Preference Judgments in the Field and in the Laboratory

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ABSTRACT

There is a certain focus in the hearing-device research community on how realistic laboratory tests should be performed. Another question is how we can collect reliable data in the field. The aim of the current study was to investigate ways to collect detailed information in the field and compare these results with results from commonly used laboratory tests. Two HA settings were compared using a double-blind design. Findings from preliminary analyses:

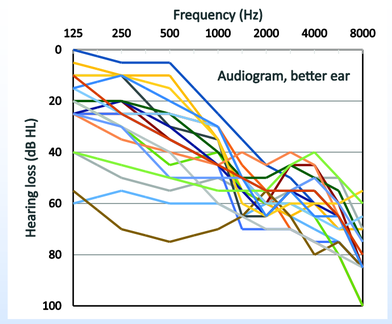
- The diary helped participants find relevant situations for assessment, and valuable data were collected.
- The questionnaire, exploring a number of situations/activities, was useful, especially for participant who used the diary sparingly.
- The data log validated the other evaluations in the field.
- The Paired Comparison (PC) data from the lab showed similarities with field data (diary and questionnaire) with regard to preference for speech intelligibility and comfort.
- The lab tests used in this study could not explain the participants' general preference, reported in an interview after the field trial.

As a complement to developing more realistic lab studies, we should try to refine our field-trial outcome measures.

METHOD

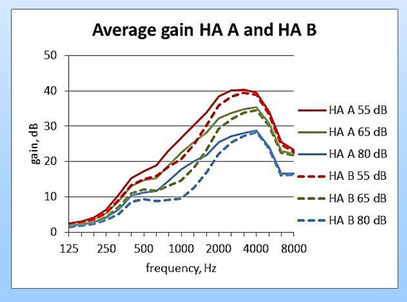
Participants

- 20 experienced HA users, 8 females, 12 males
- Average age 74 years



Hearing aids

- Research RIC hearing aids
- Custom (15 people) or standard (5 people) domes with varying vents/openness
- Directional microphones
- SII-based noise reduction
- Two settings, A and B (average coupler gain shown to the right for three input levels



FIELD TESTS

Interview Overall Preference

An interview was performed after the field test. Main question: "Which program did you prefer?". Rating of confidence in 5 levels.

9 persons preferred setting A ,11 preferred setting B, with varying degree of confidence.

Diary

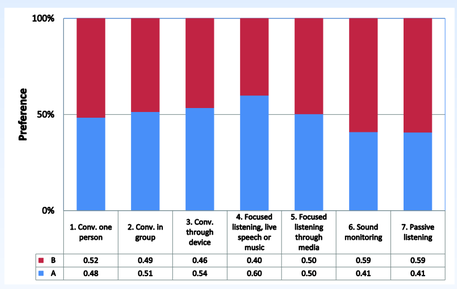
Participant-specific examples of predefined situations established before the field trial.

Date: *Thursday May 4th*

Time	Situation	Sit. no.	Prefer prg.	Comment
8	*Morning news on radio*	*5*	*2*	*Too loud in program 1*
15	*Drove a car, talked to passengers*	*2*	*1*	*Easier to follow conversation with program1*

Results

Close to equal preference, but A slightly preferred for live focused listening and B for sound monitoring and passive listening.



Discussion

The *diary* and its instructions, with suggested general "activities" and participant-specific examples, was an attempt to make the field trial more controlled. It generally worked as intended.

- Assessments in a variety of relevant sound environments, performing various activities. Median 27 entries (range 4-80), often described in detail.
- Participants seemed to make judgments without too much bias from previous comparisons in similar situations.

Questionnaire

After the field test, participants also filled out a questionnaire together with the audiologist.

Situation 1: Conversation with one person in quiet surroundings at home (indoors)

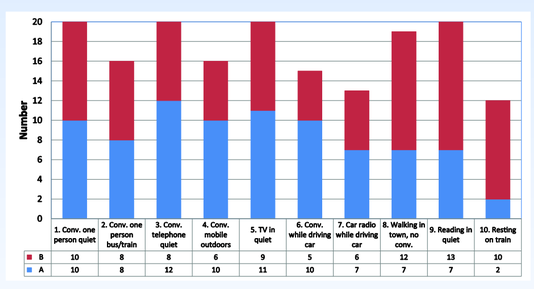
1. Has this situation occurred during the trial? Yes ☐ No ☐
2. Which program do you prefer in this situation? Program 1 ☐ Program 2 ☐
3. How confident are you in your preference judgment?

Very uncertain ☐ | Rather uncertain ☐ | In-between ☐ | Rather certain ☐ | Very certain ☐

Diary	Questionnaire
Situation 1: Conversation one person (quiet or noise)	Situation 1: Conversation one person in quiet (indoors)
	Situation 2: Conversation with one on bus or train (not using a telephone)
Situation 2: Conversation group (quiet or noise)	Situation 6: You drive a car and talk to the passengers
Situation 3: Conversation through device	Situation 3: Conversation using a phone in quiet at home
	Situation 4: Conversation using a mobile phone out on the street or in town
Situation 4: Focused listening on live speech or music	
Situation 5: Focused listening on speech or music through media	Situation 5: You watch and listen to TV in quiet at home
	Situation 7: You listen to car radio or GPS while driving
Situation 6: Sound monitoring – Activities (no conv.) with some importance to hear	Situation 8: You walk in town without conversation, e.g. while shopping
Situation 7: Passive listening - Activities (no conv.) with "no" importance to hear	Situation 9: You read a book or newspaper at home or in a park
	Situation 10: You sit on a train and rest (without listening to music or a film)
8. Other situations	Other situations

Results

Close to equal preference, but A preferred for speech and B in passive listening situations.



Discussion

The *questionnaire* listening situations were similar to the categories used in the diary. They were selected to be general enough for many participants to encounter.

- Particularly useful for participants who did not use the diary much.
- Generally, responses from the diary and the questionnaire agreed well.

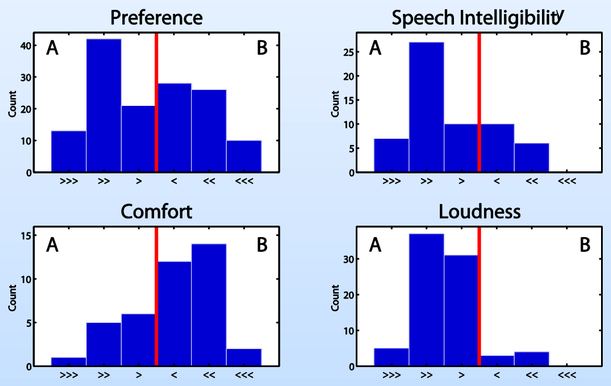
LAB TESTS

Paired Comparisons (PC)

- Rating attributes: "Preference", "Speech Intelligibility", "Comfort", and "Loudness"
- 7 sound stimuli, duration about 1 min
- 15 s HA pre-conditioning
- Volume control disabled
- Playback loop until decision made
- Binary choice and magnitude of difference determined
- For each rating attribute, a number of sound stimuli were used
- A and B settings randomized before each sound stimulus presentation

Results

Close to equal overall preference. A better for speech intellegibility, B better for comfort.



Discussion

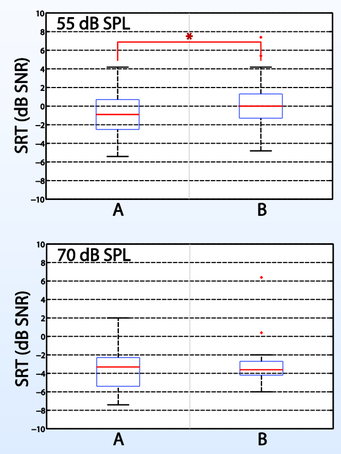
The *paired comparison* data showed that setting A was preferred more often for speech intelligibility and setting B was preferred more often for comfort. This finding agreed with the picture from the diary and questionnaire, but the PC data did not correlate with the main interview question about overall preference.
Potential explanations:

- Unrealistic presentation. The participants only listened in the lab, whereas own voice issues affect the results in the field.
- Certain easily identifiable details might have dominated the judgments.
- Focus on small loudness differences could play a larger role in the lab than in the field.

Speech test HINT

- Adaptive SNR, sentence scoring
- Female talker (0º)
- Noise from three loudspeakers
- Two noise levels: 55 and 70 dB SPL

Similar results, but A significantly better than B for 55 dB SPL noise level.

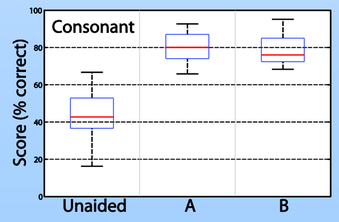


ORCA Speech Test (OST)

- Nonsense CVCVC test
- Female talker (0º)
- Noise from three loudspeakers
- Fixed SNR = 10 dB
- Speech level: 65 dB SPL
- Phoneme scoring (word scores calculated)

Results

No statistically significant difference between A and B.



Discussion

The *speech* results were very similar and there is no reason to think that this difference will play a large role for the overall preference expressed in the interview.

MEASURE RELATIONSHIPS

Correlation analyses were performed using Spearman's rank correlation coefficient between measures. Significant correlations ($p<0.05$) are marked in the matrix to the right.

Assuming the reported overall preference after the field trial is the "true preference", a statistically significant correlation with this outcome was found for 6 out of 7 diary categories and for 6 out of 10 questionnaire questions. In contrast, the data from the lab showed poor agreement with the "true preference".

		GENERAL PREFERENCE	Field - Sound Environment Questionnaire										Field - Diary						Lab - Paired comparisons																Lab - Speech		
																			Preference							Speech		Comfort	Loudness							
			Conv. one quiet	Conv. one noise	Conv. phone quiet	Conv. mobile noise	TV quiet	Conv. car	Car radio	Town	Read quiet	Rest noise	Conv. One	Conv. Group	Conv. Device	Focused Live	Focused Device	Sound Monitor	Passive listening	Speech 55 dB	Speech 65 dB	Speech in noise	Football chant	Music - piano	Music - strings	Outdoors, birds	Speech 55 dB	Speech 65 dB	Speech in noise	Speech in noise	Football chant	Speech 55 dB	Speech 65 dB	Speech in noise	Music - strings	HINT 55 dB	HINT 70 dB	OST consonants
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
		Pref	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6	SQ7	SQ8	SQ9	SQ10	D1	D2	D3	D4	D5	D6	D7	PC-P1	PC-P2	PC-P3	PC-P4	PC-P5	PC-P6	PC-P7	PC-S1	PC-S2	PC-S3	PC-C1	PC-C2	PC-L1	PC-L2	PC-L3	PC-L4	S-HI55	S-HI70	S-Oc
1	Pref	1.00	0.81	0.38	0.69	0.65	0.63	0.47	0.54	0.53	0.34	-0.03	0.60	0.54	0.61	0.10	0.55	0.57	0.69	-0.15	-0.14	-0.03	0.01	0.35	-0.12	0.18	0.04	0.22	0.11	0.29	-0.05	-0.20	-0.39	0.14	-0.03	-0.26	-0.34	0.05
2	SQ1	0.81	1.00	0.19	0.93	0.50	0.82	0.42	0.30	0.45	0.44	-0.05	0.59	0.31	0.55	0.10	0.63	0.23	0.69	0.01	0.02	-0.05	-0.11	0.35	-0.13	0.23	0.09	0.20	0.25	0.26	-0.16	-0.21	-0.24	0.27	0.22	-0.10	-0.44	0.08
3	SQ2	0.38	0.19	1.00	0.10	0.97	0.13	0.67	0.87	0.44	0.02	-0.01	0.36	0.61	0.51	0.63	0.53	0.56	0.48	-0.16	0.10	0.01	0.37	0.44	-0.15	-0.11	-0.24	0.34	0.21	0.26	0.49	0.06	-0.07	-0.15	0.09	-0.43	-0.01	-0.18
4	SQ3	0.69	0.93	0.10	1.00	0.44	0.80	0.39	0.22	0.32	0.43	-0.09	0.57	0.30	0.55	0.06	0.63	0.22	0.71	0.07	0.04	-0.17	-0.20	0.28	-0.09	0.15	0.09	0.28	0.23	0.08	-0.23	-0.16	-0.15	0.23	0.28	-0.12	-0.38	0.02
5	SQ4	0.65	0.50	0.97	0.44	1.00	0.39	0.43	0.84	0.51	0.03	0.03	0.43	0.51	0.69	0.62	0.66	0.57	0.47	-0.01	0.21	-0.18	0.42	0.61	-0.24	-0.04	-0.31	0.51	0.39	0.21	0.42	-0.03	-0.19	-0.28	0.11	-0.42	-0.29	0.02
6	SQ5	0.63	0.82	0.13	0.80	0.39	1.00	0.54	-0.01	0.33	0.38	-0.02	0.63	0.43	0.53	0.06	0.72	0.29	0.52	0.14	-0.15	-0.20	-0.08	0.18	-0.28	-0.02	0.12	0.28	0.23	0.03	-0.36	-0.10	-0.01	0.23	0.02	0.01	-0.38	-0.24
7	SQ6	0.47	0.42	0.67	0.39	0.43	0.54	1.00	0.30	0.43	0.28	-0.26	0.30	0.78	0.32	0.36	0.62	0.20	0.47	-0.03	-0.03	0.18	0.14	0.04	-0.28	-0.13	0.25	0.37	0.07	0.08	-0.04	0.02	0.29	0.18	0.07	0.07	-0.03	-0.28
8	SQ7	0.54	0.30	0.87	0.22	0.84	-0.01	0.30	1.00	0.44	0.00	-0.15	0.15	0.38	0.82	0.53	0.41	0.67	0.46	-0.14	0.00	-0.18	0.38	0.46	0.11	0.15	-0.35	0.16	0.28	0.22	0.61	0.11	-0.24	-0.09	0.05	-0.79	-0.33	0.34
9	SQ8	0.53	0.45	0.44	0.32	0.51	0.33	0.43	0.44	1.00	0.69	0.63	0.50	0.64	0.41	0.12	0.27	0.54	0.59	-0.12	-0.16	0.25	0.51	0.11	-0.37	-0.16	-0.21	-0.17	-0.09	0.14	0.43	-0.15	-0.25	-0.03	-0.18	-0.22	-0.17	-0.19
10	SQ9	0.34	0.44	0.02	0.43	0.03	0.38	0.28	0.00	0.69	1.00	0.84	0.42	0.46	0.20	-0.18	-0.03	0.38	0.64	-0.15	-0.18	0.49	0.21	0.05	-0.07	0.04	-0.14	-0.38	-0.30	0.20	0.23	-0.24	-0.31	0.17	-0.29	0.03	-0.14	-0.15
11	SQ10	-0.03	-0.03	0.09	-0.09	0.03	-0.08	-0.22	-0.15	0.63	0.84	1.00	0.12	0.09	-0.10	-0.60	-0.53	0.34	0.16	-0.36	-0.51	0.43	0.59	-0.06	-0.03	-0.13	-0.36	-0.57	-0.42	0.05	0.30	-0.49	-0.26	0.15	-0.16	0.11	-0.23	-0.20
12	D1	0.60	0.59	0.36	0.57	0.43	0.63	0.30	0.15	0.50	0.42	0.12	1.00	0.27	0.68	-0.02	0.50	0.39	0.73	0.25	0.09	0.00	0.01	0.08	-0.11	0.06	0.06	0.24	0.18	0.19	-0.17	0.09	0.25	0.09	0.07	-0.07	-0.32	-0.25
13	D2	0.54	0.31	0.61	0.30	0.51	0.43	0.78	0.38	0.64	0.46	0.09	0.27	1.00	0.47	0.28	0.41	0.79	0.56	-0.09	-0.24	0.09	0.11	0.11	-0.32	-0.37	0.10	0.18	-0.02	-0.06	0.13	-0.13	-0.16	0.00	-0.29	-0.16	-0.01	-0.22
14	D3	0.61	0.55	0.51	0.55	0.69	0.53	0.32	0.82	0.41	0.20	-0.10	0.68	0.47	1.00	0.27	0.66	0.66	0.63	0.06	-0.17	-0.44	-0.02	0.07	-0.04	-0.05	-0.09	0.21	0.27	-0.14	0.08	0.17	-0.08	0.15	-0.10	-0.53	-0.27	0.15
15	D4	0.10	0.10	0.63	0.06	0.62	0.06	0.36	0.53	0.12	-0.18	-0.60	-0.02	0.28	0.27	1.00	0.21	0.13	-0.10	0.58	0.67	-0.07	0.16	0.66	-0.18	-0.15	-0.04	0.60	0.87	0.10	0.27	0.29	-0.15	-0.51	-0.03	-0.24	-0.22	0.14
16	D5	0.55	0.63	0.53	0.63	0.66	0.72	0.62	0.41	0.27	-0.03	-0.53	0.50	0.41	0.66	0.21	1.00	0.18	0.48	-0.01	-0.11	-0.51	-0.23	-0.03	-0.45	-0.14	0.12	0.33	0.25	-0.18	-0.20	0.18	0.26	0.18	0.37	-0.07	-0.17	-0.18
17	D6	0.57	0.23	0.56	0.22	0.57	0.29	0.20	0.67	0.54	0.38	0.34	0.39	0.79	0.66	0.13	0.18	1.00	0.57	-0.14	-0.26	0.07	0.23	0.24	0.11	-0.06	-0.08	0.10	-0.05	0.11	0.31	-0.13	-0.32	0.03	-0.40	-0.40	-0.08	0.13
18	D7	0.69	0.69	0.48	0.71	0.47	0.52	0.47	0.46	0.59	0.64	0.16	0.73	0.56	0.63	-0.10	0.48	0.57	1.00	-0.12	-0.12	0.06	0.10	0.11	-0.06	0.17	-0.17	0.05	-0.11	0.31	0.07	-0.06	-0.27	0.16	0.08	-0.38	-0.17	0.00
19	PC-P1	-0.15	0.01	-0.16	0.07	-0.01	0.14	-0.03	-0.14	-0.12	-0.15	-0.36	0.25	-0.09	0.06	0.58	-0.01	-0.14	-0.12	1.00	0.50	-0.34	-0.19	0.01	-0.27	-0.11	0.22	0.47	0.64	-0.21	-0.45	0.54	0.00	-0.02	0.16	-0.04	-0.39	0.15
20	PC-P2	-0.14	0.02	0.10	0.04	0.21	-0.15	-0.03	0.00	-0.16	-0.18	-0.51	0.09	-0.24	-0.17	0.67	-0.11	-0.26	-0.12	0.50	1.00	0.16	-0.21	0.37	-0.03	0.09	0.10	0.62	0.56	0.22	0.00	0.18	-0.16	-0.14	0.32	0.28	0.16	0.26
21	PC-P3	-0.03	-0.05	0.01	-0.17	-0.18	-0.20	0.18	-0.18	0.25	0.49	0.43	0.00	0.09	-0.44	-0.07	-0.51	0.07	0.06	-0.34	0.16	1.00	0.35	0.38	0.34	0.28	-0.05	-0.30	-0.32	0.63	0.47	-0.44	-0.26	-0.05	-0.28	0.36	0.29	-0.09
22	PC-P4	0.01	0.11	0.37	-0.20	0.42	-0.08	0.14	0.38	0.51	0.21	0.59	0.01	0.11	-0.02	0.16	-0.23	0.23	0.10	-0.19	-0.21	0.35	1.00	0.30	0.12	0.03	-0.60	-0.17	-0.25	0.27	0.56	-0.31	-0.07	-0.49	-0.33	-0.26	-0.22	-0.09
23	PC-P5	0.35	0.35	0.44	0.28	0.61	0.18	0.04	0.46	0.11	0.05	-0.06	0.08	0.11	0.07	0.66	-0.03	0.24	0.11	0.01	0.37	0.38	0.30	1.00	0.31	0.27	-0.15	0.34	0.43	0.59	0.40	-0.38	-0.43	-0.35	-0.01	-0.15	-0.21	0.20
24	PC-P6	-0.12	-0.13	-0.15	-0.09	-0.24	-0.28	-0.28	0.11	-0.37	-0.07	-0.03	-0.11	-0.32	-0.04	-0.18	-0.45	0.11	-0.06	-0.27	-0.03	0.34	0.12	0.31	1.00	0.58	0.10	-0.13	-0.03	0.41	0.30	-0.32	0.10	-0.09	0.01	-0.08	0.07	0.57
25	PC-P7	0.18	0.23	-0.11	0.15	-0.04	-0.02	-0.13	0.15	-0.16	0.04	-0.13	0.06	-0.37	-0.05	-0.15	-0.14	-0.06	0.17	-0.11	0.09	0.28	0.03	0.27	0.58	1.00	0.08	-0.10	-0.11	0.75	0.09	0.14	0.01	0.21	0.16	0.01	-0.21	0.50
26	PC-S1	0.04	0.09	-0.24	0.09	-0.31	0.12	0.25	-0.35	-0.21	-0.14	-0.36	0.06	0.10	-0.09	-0.04	0.12	-0.08	-0.17	0.22	0.10	-0.05	-0.60	-0.15	0.10	0.08	1.00	0.21	0.25	-0.11	-0.43	0.14	0.48	0.57	0.45	0.46	0.10	0.14
27	PC-S2	0.22	0.20	0.34	0.28	0.51	0.28	0.37	0.16	-0.17	-0.38	-0.57	0.24	0.18	0.21	0.60	0.33	0.10	0.05	0.47	0.62	-0.30	-0.17	0.34	-0.13	-0.10	0.21	1.00	0.59	-0.04	-0.33	0.11	0.07	-0.13	0.34	0.08	-0.02	0.12
28	PC-S3	0.11	0.25	0.21	0.23	0.39	0.23	0.07	0.28	-0.09	-0.30	-0.42	0.18	-0.02	0.27	0.87	0.25	-0.05	-0.11	0.64	0.56	-0.32	-0.25	0.43	-0.03	-0.11	0.25	0.59	1.00	-0.05	-0.17	0.15	-0.06	-0.18	0.31	-0.14	-0.34	0.25
29	PC-C1	0.29	0.26	0.26	0.08	0.21	0.03	0.08	0.22	0.14	0.20	0.05	0.19	-0.06	-0.14	0.10	-0.18	0.11	0.31	-0.21	0.22	0.63	0.27	0.59	0.41	0.75	-0.11	-0.04	-0.05	1.00	0.35	-0.12	-0.29	-0.03	0.00	-0.01	-0.03	0.10
30	PC-C2	-0.05	-0.16	0.49	-0.23	0.42	-0.36	-0.04	0.61	0.43	0.23	0.30	-0.17	0.13	0.08	0.27	-0.20	0.31	0.07	-0.45	0.00	0.47	0.56	0.40	0.30	0.09	-0.43	-0.33	-0.17	0.35	1.00	-0.21	-0.18	-0.43	-0.28	-0.29	0.27	0.10
31	PC-L1	-0.20	-0.21	0.06	-0.16	-0.03	-0.10	0.02	0.11	-0.15	-0.24	-0.49	0.09	-0.13	0.17	0.29	0.18	-0.13	-0.06	0.54	0.18	-0.44	-0.31	-0.38	-0.32	0.14	0.14	0.11	0.15	-0.12	-0.21	1.00	0.22	0.21	0.10	-0.14	-0.04	0.01
32	PC-L2	-0.39	-0.24	-0.07	-0.15	-0.19	-0.01	0.29	-0.24	-0.25	-0.31	-0.26	-0.13	-0.16	-0.08	-0.15	0.26	-0.32	-0.27	0.00	-0.16	-0.26	-0.07	-0.43	0.10	0.01	0.48	0.07	-0.06	-0.29	-0.18	0.22	1.00	0.25	0.47	0.36	0.15	-0.01
33	PC-L3	0.14	0.27	-0.15	0.23	-0.28	0.23	0.18	-0.09	-0.03	0.17	0.15	0.25	0.00	0.15	-0.51	0.18	0.03	0.16	-0.02	-0.14	-0.05	-0.49	-0.35	-0.09	0.21	0.57	-0.13	-0.18	-0.03	-0.43	0.21	0.25	1.00	0.30	0.29	-0.07	-0.07
34	PC-L4	-0.03	0.22	0.09	0.28	0.11	0.02	0.07	0.05	-0.18	-0.29	-0.16	0.09	-0.29	-0.10	-0.03	0.37	-0.40	0.08	0.16	0.32	-0.28	-0.33	-0.01	0.01	0.16	0.45	0.34	0.31	0.00	-0.28	0.10	0.47	0.30	1.00	0.20	-0.11	0.22
35	S-HI55	-0.26	-0.10	-0.43	-0.12	-0.42	0.01	0.07	-0.79	-0.22	0.03	0.11	-0.07	-0.16	-0.53	-0.24	-0.07	-0.40	-0.38	-0.04	0.28	0.36	-0.26	-0.15	-0.08	0.01	0.46	0.08	-0.14	-0.01	-0.29	-0.34	0.36	0.29	0.20	1.00	0.31	-0.17
36	S-HI70	-0.34	-0.44	-0.01	-0.38	-0.29	-0.38	-0.03	-0.33	-0.17	-0.14	-0.23	-0.12	-0.01	-0.27	-0.22	-0.17	-0.08	-0.17	-0.39	0.16	0.29	-0.22	-0.21	0.07	-0.21	0.10	-0.02	-0.34	-0.03	0.27	-0.04	0.15	-0.07	-0.11	0.31	1.00	-0.31
37	S-Oc	0.05	0.08	-0.18	0.12	0.02	-0.24	-0.28	0.34	-0.19	-0.15	-0.20	-0.25	-0.22	0.15	0.14	-0.18	0.13	0.00	0.15	0.26	-0.09	-0.09	0.20	0.57	0.50	0.14	0.12	0.25	0.10	0.10	0.01	-0.01	-0.07	0.22	-0.17	-0.31	1.00

SUMMARY

Based on the results we will:

- Refine the way we collect data in the field, in particular how "listening situations" or "activities" should be grouped and presented to the participants.
- Revisit the way we make Paired Comparisons in the laboratory.

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