A NEW ONLINE QUESTIONNAIRE FOR ASSESSING SPATIAL-HEARING ABILITY

Adriana Goyette,[a] Christophe Micheyl,[a,b] Swapan Gandhi,[a] Susie Valentine,[a] Harvey Abrams,[a] Sridhar Kalluri,[a] Simon Carlile[a]

[a]*Starkey Hearing Technologies;* [b]*Starkey France*

INTRODUCTION

In this study we developed and validated the Inventory of Spatial Hearing Abilities (ISHA) with the following goals:

- Reduce response biases and improve response accuracy by including questions about behavior instead of only questions about perception.
- Facilitate recall of experiences with images
- Reduce the risk of response anchoring and carry-over effect by using verbal answers instead of numeric and avoiding consecutive questions that used the same answer alternatives[1,2]

To further validate the ISHA we compared the results with the Speech and Spatial Qualities questionnaire (SSQ).[3]

METHODS

- 32 questions about sound-localization (azimuth, distance, left/right, front/back, and up/down discrimination) and spatial selective attention.
- Participants completed online versions of the ISHA (verbal answers and images) and the SSQ-S (0-10 rating scale).
- Data were obtained from 78 participants divided in 9 groups, including individuals normal hearing, unilateral, asymmetric, or symmetric sensorineural hearing loss, hearing aid wearers and non-wearers.
- The design and analyses of the ISHA was conducted using the probabilistic (Bayesian) Item Response Theory (IRT).[4]

Inventory of Spatial Hearing Abilities (ISHA)

Do you often have to look attentively around you to find out where a sound like you hear (like a voice or noise) is coming from?

○ Yes, I do this often
○ No, not often; I usually have a good sense of where sounds are coming from around me.
○ I have no idea.

You are having lunch with a friend or relative in a quiet place. If given a seating position, where would you sit to ensure that you can hear the other person well?

○ Facing the other person
○ So that the other person in to my left
○ So that the other person in to my right
○ It does not matter
○ I have no idea

RESULTS

Sensitivity to effects of hearing loss and hearing aids

- Azimuth, Distance, and L/R, showed expected group differences when comparing most of the hearing impaired groups with the normal hearing group in both questionnaires.
- For two other abilities, F/B and SSA, significant differences between the normal hearing and various hearing impaired groups were observed with the ISHA, where none were found with the SSQ-S.

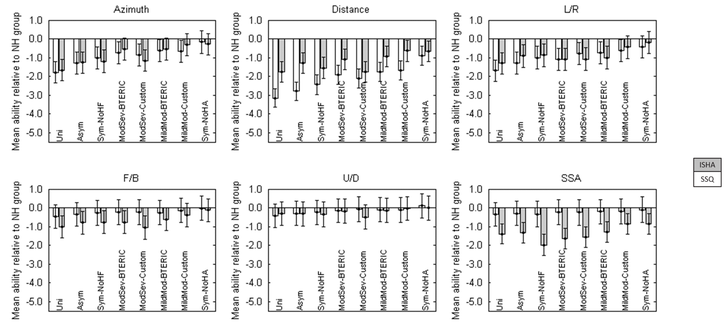

Figure 1. Mean spatial-hearing abilities, relative to the NH group, inferred using the SSQ-S and the ISHA for the different participant groups. Error bars: +/- 1.96SD.

Correlations between ISHA and SSQ-S

- Spatial-hearing abilities inferred using the two questionnaires were significantly correlated. As much as 66% of the inter-individual variance in ability inferred using one questionnaire could be accounted for by the ability inferred using the other.

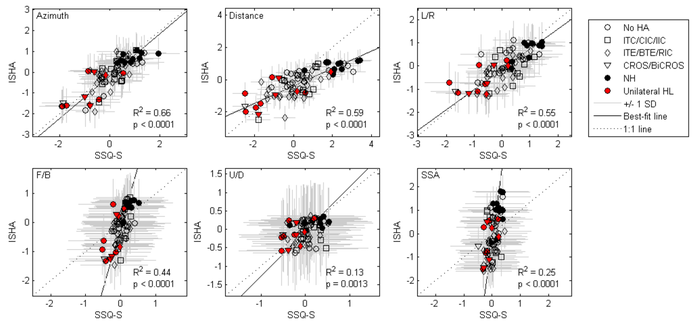

Figure 2. Scatter plots (mean +/- SD) of individual inferred abilities for the ISHA versus the SSQ-S. Each data point corresponds to one participant.

RESULTS (CONT.)

Test-retest reliability

- Test-retest reliability was generally high, except for up/down discrimination.

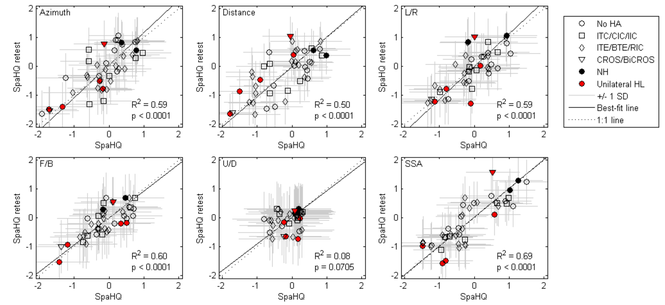

Figure 3. Scatter plots of individual spatial-hearing ability estimates for the first ISHA test versus the retest for the subset of 43 participants who took this questionnaire twice. The format of this figure is the same as for Figure 2.

CONCLUSIONS

- The ISHA is a valid and reliable (test-retest) tool that should be considered for use in research that investigates spatial hearing ability.
- Spatial-hearing abilities inferred using this questionnaire are correlated with abilities inferred using the SSQ (spatial).
- ISHA may be more sensitive than the SSQ to spatial-selective attention and front/back discrimination deficits in HI individuals; this remains to be confirmed.
- The IRT model that we developed specifically to analyze the data from these spatial-hearing questionnaires provides a principled tool for analyzing such questionnaire data and comparing results across questionnaires using different answer scales (verbal vs numeric).

REFERENCES

1. Krosnick, J. A., Narayan, S. S., & Smith, W. R. (1996). Satisficing in surveys: Initial evidence. New directions for evaluation, (70), 29–44.
2. Hunter G, Barge S. (2012) Anchoring and Adjusting in Questionnaire Responses. Basic and Applied Social Psychology 34 (5): 417-433.
3. Gatehouse S. & Noble, W. (2004). The speech, spatial and qualities of hearing scale (SSQ). Int J Audiol, 43(2): 85–99
4. Bishop, CM (2006). Pattern Recognition and Machine Learning. Springer. pp. 359–422.