Comparison of two newly introduced bone anchored hearing instruments in first-time users (Updated September 2010)

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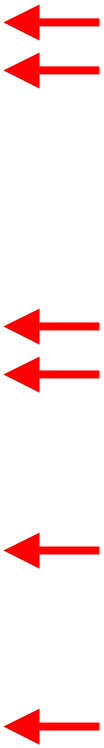
RH experience1989-March 2010

- 103 patients had surgery
  - 16 bilaterally
  - 53 females, 50 males
  - Median age at surgery: 9 years (range:2-16)
    (Children, N=14)
  - Median age at surgery: 55 years (range:17-84)
    (Adults, N=90)

Background

- BP100 (Introduced 2009):
  - by Cochlear, the successor of the original Baha™ manufacturer
- Ponto Pro (Introduced 2009):
  - by Oticon Medical, subsidiary of hearing instrument manufacturer

	Cochlear Baha® BP100	**Oticon Medical Ponto Pro**
Fitting range	Average BC threshold ≤ 45 dB HL across 0.5, 1, 2 and 3 kHz	Average BC threshold < 45 dB HL across 0.5, 1, 2 and 3 kHz
Indications	Conductive and mixed losses, single-sided deafness	Conductive and mixed losses, single-sided deafness
Hearing device	Programmable, head worn	Programmable, head worn
Sound processing	12 frequency channels	15 sound processing channels,
	10 channel frequency response shaping.	10 channel frequency response shaping.
	Output AGC	Output AGC
Fitting rationales	Proprietary Cochlear Baha® prescription rule for bone conduction. Wide-band Dynamic Range Compression	Linear amplification for conductive losses, little compression for mixed losses (CR identical to NAL-NL1 prescription)
Automatic adaptive multi-band directional system	Adaptive polar plot: Unlimited number of frequency bands.	Adaptive polar plot: 4 frequency bands.
	Automatic directionality changes between omni-directional and directional mode.	Automatic directionality changes between surround (omni-directional), split directionality and full directionality.
User presets	Up to 3 user-defined programs	Up to 4 user defined programs
	Dedicated listening programs for music and noisy environments	
Automatic noise reduction	Based on modulation detection.	Based on modulation and speech detection.
Feedback cancellation	Active Feedback Cancellation	No
Direct bone conduction measurements	Yes, with the hearing device placed on implant.	No
Compensation for loudness of sounds from the rear	Position compensation system	Enhanced surround-mode (Front focus)
Data Logging	Total use time	Total use time
	Programme use	Programme use
	Volume control use	Volume control use
		Listening environments
		Automatic feature logging
Learning volume control	No	Yes
Wind Noise Reduction	Gore-Tex membrane and sound processor design protects from wind-noise.	When wind noise is detected the sound is attenuated and surround mode will automatically be selected
Start-up delay	Yes	Yes
Mute/stand-by function	Yes	Yes
Low battery warning	Visual indication	Beep indication
	Beep indication	
Direct Audio Input	Europlug connector	Cochlear Baha plug
Left and right styles	Same style for left and right	Separate left and right styles
Colours	Champagne Blonde, Soft Black, Slate Grey, Chestnut Brown, Glacier White, Piano Black	Chroma Beige, Mocca Brown, Diamond Black
	Personalized battery lid colours	
	Pediatric colours	
User controls	One digital push button for volume up, another for volume down and a third push button for programme selection and for on/off.	Digital wheel for volume up/down and a push button for programme shift and for mute.
	Key lock function (pediatrics)	
Tamper proof	Yes	No
Moisture resistant	Yes	No
	(Never wear in heavy rain, in the shower or when bathing)	(Always disconnect the sound processor before taking a shower, bathing or swimming)
Visual indicators	Yes	No
Battery type	13	13
Weight (without battery)	14g	13,2 g
Size (exclusive coupling)	Square shaped, 30 x 21 x 12mm	Earshaped, Max: 33,6 x 21,4 x 11,5mm



Aim of study

To investigate if there are differences in the user experienced benefit with the two new devices

Test subjects

- 12 subjects were fitted with both devices
- First time users of bone anchored system
- 7 male, 5 female subjects
- Median age: 52 years
  - (range: 18-69 years)
- 11 unilateral, 1 bilateral fitting
- Median surgery-to-load period : 69 days
  - (range: 59-91 days)

Hearing loss (N = 12 subjects)

Better ear	Poorer ear
Normal hearing (4)	Severe conductive loss (2) Severe mixed loss (1) Anacusis (1)*
Mild, conductive hearing loss (1)	Severe mixed loss (1)
Mild, perceptive hearing loss (2)	Severe mixed loss (1) Severe perceptive loss (1)
Moderate, conductive hearing loss (1)	Mod, conductive hearing loss (1)
Moderate, mixed hearing loss (4)	Moderate, mixed (1) Severe, mixed loss (3)
Total (12)	Total (12)

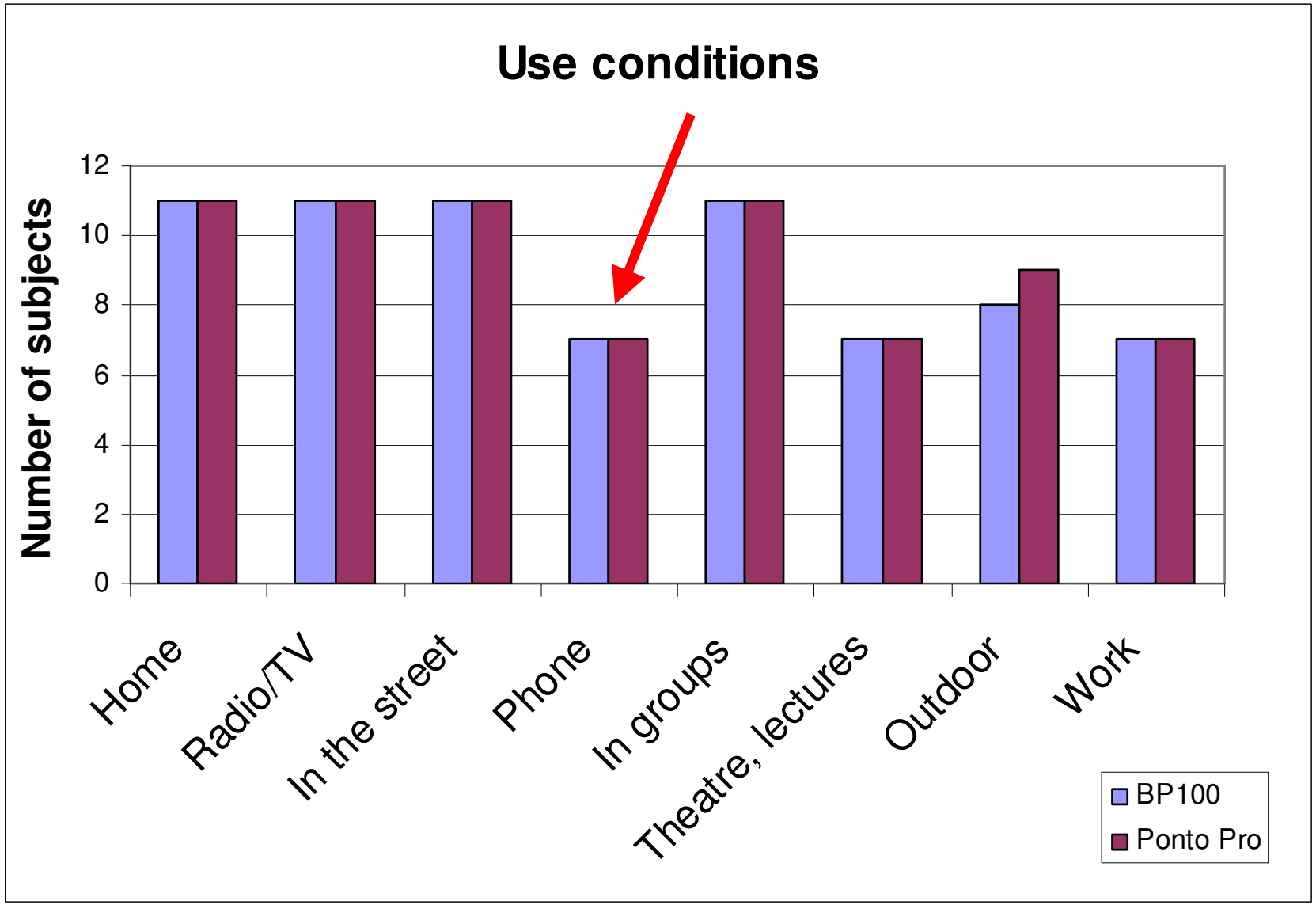
Holgers' Score *
(12 Subjects, 13 implants)

Score	# implants	Description
0	10	No irritation/slightly red < 1mm from implant
1	3	Red < 1 mm from implant
2	0	Red and moist
3	0	Red and moist with granulation tissue
4	0	Extensive soft-tissue reaction resulting in the implant removal

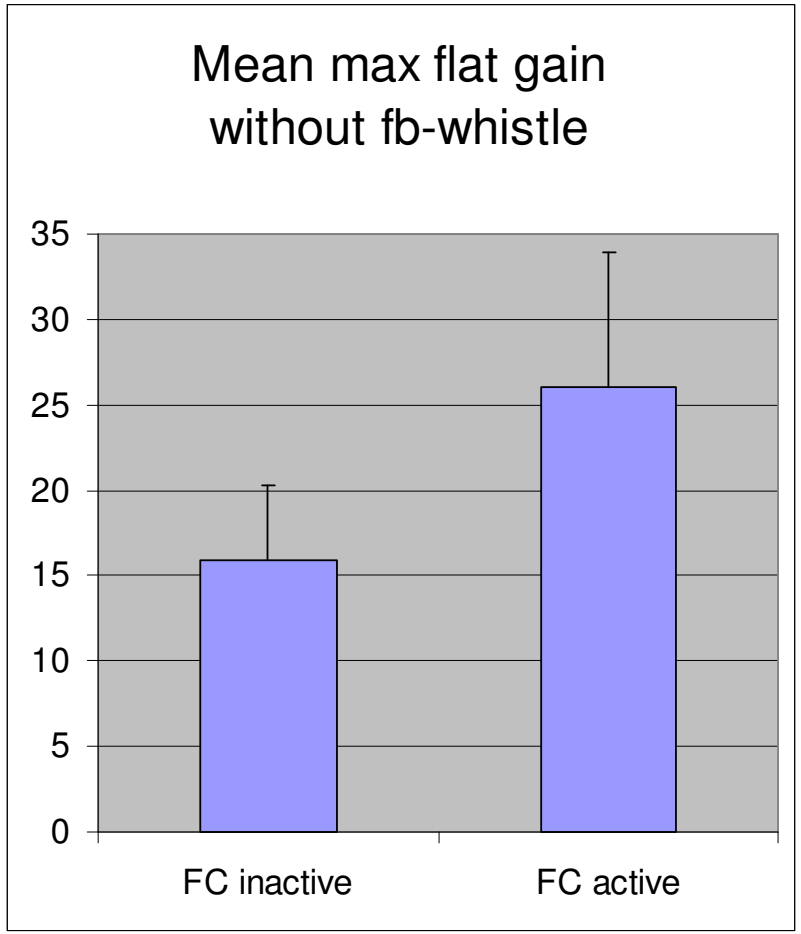
*) Holgers, 2000

Test

- Cross over study design
- 6 started with BP100, 6 started with Ponto Pro
- Median observation period for each device: 34 days (range: 25-50 days)
- 9 used both devices for more than 8 hours/day
- 2 used both devices for 4-8 hours/day
- 1 will finish the study later this month

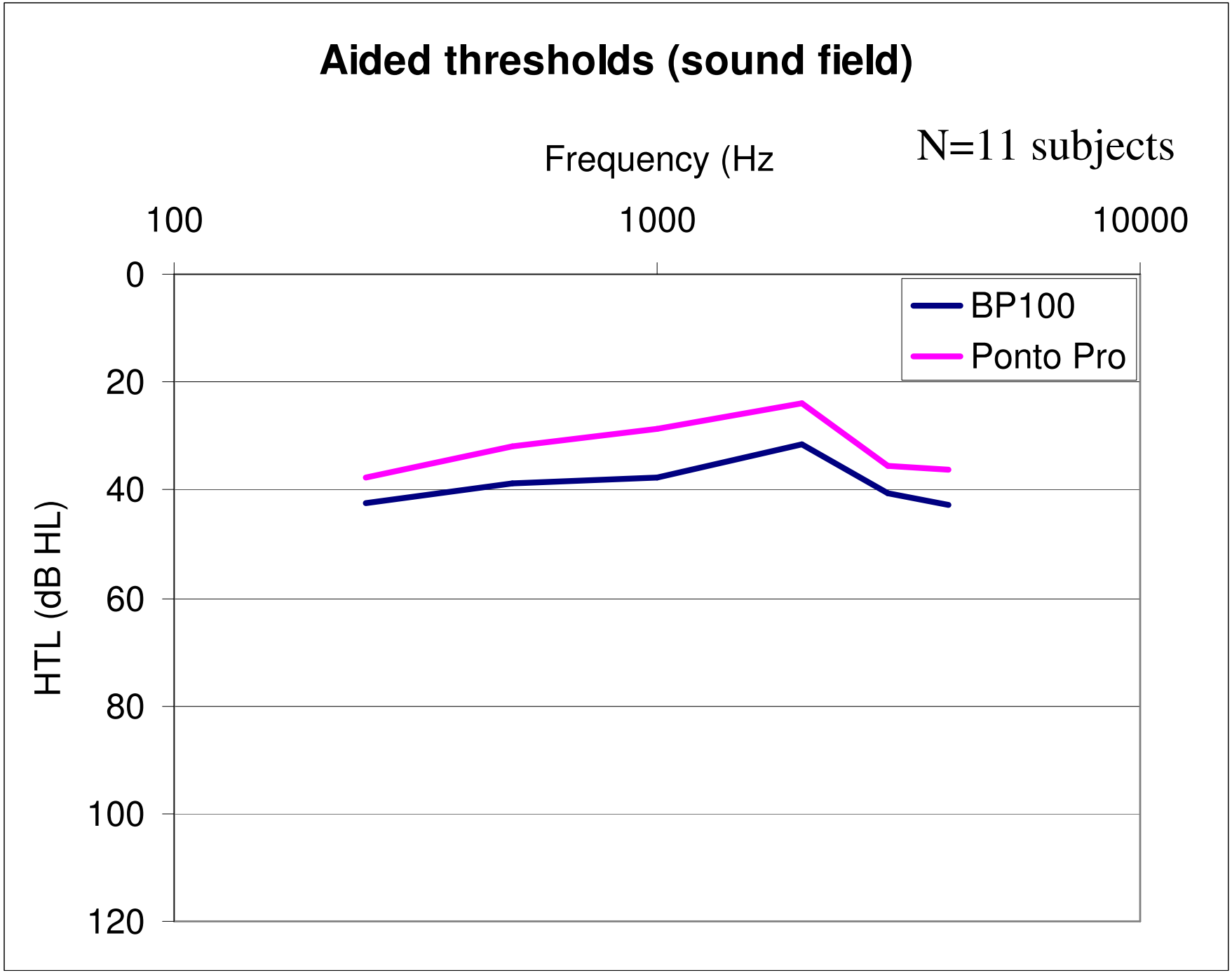

Use conditions
Number of subjects
12
10
8
6
4
2
0
Home
Radio/TV
In the street
Phone
In groups
Theatre, lectures
Outdoor
Work
BP100
Ponto Pro

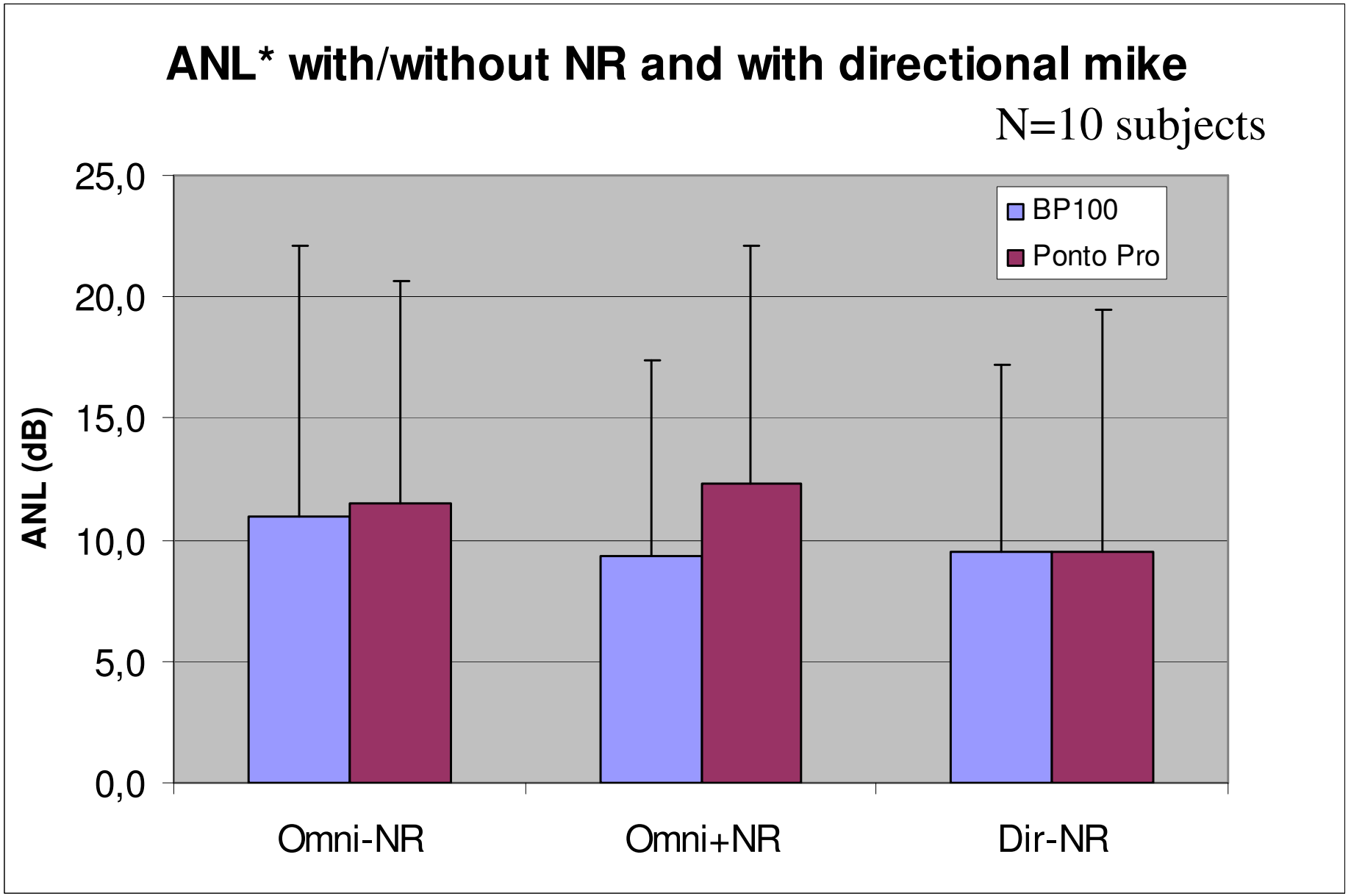
Feedback test (BP100, N=11)



The difference is statistically significant
(P = 0.002)

Four subjects reported artifacts (during daily life use) created by the feedback canceling system

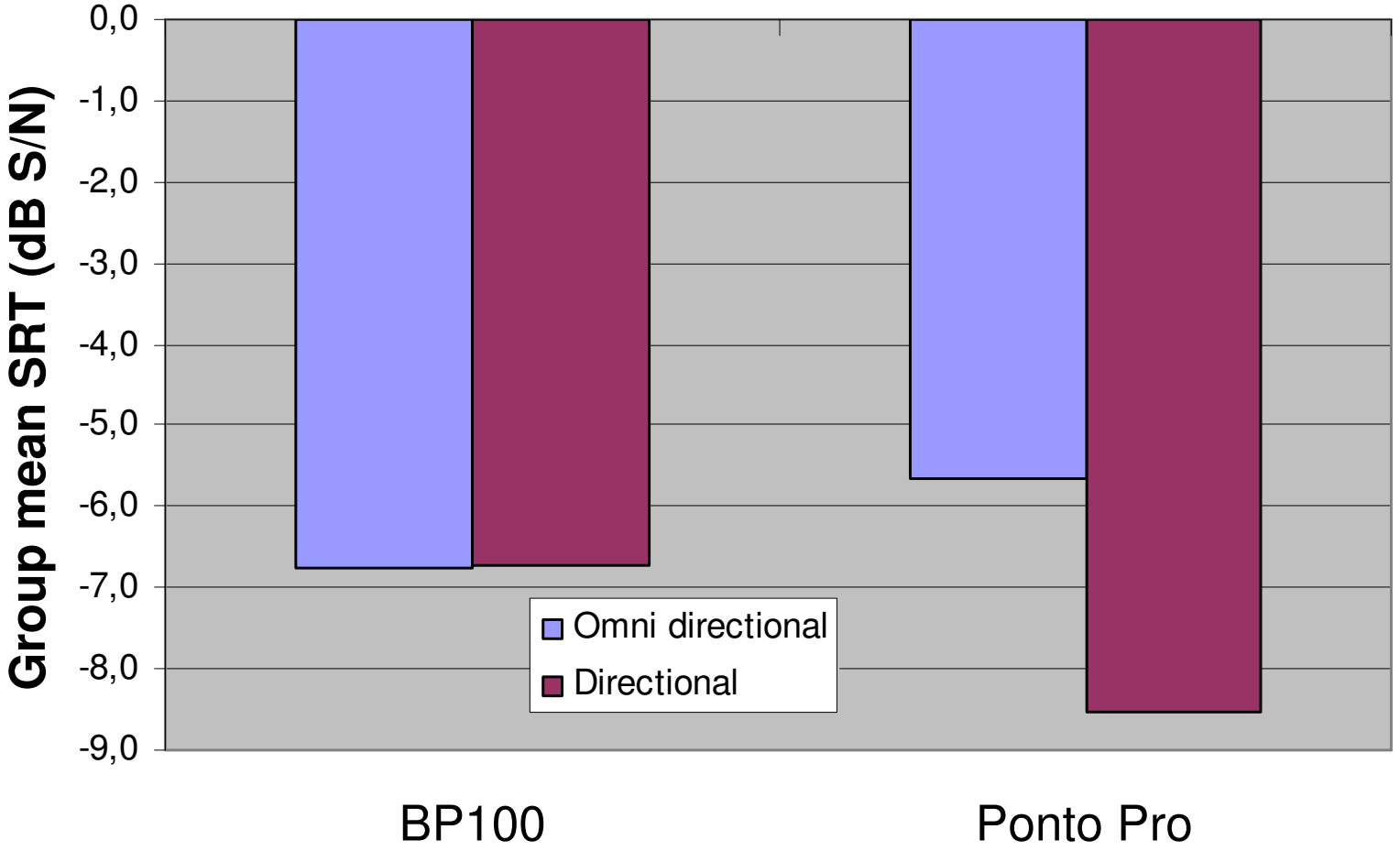

Aided thresholds (sound field)
N=11 subjects
Frequency (Hz
100
1000
10000
0
20
40
60
80
100
120
HTL (dB HL)
BP100
Ponto Pro



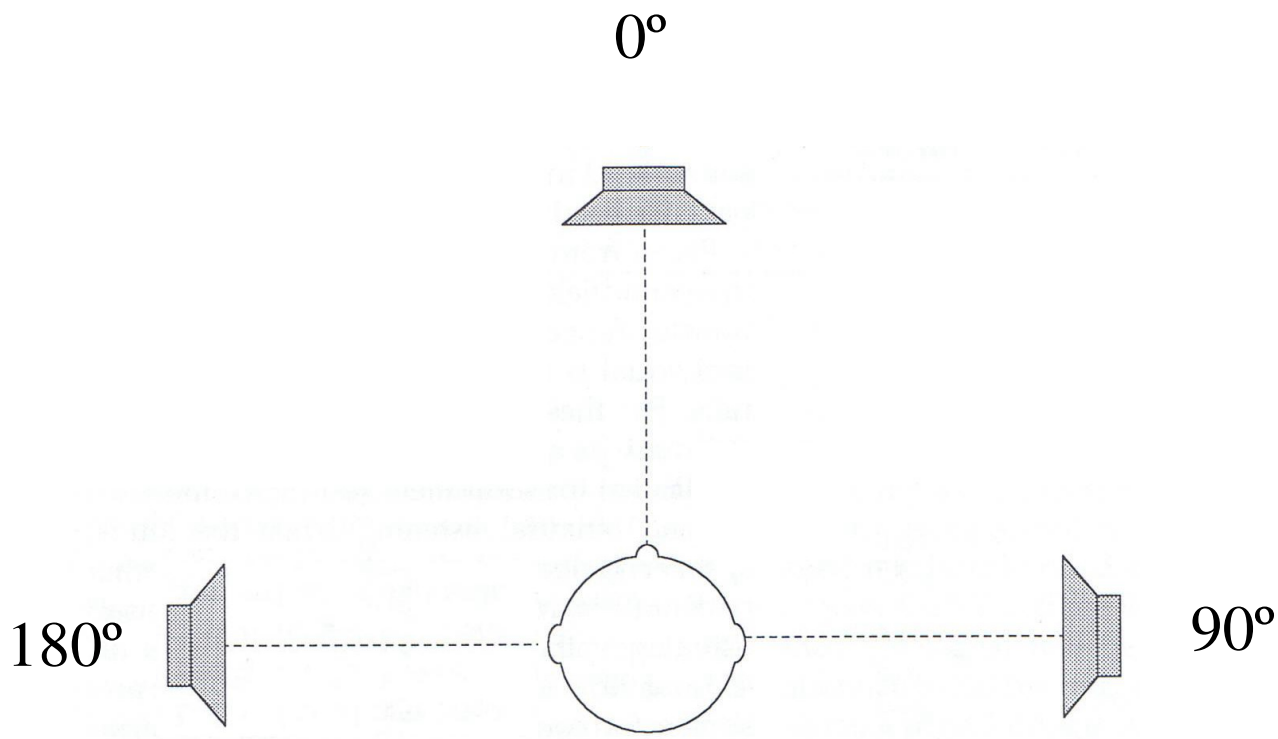
Differences not statistically significant

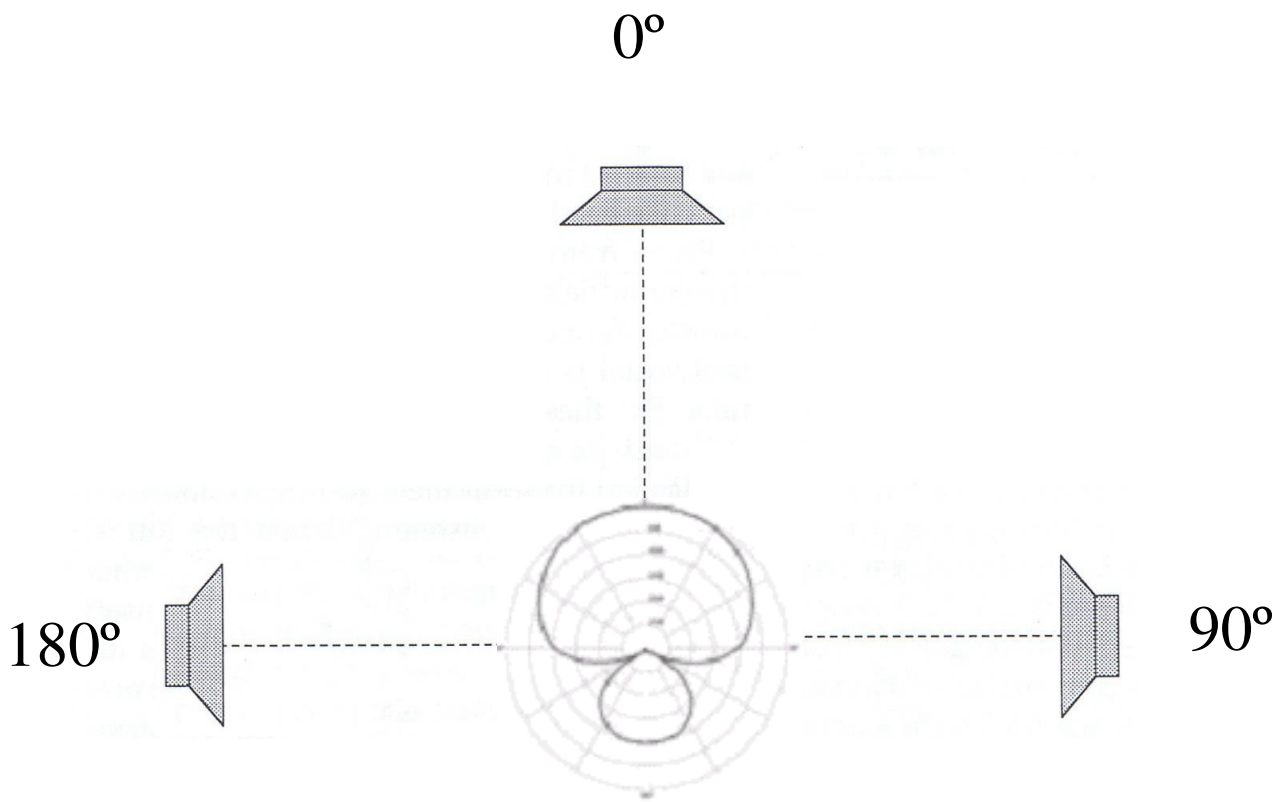
*) Nabelek et al., 1991

Dantale II* outcome N=10 subjects

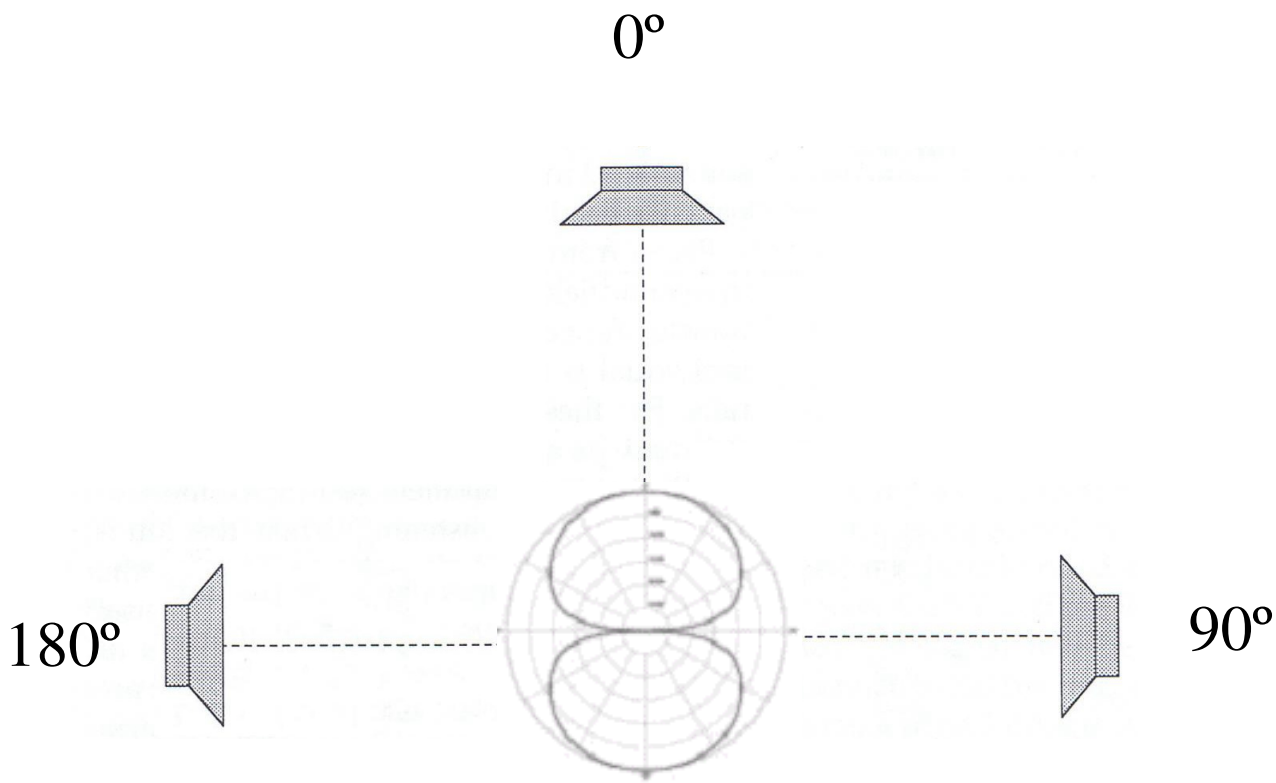


*) Wagener et al., 2003

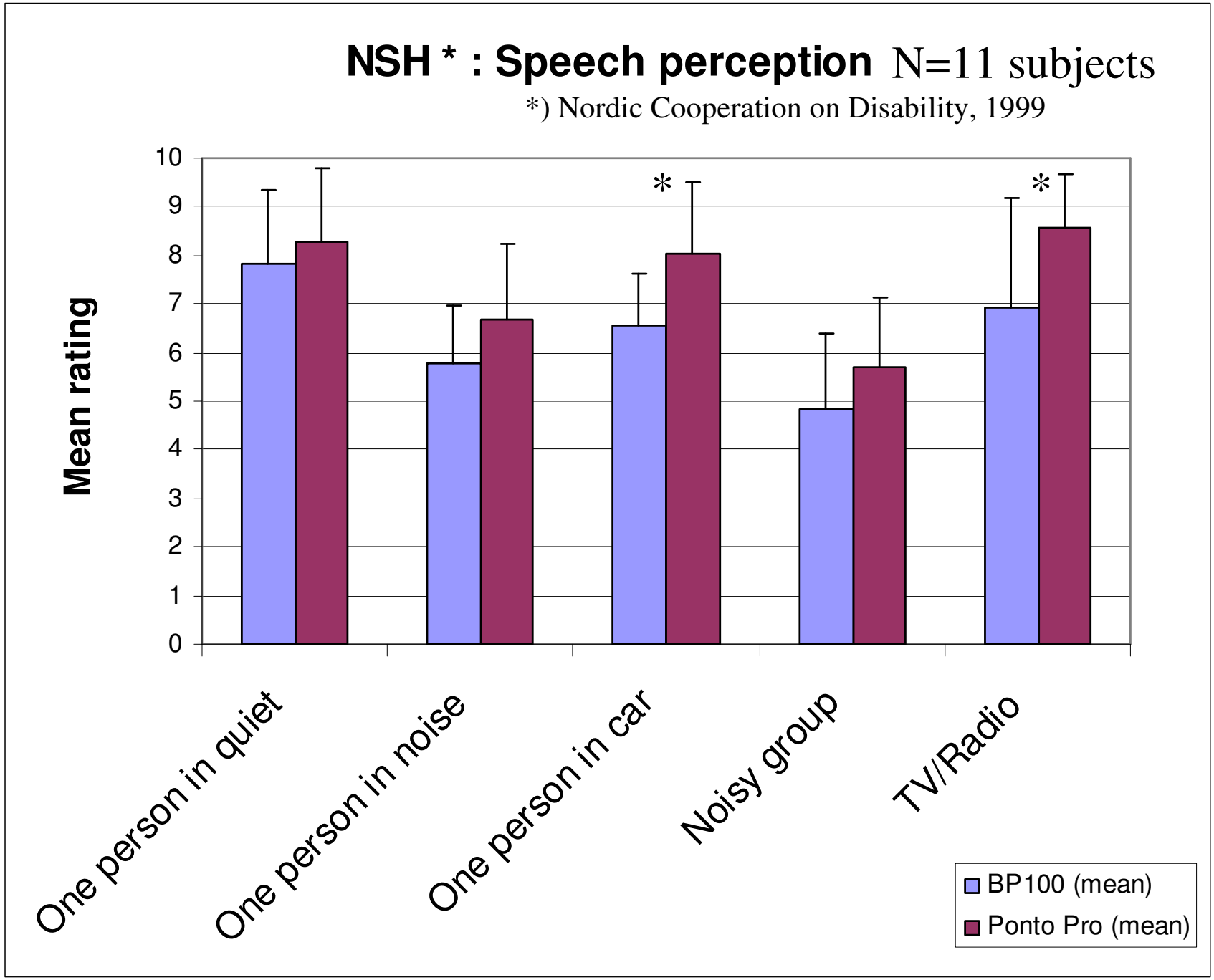

0º
180º
90º

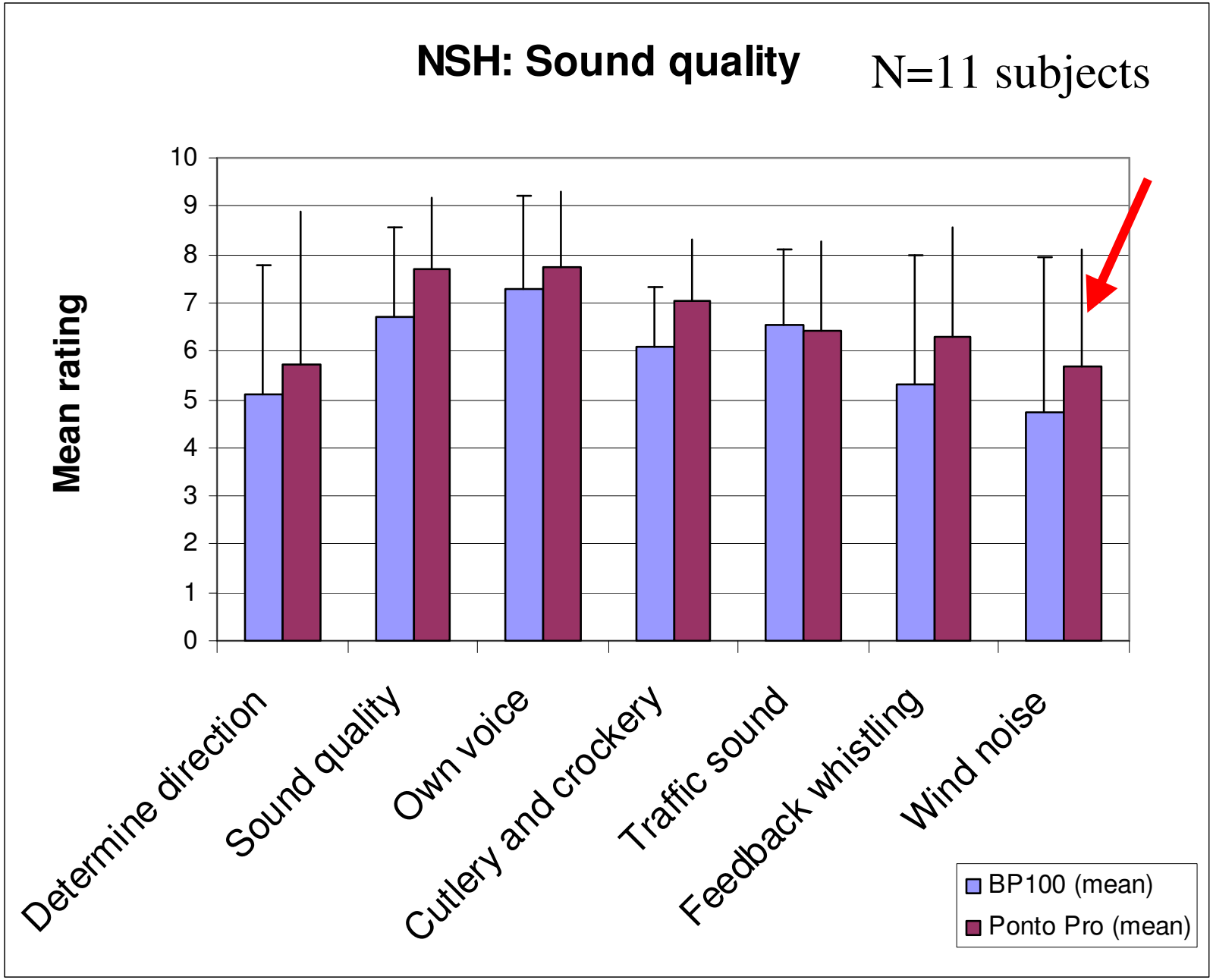


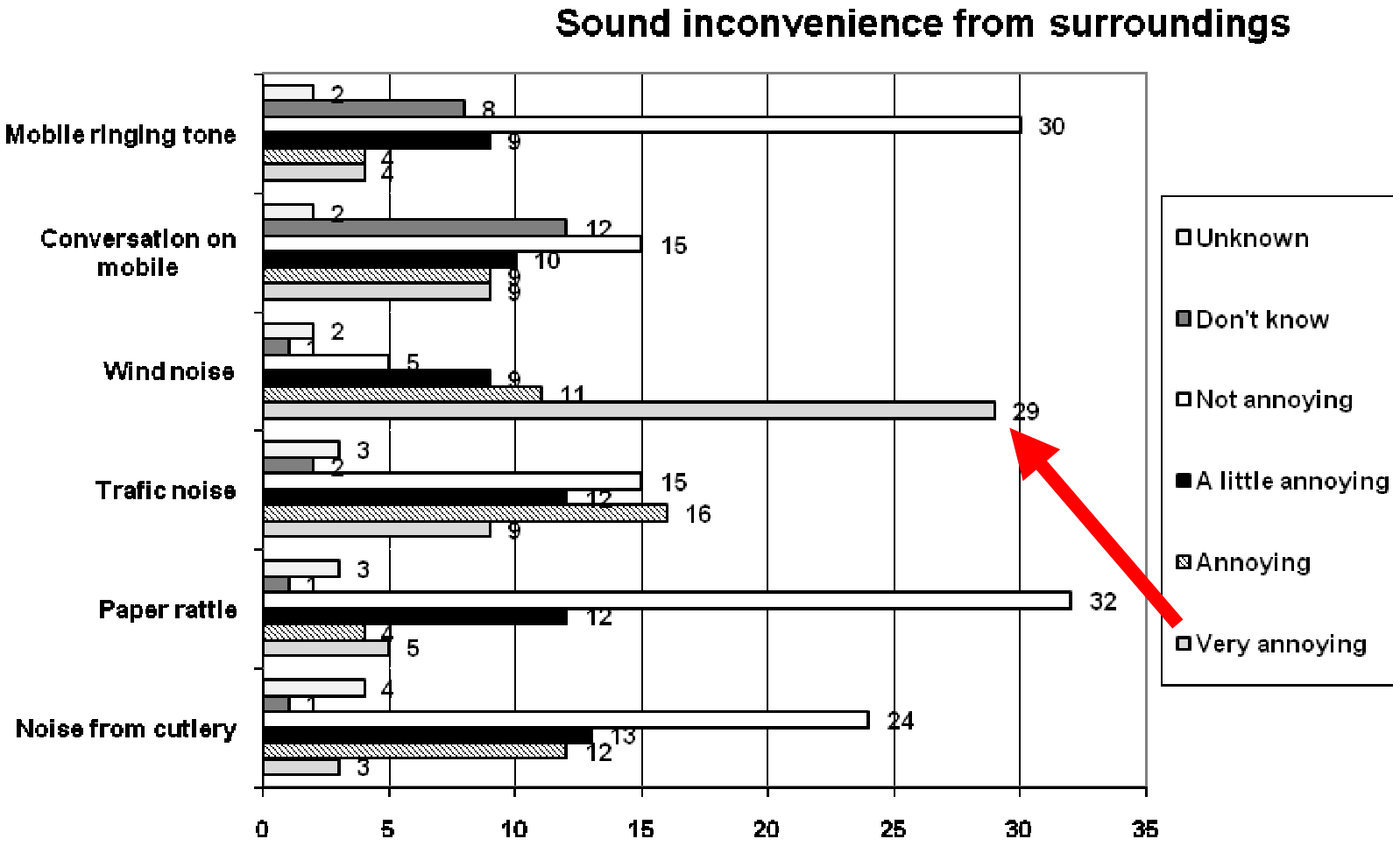
Super cardioid



Bi directionel

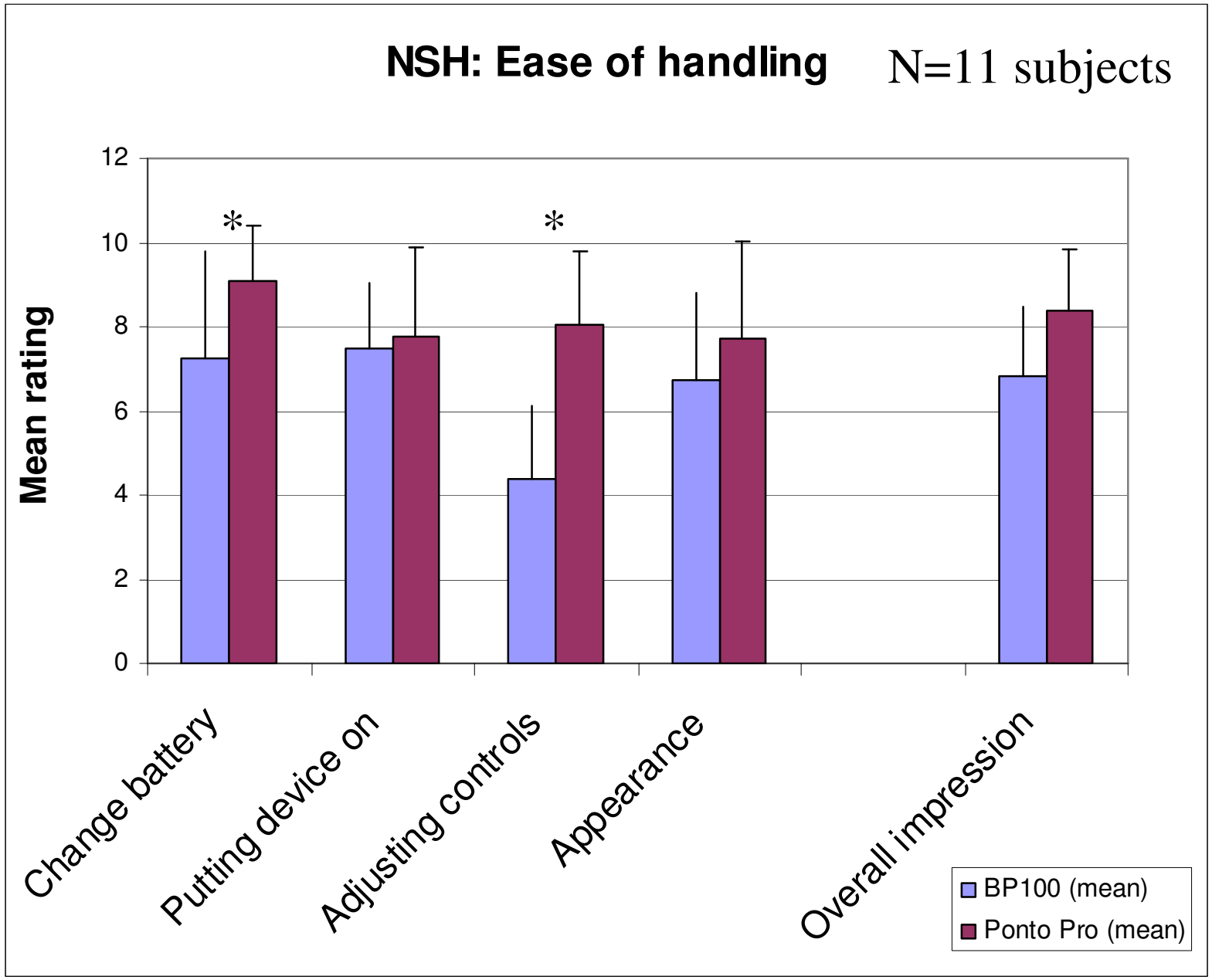

NSH * : Speech perception N=11 subjects
*) Nordic Cooperation on Disability, 1999
Mean rating
10
9
8
7
6
5
4
3
2
1
0
*
*
One person in quiet
One person in noise
One person in car
Noisy group
TV/Radio
BP100 (mean)
Ponto Pro (mean)


NSH: Sound quality
N=11 subjects
Mean rating
10
9
8
7
6
5
4
3
2
1
0
Determine direction
Sound quality
Own voice
Cutlery and crockery
Traffic sound
Feedback whistling
Wind noise
BP100 (mean)
Ponto Pro (mean)



N = 57 subjects

Rasmussen (2007)


NSH: Ease of handling
N=11 subjects
Mean rating
12
10
8
6
4
2
0
*
*
Change battery
Putting device on
Adjusting controls
Appearance
Overall impression
BP100 (mean)
Ponto Pro (mean)

User preference (N=12)

- 4 subjects selected BP100
- 8 subjects selected Ponto Pro

User profiles (1)

	BP100	Ponto Pro
Median age	52. 5	53.5
Gender	2F/2M	3F/5M
Opposite conventional aid	0 subjects	2 subjects

User profiles (2)

BP100		Ponto Pro	
Non use ear (#)	**Use ear (#)**	**Non use ear (#)**	**Use ear (#)**
Normal hearing (1)	Severe, mixed (1)	Normal hearing (3)	Severe, conductive (2) Deaf (1)
Mild, perceptive (1)	Severe, mixed (1)	Mild, perceptive (1)	Severe, perceptive (1)
		Moderate, conductive (1)	Moderate, conductive (1)
Moderate, mixed (1)	Moderate, mixed (1)	Moderate, mixed (1)	Severe, mixed (1)
Severe, mixed (1)	Mild, conductive (1)	Severe, mixed (2)	Moderate, mixed (2)
Total (4)	Total (4)	Total (8)	Total (8)

User comments (1)

Feedback & artefacts	**Positive (# of comments)**	**Negative (# of comments)**
BP100	No feedback whistle (2)	Often feedback (4) DFC artefacts (4)
Ponto Pro	Seldom feedback whistle (2)	Too much feedback whistle (2)

User comments (2)

Handling	**Positive (# of comments)**	**Negative (# of comments)**
BP100	Easy to switch on/off (1)	Difficult to handle (10), Battery replacement, use of VC, on/off
Ponto Pro	Easy to handle (11) Battery replacement, use of VC	Feels unpleasant on head when pressing mute button (1)

User comments (3)

Wind noise	**Positive (# of comments)**	**Negative (# of comments)**
BP100	No wind noise (1)	Often wind noise (1)
Ponto Pro	Little wind noise (3)	Wind noise (1)

User comments (4)

Visual appearance	**Positive (# of comments)**	**Negative (# of comments)**
BP100		Not nice (2) Not separate R/L (1)
Ponto Pro	Nice (3) Separate R/L (1)	

User comments (5)

Sound quality	**Positive (# of comments)**	**Negative (# of comments)**
BP100	Natural sound (1) Own voice good (1)	Internal noise (2) rattling (1), clicks (1)
Ponto Pro	Good sound (3)	Unnatural sound (1) Soft sounds annoying (1)

User comments (6)

Connection to abutment	**Positive (# of comments)**	**Negative (# of comments)**
BP100	Well fixed (1) Easy to click on (2)	A little difficult to click on (1)
Ponto Pro	Easy to click on (3)	Coupling causes pain (1), poorer fixation (1) difficult to click on (2)

Research questions (1)

- Is user reported and measured speech understanding better using one of the test devices?
  - Ponto Pro gets statistically better median NSH ratings in two situations
    - Talk to one person in car
    - Listen to TV/radio
  - Ponto Pro has statistically better DanTale II results in directional setting
    - Speech from 0º, noise from +/- 90º.
- Is the sound quality perceived as better in one of the test devices?
  - Ponto Pro gets better median NSH ratings (Not statistically significant)

Research questions (2)

- Is the wind noise perceived as more acceptable in one of the test devices?
  - Ponto Pro gets higher ratings (Not statistically significant)
  - Still relatively low scores with both devices
- Is one of the test devices better than the other regarding feed back whistle?
  - Ponto Pro gets higher ratings (Not statistically significant)

Research questions (3)

- Is handling easier with one of the devices?
  - Ponto Pro gets higher ratings (Statistically significant)
- Is user preference influenced by different hearing profiles?
  - We see no important differences between the groups that selected BP100 and Ponto Pro