

Subjective Aided Preferences of Severe-to-Profound Listeners

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Question:

Will subjects with a severe-to-profound hearing loss prefer hearing aids with a directional microphone and/or noise reduction for real-world use?

- Eight subjects with severe-to-profound hearing loss
 - PTA > 70 dB HL
- Fit with Senso Diva 19 BTE hearing aids
 - Vinyl skeleton closed molds
- Hearing aid features were evaluated over a total of 15 weeks

Fitting and Take-Home Trials



First Visit:

- Hearing aids were fit according to Widex fitting formula
 - Adjustments were made to achieve the best aided thresholds
- Given one listening program
 - Adaptive features activated
 - NR on
 - Adaptive directional microphones on
- Wore hearing aids for one week

Second (to seventh) Visit:

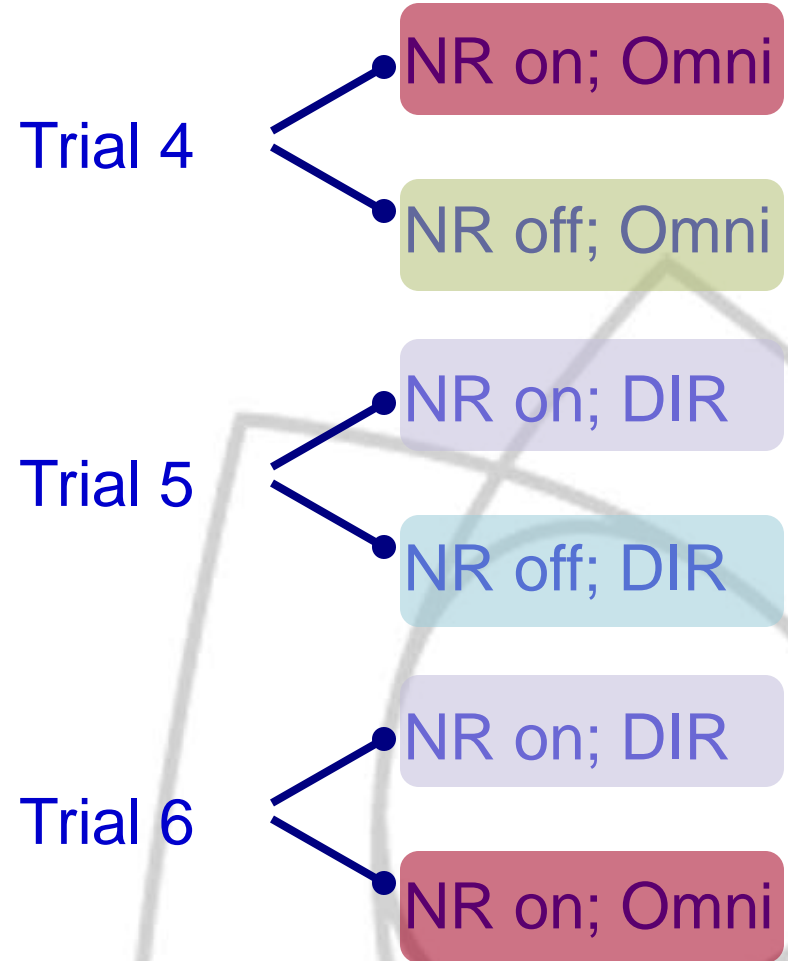
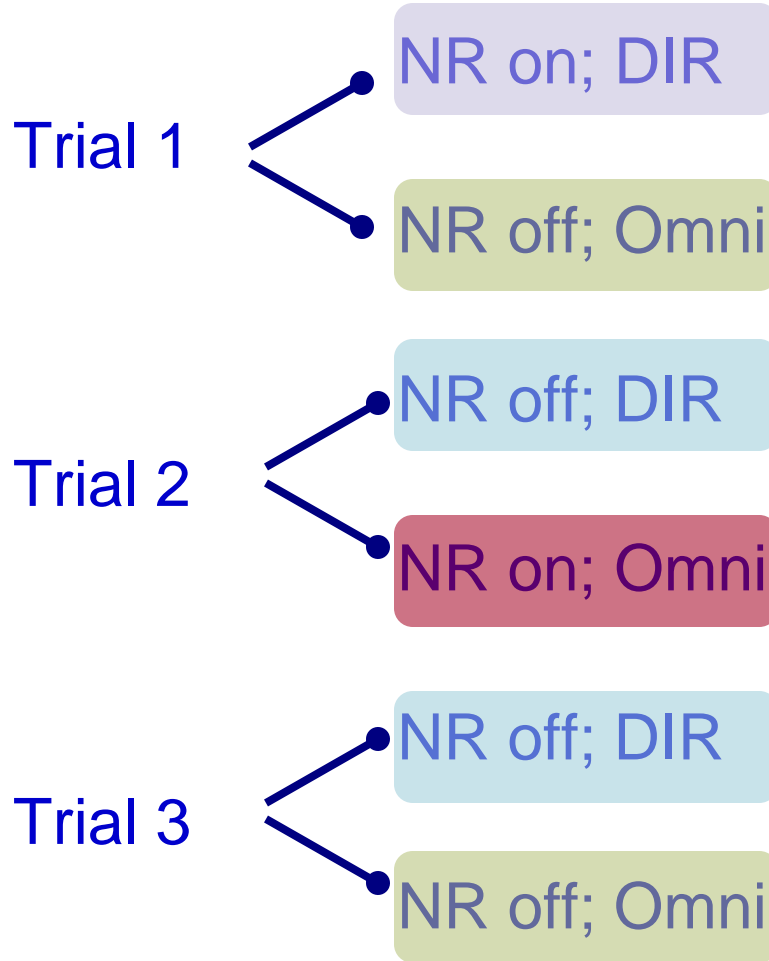
- Given two listening programs
 - Counterbalanced between visits

Advanced Technology: Round-Robin Design

Feature comparisons

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- Fitting 1 week → Adjustments and program change 2 weeks → Return questionnaire, speech testing, and get next two programs
- Noise reduction and directional microphones alternately available
 - NR off, Omnidirectional microphones
 - NR on, Omnidirectional microphones
 - NR off, Adaptive directional microphones
 - NR on, Adaptive directional microphones
 - In a two week period two combinations of features were programmed into the hearing aids
 - Each program was evaluated three times

Sample Program Assignment



- **Double-blind experiment:**
 - Subjects and I did not know which programs were provided
- **Subjects completed questionnaire on experiences at home**
 - **Widex Multi-Program Comparison in Daily Listening Situations questionnaire**
 - Directional microphones are more helpful in some listening situations than in others

Subjective Measure of Features: Questionnaire

Widex Multi-Program Comparison in Daily Listening Situations questionnaire

- **Three parts**
 - Quiet situations
 - Noisy situations
 - Other situations (TV, radio, etc.)
- **Address a large group of variables & interactions:**

Familiarity

Reverberation

Noise

Distance

Speaker location

Speaker gender/age

Telephone

Own voice

Media

Traffic

Music

Nature

Wind

Instruments

Engine noise

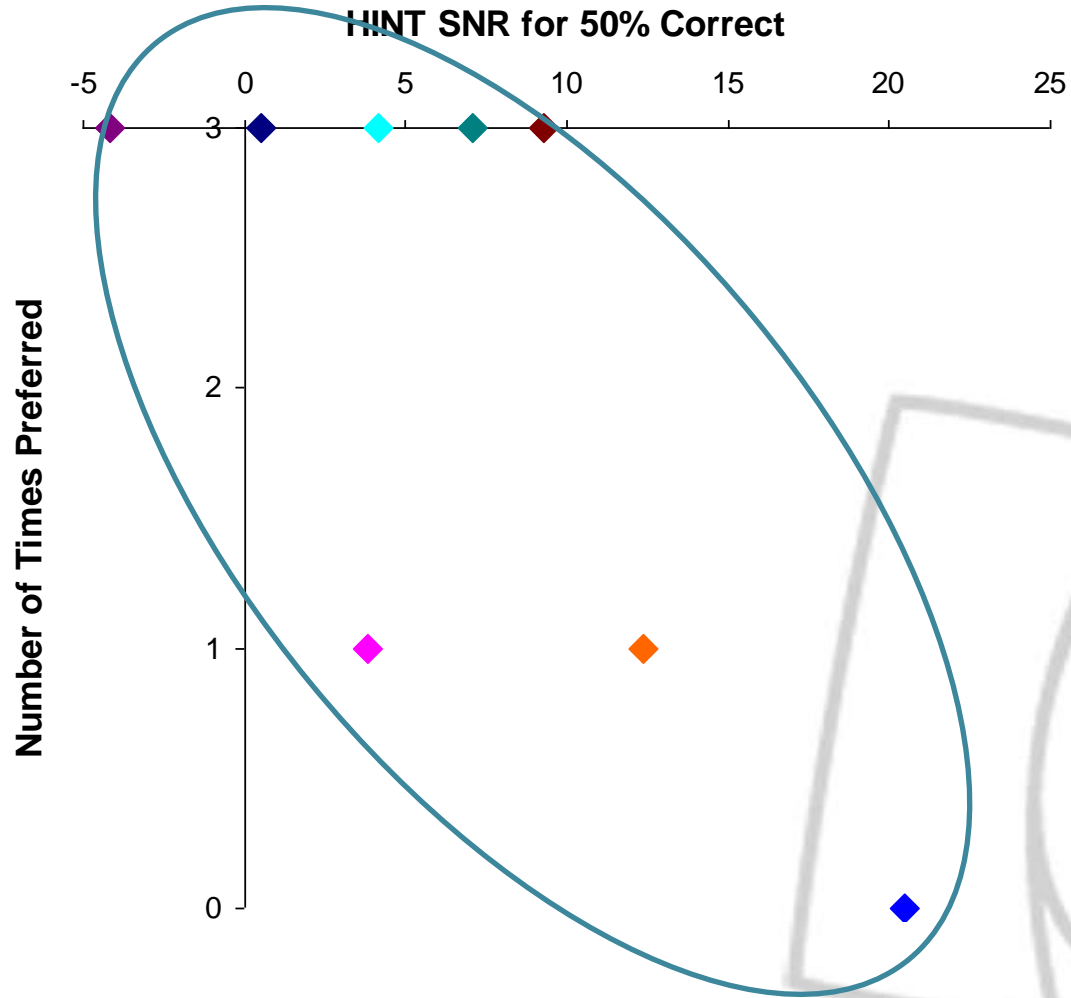


NA Condition Preference vs. Performance

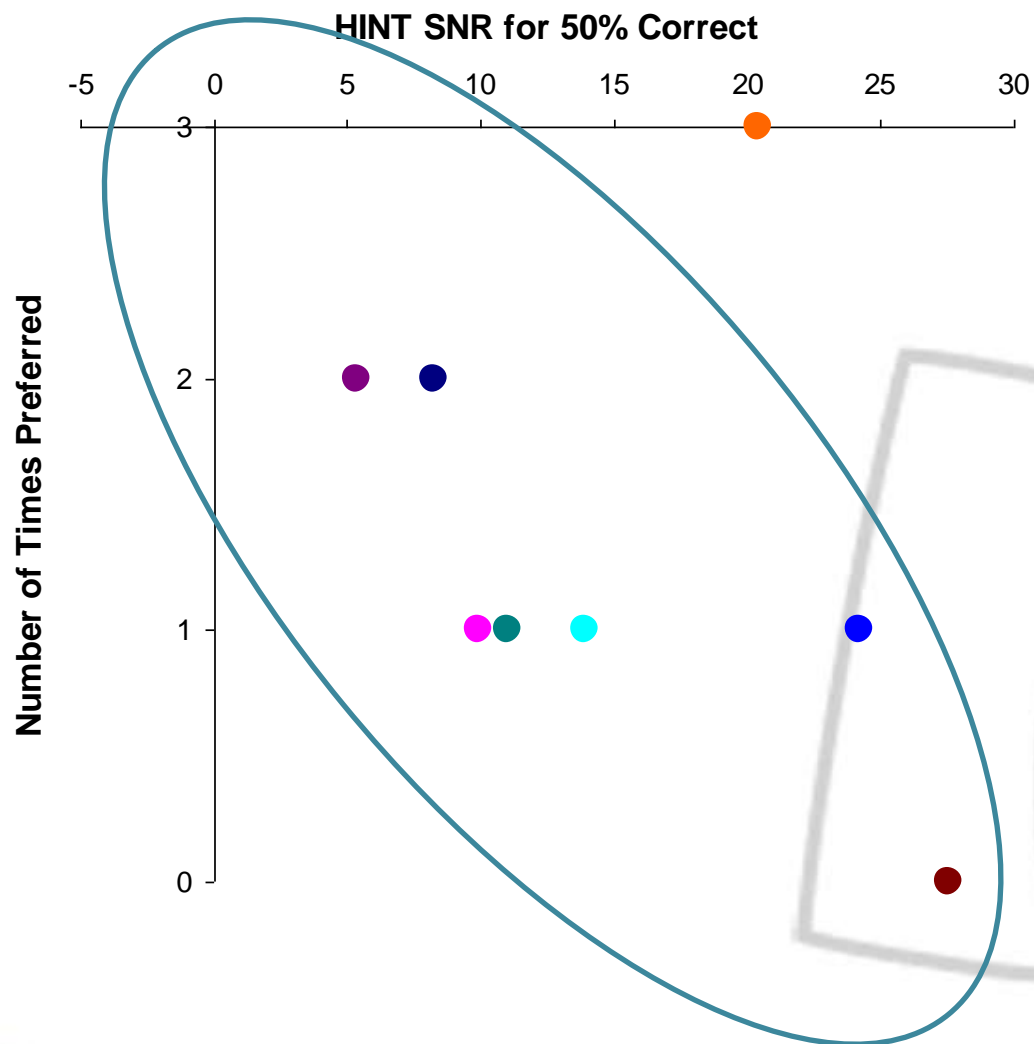
Round robin Take-Home Results:

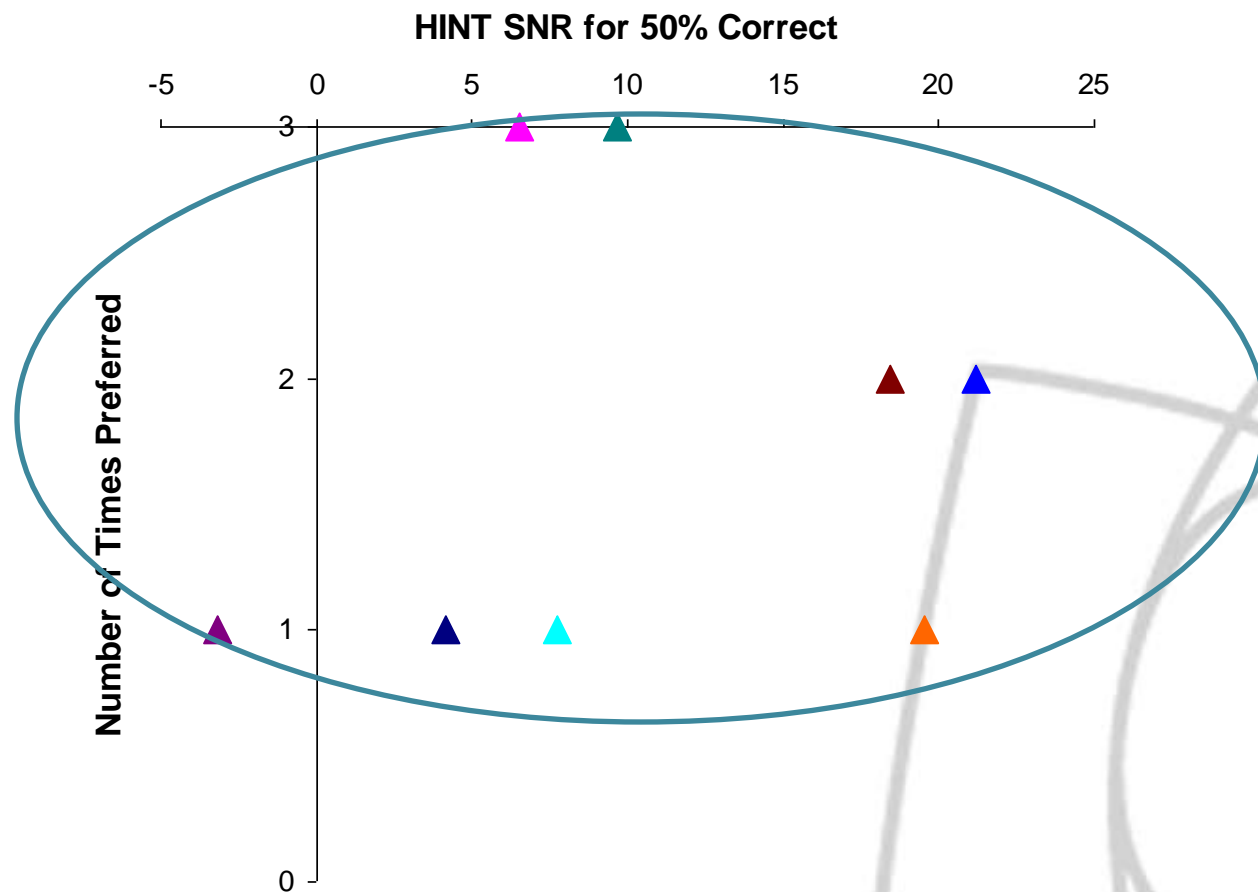
- **Speech Testing Performance:**
 - 24 possible wins per program
 - **Subjects reported which program was preferred in most situations**
- NR on; **Lowest** had the largest number of wins

		<i>Noise Reduction</i>		
		<i>On</i>	<i>Off</i>	
<i>Directional Microphones</i>	<i>On</i>	17 3.46	12 7.23	= 29
	<i>Off</i>	13 12.67	8 14.15	= 21
		+	+	
		<hr style="width: 100%; border: 0.5px solid black;"/>		
		30	20	

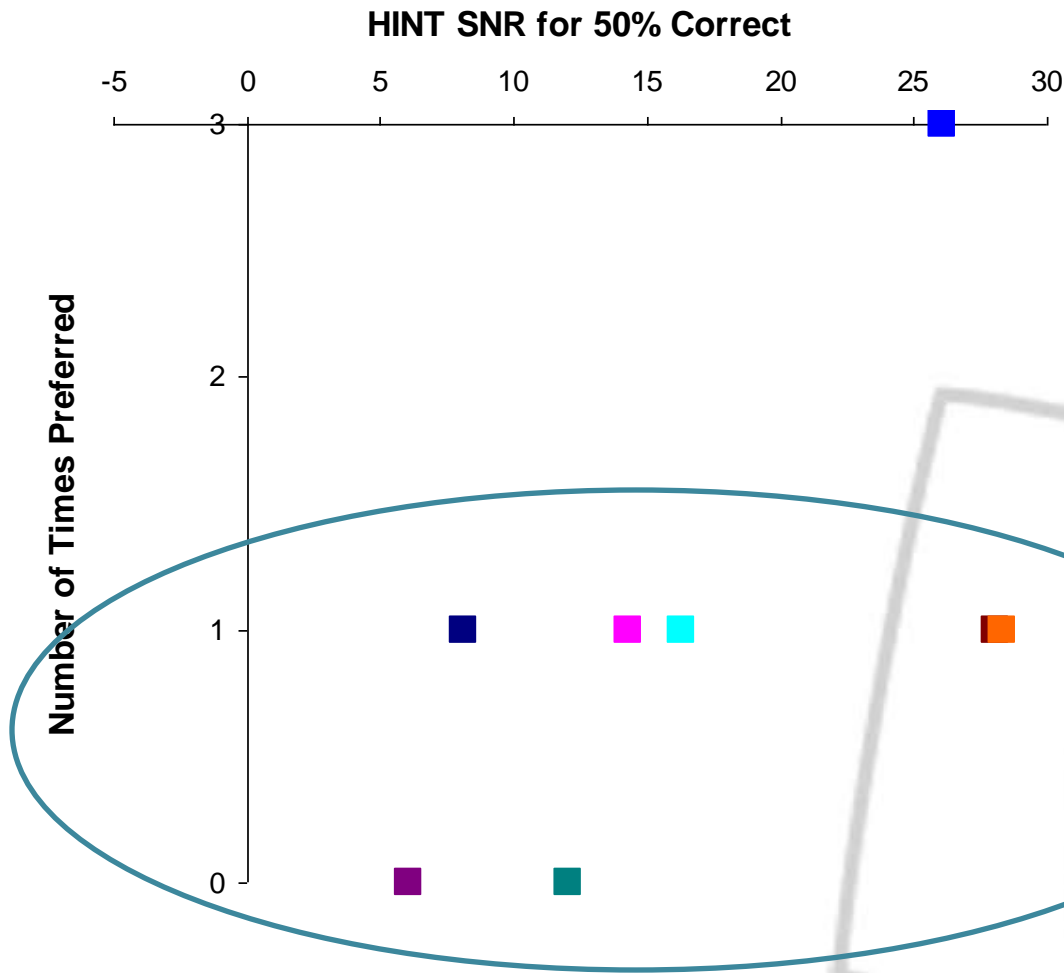


NR on; Omni





NR off; Omni



HA Feature Results:

Correlation of Subjectively Chosen Program and Program With the Best Performance

		Preference			
		NR ON DIR	NR OFF DIR	NR OFF Omni	NR ON Omni
Best HINT Performance	NR ON DIR	1, 2, 5, 6, 8	3, 7	4	

- Best performance for all subjects occurred with NR On; DIR
 - Preferred hearing aid features correlated with the best performance for 5 of the 8 subjects

Questionnaire Analysis

- Compare rating provided for each program in a given trial

Listening Situations	Program 1	Program 2	Difference
Hearing Aid Program	NR on; DIR	NR on; O	
Watching TV at normal volume (as judged by others)	4	5	-1

- Positive difference is a win for program 1
- Negative difference is a win for program 2
- Zero result is a tie

Adaptive Feature Preference in Different Listening Environments

Results of the questionnaire:

In quiet:

- NR on; DIR = 89.04%
- NR off; DIR = 89.78%
- NR on; Omni = 90.14%
- NR off; Omni = 93.95%
 - Significantly different from other HA conditions ($p < .05$)

In noise:

- NR on; DIR = 91.63%
 - Significantly different from other HA conditions ($p < .05$)
- NR off; DIR = 85.19%
- NR on; Omni = 85.1%
- NR off; Omni = 78.34%

Listening Situation Variables

Speaker location

- Programs were not significantly different

Front: NR On; DIR won with 92% (146/159)

Back: NR Off; Omni won with 90% (152/168)

- NR on; DIR 80.75% (130/161)

Side: NR Off; Omni won with 89% (151/169)

- NR on; DIR 82.8% (130/157)

Speaker in noise

- Programs were significantly different

3-4, 10, or more than 50 people speaking:

NR On; DIR won with 94-95%



- Overall, severe-to-profound hearing loss subjects in this study preferred noise reduction and directional microphones to be active during speech in noise tasks
- Different listening programs were preferred for different listening situations

Hearing aids fit on severe-to-profound listeners should provide adaptive changes.

- Adaptive features are available in the Senso Diva.