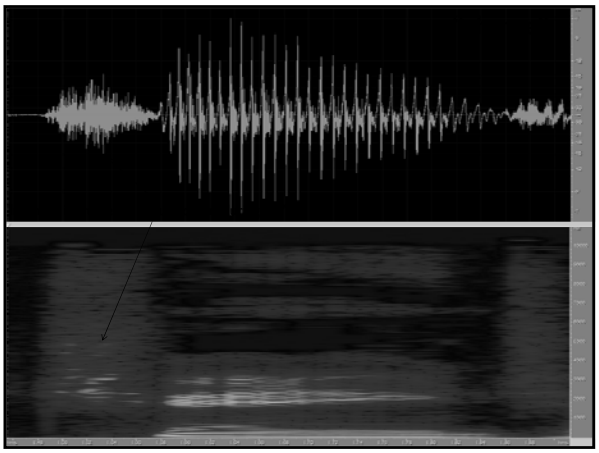
Answer 1: The Acoustic Reflection of Movement

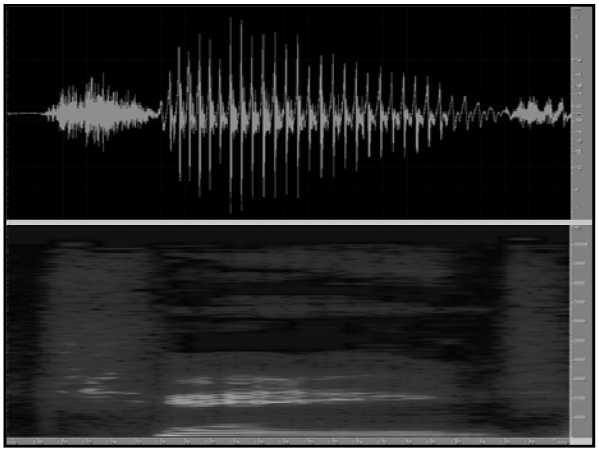
Slip knot

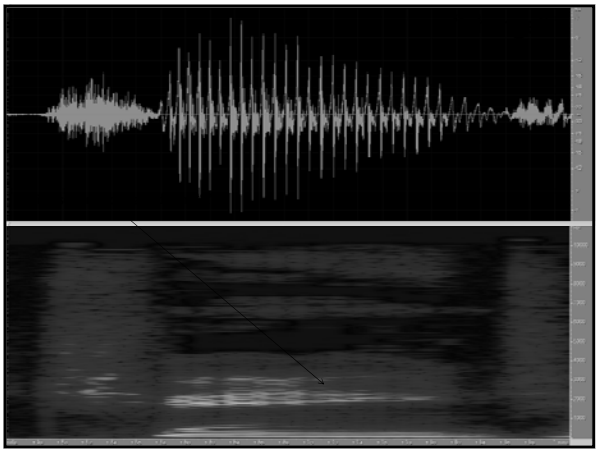

"Why chew my shoe"

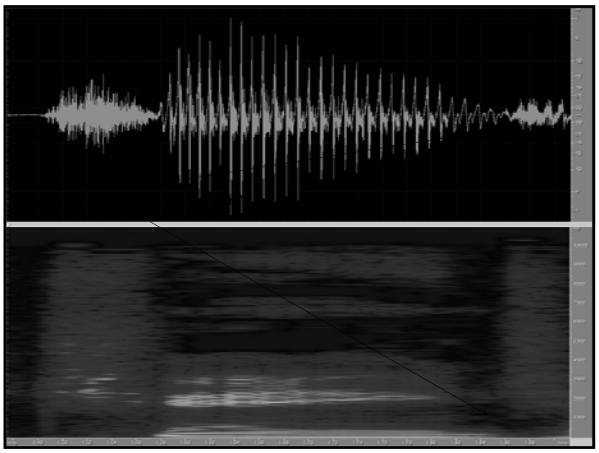

Envelope of Onset
"ch"
"sh"











What is Speech?

Answer 2: A Path to the Intent of the Talker

What is Speech?

Answer 3: A Stream in a Bigger River

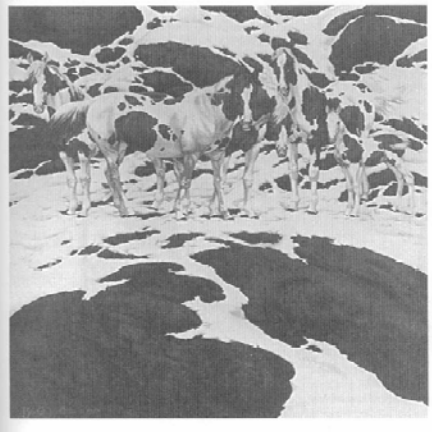


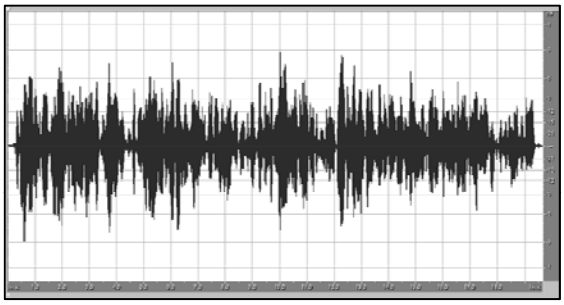
Figure 5.16
Pintos by Bev Doolittle (1979).

she the see watch Fred bring said is us on give me a the my fish kiss wrist

She said give me a kiss

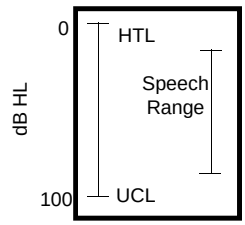
See Fred bring us the fish

The watch is on my wrist

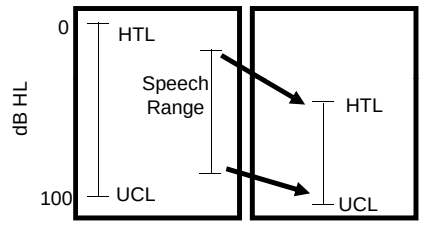


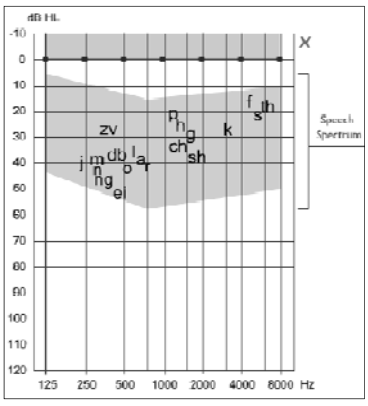
The Acoustics Approach

SNHL: Sensitivity Loss & Reduced Dynamic Range

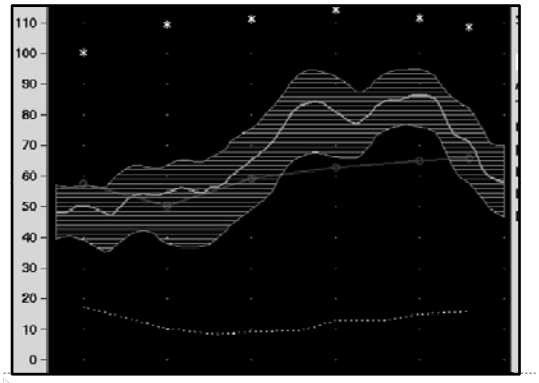


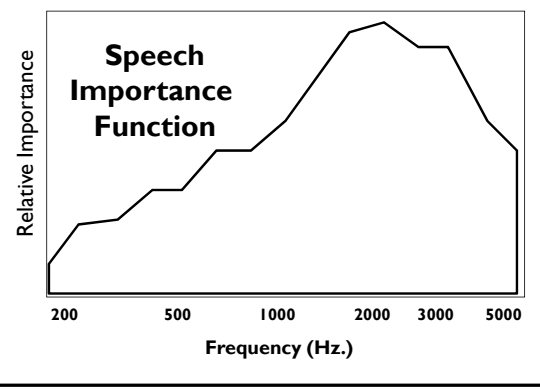
SNHL: Sensitivity Loss & Reduced Dynamic Range

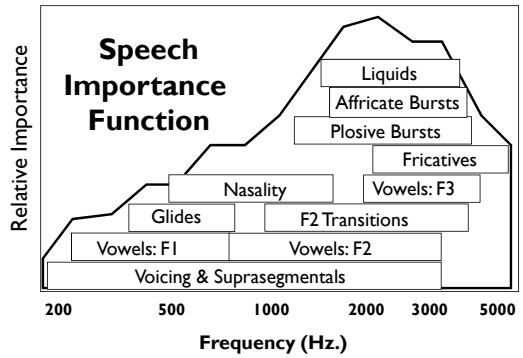


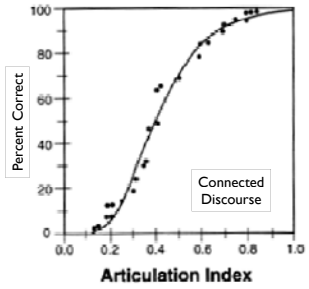


Audibility is necessary, but how much?









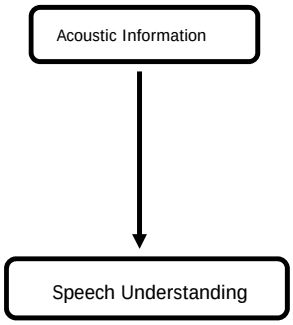
DePaolis, Janota & Frank (1996)

"speech is redundant"

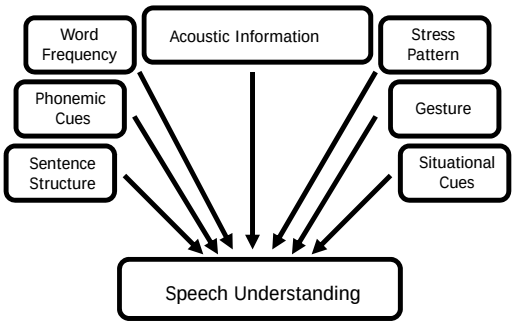
The Cognitive Approach

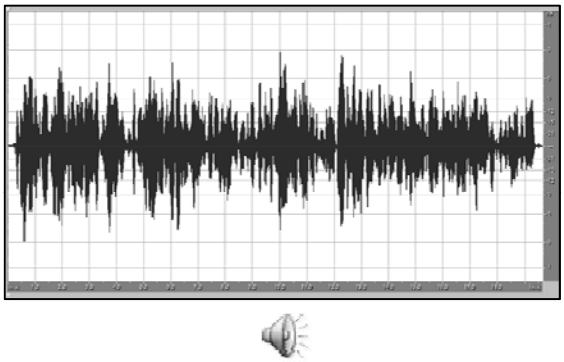
Goal: Automatic Object Formation

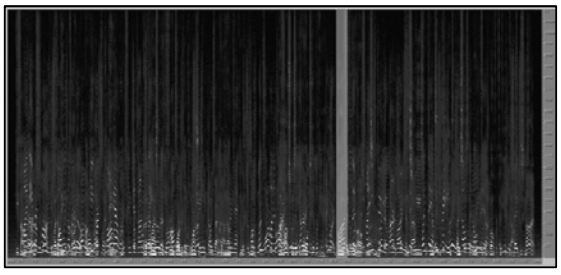
Multiple Cue Speech Processing

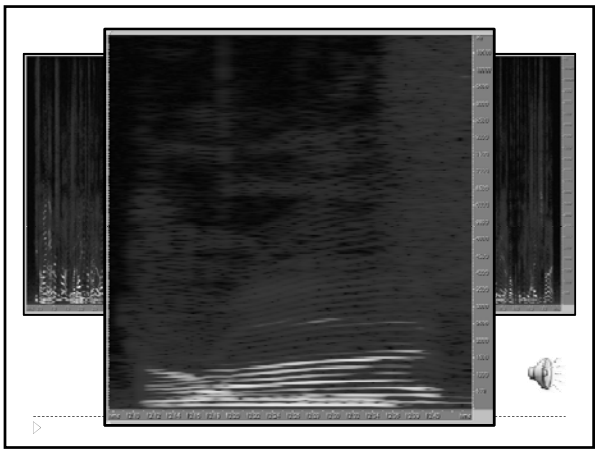


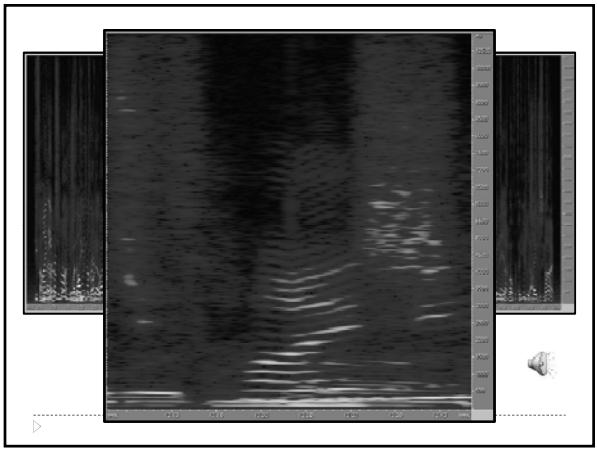
Multiple Cue Speech Processing











Natural Voice Separation & Tracking:

Fundamental Frequency
Harmonic Structure
Supra-segmentals
Visual Cues
Linguistics
Loudness
Location
Timbre
Rate
etc.

XXX

Auditory Scene Analysis
&
Stream Segregation

Auditory Scene Analysis
&
Stream Segregation

Organize, Select & Follow

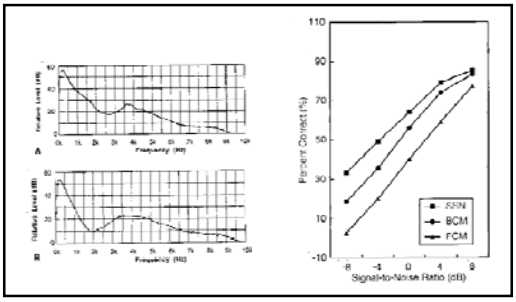
Situational Factors

Complex Environments

- Multiple talkers
- Movement
- Stable, non-speech sources
- Unstable, non-speech sources
- Distractions
- Shifting focus
- A little bit of everything

Speech versus Non-speech Competition

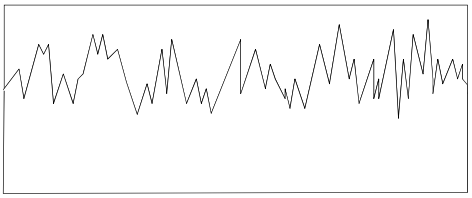
The Effect of Linguistic Competition
(Sperry, Wiley & Chial, 1997)



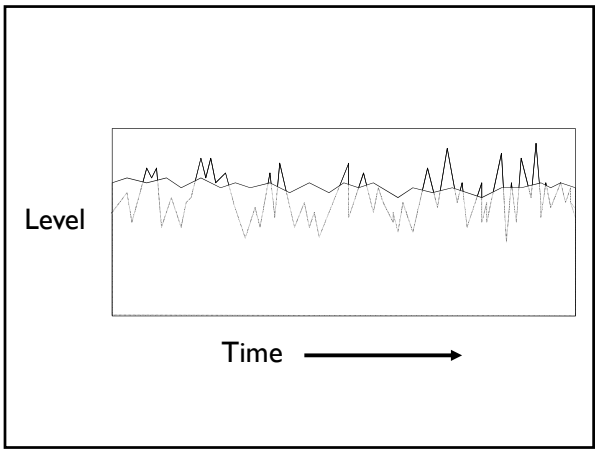
Picket Fence

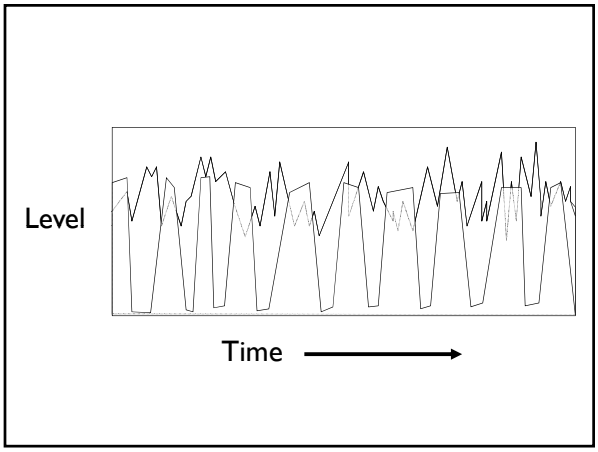
D. Brungart & colleagues
Wright-Patterson AFB

Level



Time →


Level
Time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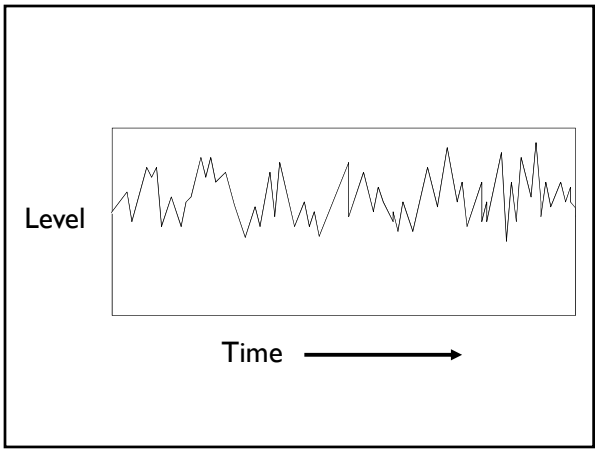
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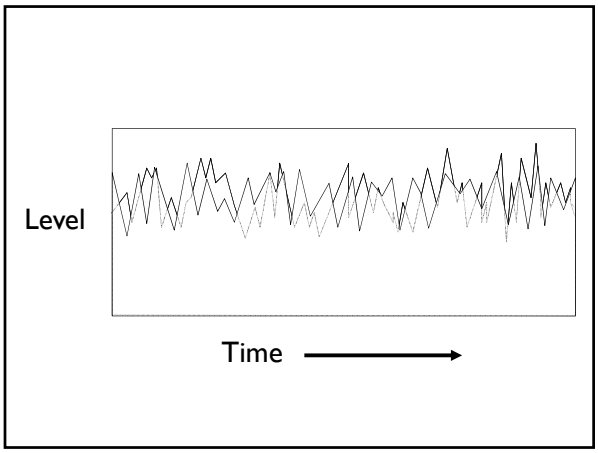
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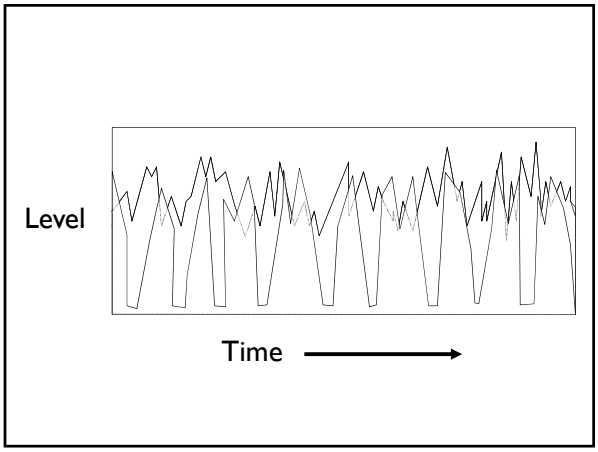
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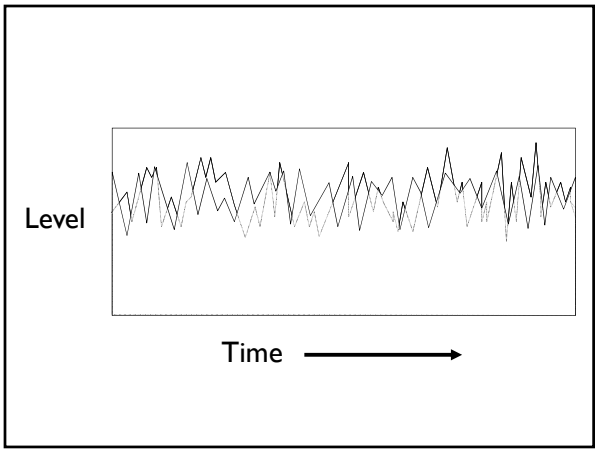
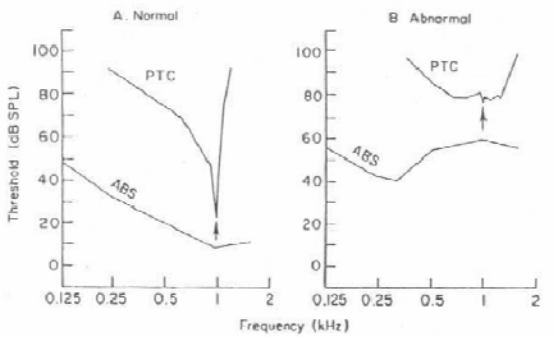
Time


Level
Time

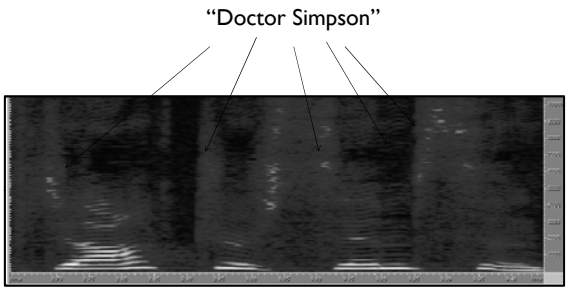
The Distribution of Cognitive Resources

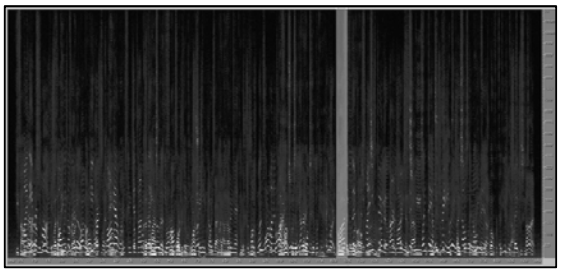
Clinical Confounding Factors

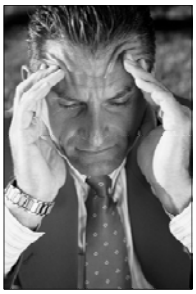
SNHL: Poor Coding of the Acoustic Signal



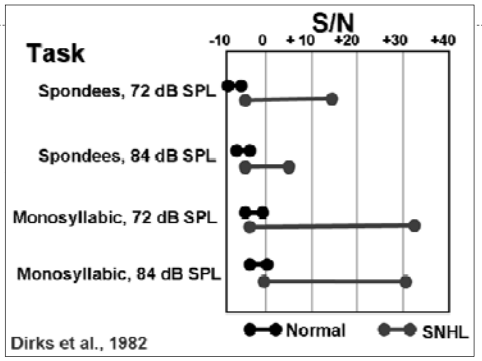
Nelson & Turner, 1980





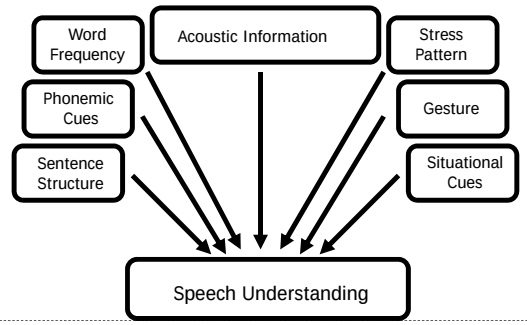


SNHL:
Loss of the ability to
Organize Sound



Normal Aging: Neural Slowing

Multiple Cue Speech Processing

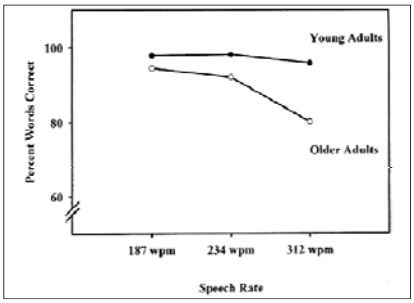


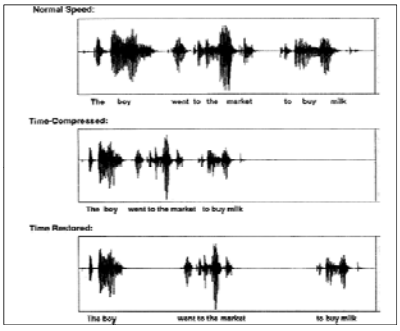
Speed of Information Flow

Spoken Language Comprehension in Older Adults: Interactions between Sensory and Cognitive Change in Normal Aging

Arthur Wingfield, Ph.D.,[1] and Patricia A. Tun, Ph.D.[1]

Seminars in Hearing, 2001

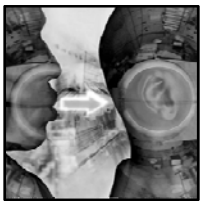




Wingfield & Tun, 2001

Speech Understanding in Noise:

- Audible?
- Above the noise?
- How sensitive to noise? (distortional component)
- Where does the noise come from?
- What constitutes the "noise"?
- Who is the talker?
- Support cues?
- How good is the patient at piecing together a partial signal?



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Tinnitus Week

Monday: Tinnitus Management: A Patient-Centered Approach
Presenter: Anne-Mette Mohr

Tuesday: Tinnitus: Causes, Investigation & Medical Treatment
Presenter: Claudia Coelho, M.D., Ph.D.

Wednesday: Tinnitus: Current Views on its Pathogenesis
Presenter: James Kaltenbach, Ph.D.

Thursday: Managing Tinnitus Management in Your Practice
Presenter: Christina T. Stocking, Au.D.

Friday: Counseling & Sound Therapy using Tinnitus Activities Treatment
Presenter: Richard S. Tyler, Ph.D.

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